

Special Issue Reprint

Studies on the Real Estate Market and Property Management in the Post-pandemic Era

Edited by
Xin Janet Ge and Song Shi

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Studies on the Real Estate Market and Property Management in the Post-pandemic Era

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This is a reprint of the Special Issue, published open access by the journal *Buildings* (ISSN 2075-5309), freely accessible at: https://www.mdpi.com/journal/buildings/special_issues/RW2I4N97CB.

For citation purposes, cite each article independently as indicated on the article page online and as indicated below:

Lastname, A.A.; Lastname, B.B. Article Title. <i>Journal Name</i> Year , Volume Number, Page Range.
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ISBN 978-3-7258-4326-8 (Hbk)

ISBN 978-3-7258-4325-1 (PDF)

<https://doi.org/10.3390/books978-3-7258-4325-1>

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Reprinted from: *Buildings* **2024**, *14*, 159, <https://doi.org/10.3390/buildings14010159> **184**

About the Editors

Xin Janet Ge

Dr. Janet Ge is an Associate Professor in the School of Built Environment, University of Technology Sydney. Janet's primary research covers housing affordability, the housing market, and house prices; property development finance and investment; and the application of property technologies with over a hundred refereed papers, book chapters, and reports published. Her doctoral research explored the use of multiple regression analysis and recurrent neural network methods to establish forecasting models for estimating private housing prices in Hong Kong. She also applied cusp catastrophe theory to develop a generic system for predicting discontinuous changes in housing prices and their effects under different housing policies. Her thesis received the Excellent Building Research Postgraduate Award from the Chartered Institute of Building (CIOB) Australia and a Chapter Medal and the Professional Excellence Awards (PEA) for the Outstanding Graduate of the Doctor of Philosophy (Building) Program from the Australian Institute of Building (AIB) in 2005. Janet has a strong track record in collaborative research for organisations and the property industry. Examples of completed projects include social and economic benefits and costs for development projects, the policy impacts and financial risk management of property development firms, property price forecasting in Sydney, the economic appraisal of strategic conservation planning options, etc. Janet received the 2023 Award for Highest Impact Industry Partnership (Research, Teaching or Philanthropy) presented by the faculty. Janet lectures in property investment and valuation to undergraduates and property development finance to postgraduates in the School of the Built Environment. Janet has supervised several Ph.D. and Master theses to completion in the past, and she is also a Category 1 UTS Research Supervisor.

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Dr. Song Shi is an Associate Professor of Property Economics at the School of Built Environment, UTS. His research focuses on housing market dynamics, with interests in house price forecasting, sustainable real estate, environmental studies, and social justice, specifically in relation to housing affordability, inequity, and accessibility in urban development. He is widely published in leading academic (A*, A-, or Q1-ranked) journals in the fields of finance, real estate, and urban development. He has made more than 120 contributions to research, including 1 book chapter, 36 refereed academic journal articles, 5 professional articles, 4 expert witness reports, 32 conference papers, 20 invited seminars/keynote presentations, and 24 broadcast or media engagements. Key publications include papers on the effectiveness of using interest rates to control house prices published in the *Journal of Banking and Finance*, animal spirits in the housing market published in *Real Estate Economics*, the ripple effects of local house price movements published in the *Journal of Property Research*, and house price/volume dynamics published in the *Journal of Real Estate Research*. More recently, his research has focused on environmental risk and social justice, which also aligns with the faculty and school's research priorities, with articles published in the *Journal of Regional Science*; *International Journal of Disaster Risk Reduction*; *Housing Studies*; *Cities*; and *Humanities and Social Sciences Communications*.

Preface

The outbreak of the COVID-19 pandemic in early 2020 initiated a period of profound disruption and transformation across various sectors of the global economy. Among the most significantly impacted was the real estate market, which experienced both immediate and long-term structural changes. The pandemic accelerated pre-existing trends, introduced new behavioural patterns, and compelled a re-evaluation of traditional practices in property management.

This reprint, “Studies on the Real Estate Market and Property Management in the Post-pandemic Era”, seeks to investigate the evolving dynamics of real estate markets in the aftermath of the pandemic. It investigates the impacts of the pandemic on real estate market dynamics and the relationship between the built and social environment, as well as changes in multi-family housing related to the pandemic. Through analysing the impact of housing demand on house prices, a significant policy implication for easing the housing pressure on young people and a co-living strategy are suggested. On the supply side, this reprint contributes to understanding the Build-to-Rent on affordable housing and the perceptions of young adults on the critical success factors of the Build-to-Rent housing model. This reprint also provides insight into the challenges encountered by property academics concerning the training of property graduates for the digital age and the efficacy of strategies used to achieve this.

The reprint is grounded in the premise that understanding these transformations is essential for developing sustainable, resilient, and adaptive strategies for the future of the property industry. The research in this reprint covers case studies in Brazil, Dubai, United Arab Emirates, Italy, Hong Kong, Nanjing, China, Serbia, and Sydney, Australia. By drawing on empirical data, case studies, and theoretical frameworks, this work aims to contribute to the academic discourse on urban economics, real estate studies, and property management.

I wish to express my deepest gratitude to the authors, who share their knowledge in studying housing demand and supply and their contributions to this Special Issue. I am also thankful to the MPID member, who facilitates the online platform for paper submissions.

I hope that this reprint will serve as a useful resource for scholars, practitioners, and policymakers engaged in navigating the complexities of the real estate market in the post-pandemic era.

Xin Janet Ge and Song Shi

Guest Editors

Article

Learning from the Past, Looking to Resilience: Housing in Serbia in the Post-Pandemic Era

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Abstract: The COVID-19 pandemic has profoundly reshaped life across the globe, significantly influencing the future of housing. The enactment and densification of diverse activities within one place have resulted in varying degrees of conflict between the built and social environment. This conflict is directly related to the degree of housing adaptability to new life, work, and leisure conditions. Movement restrictions and distance learning have significantly impacted the young population, which is susceptible to ‘enforced togetherness’ conditions. However, studies on post-pandemic housing in Serbia are rare. This paper investigates the relationship between the built and social environment, focusing on current trends in multi-family housing from the perspective of the progressive change of life standards in the post-pandemic era. It also includes a survey of the living conditions of architecture students in Serbia during lockdown and distance learning, offering insights into the impact of the physical environment on virus transmission and social dynamics. The main objective of this study is to formulate guidelines for developing a resilient housing model in Serbia that will address both current and future crises. From the findings, it can be concluded that radical changes in housing policy are necessary to enable less interdependence among layers within the system striving to be resilient.

Keywords: housing; post-pandemic era; social sustainability; resilience; youth

1. Introduction

Social sustainability catalyzes changing attitudes toward housing in a new era [1]. It should provide a quality living environment for residents and communities in the long-term. Social sustainability, which focuses on users and their needs, is an insufficiently represented issue that directly influences overall quality of life alongside ecological and economic sustainability. It encompasses various issues such as accessibility, inclusivity, adaptability, well-being, etc. Addressing these issues is crucial for achieving a holistic approach to housing conditions that supports sustainable urban development. Accessibility refers to providing financially accessible housing for people of all income levels, which is vital for preventing homelessness and housing insecurity. Inclusivity refers to designing and maintaining housing solutions tailored to different populations, including various age groups and cultural backgrounds, guaranteeing everyone equal access to housing conditions. Well-being refers to providing housing conditions that positively contribute to residents’ health, safety, and overall quality of life. It also includes good construction standards, access to green spaces, and proximity to essential services such as healthcare, education, and employment. Adaptability refers to creating housing conditions that can adapt to changing demographic and environmental conditions, including the ability to modify living spaces as residents’ needs change over time.

Proper development of personality, community, and value categories, and the illusion of human permanence in space are essential prerequisites for maintaining social community.

Numerous studies have shown a cause-and-effect relationship between housing conditions and the psycho-physical and social development of the individual [2–4]. Particular human needs appear in the interaction between man and his environment, whether individual or collective in nature. The level of correspondence between the physical and social environment is determined by how the family's and its members' needs are met. A housing environment that is rigid and unadaptable to external and internal changes can leave severe consequences for a person and their identity and cause psychological and sociological conflicts in the family group.

Before the onset of the COVID-19 pandemic, initial efforts were made to tackle the global housing crisis. During infectious disease outbreaks such as COVID-19, the resilience of communities in facing challenges hinges on their social vulnerability [5]. Housing, which both contributes to and is influenced by vulnerability, must be examined within this context [6]. Housing systems worldwide are contending with crises across several fronts, encompassing socio-economic gaps, class stratifications, racial inequities, gender prejudices, generational challenges, and more. These challenges are extensive and intricate, impacting various facets of society. The growing perception is that these multiple crises are not slowing down despite the pandemic but are accelerating due to it [7].

The global crisis caused by the COVID-19 pandemic has led to a housing crisis whose symptoms are more or less pronounced globally. The pandemic has caused a reduction in economic activities and business closures in many countries, leading to job losses and triggering a financial crisis in households and society as a whole. This type of economic instability makes it difficult to cover housing costs, primarily rental, mortgage, and tax obligations. Construction and design practices have been delayed during this period due to lockdowns, delays in material and resource deliveries, and general financial uncertainties, resulting in a reduced supply of new housing units and worsened housing shortages in certain areas. Ultimately, it has led to an increase in property prices and made housing even more unaffordable. The pandemic has also shifted housing preferences, with many families seeking homes and locations outside urban centers for better environmental living conditions, further complicating housing accessibility issues. The housing crisis has particularly affected less developed communities and low-income families. All these factors contribute to the complexity and multidimensionality of the housing crisis during the COVID-19 pandemic, emphasizing the interconnectedness of economic, social, and environmental factors in developing sustainable and accessible housing.

The pandemic response, marked by excessive reaction, has triggered a secondary effect potentially more severe than the health crisis itself. Much like the virus, a behavioral contagion has rapidly spread globally, possibly surpassing the virus in transmission speed [8]. Although most age groups, except older adults, face low health risks from COVID-19, individual risk attitudes strongly shape their behavioral responses. Rather than actual risk levels, risk attitudes play a key role in determining behavior for both young and elderly individuals. Changes in risk perceptions, influenced by disease-related information, can significantly affect people's responses to the pandemic. Failure by certain groups to recognize COVID-19 as a significant personal threat may inadvertently contribute to further virus spread [9]. Self-isolation or restriction of an individual can change the habitational dynamics and rhythms, stimulating several issues, such as putting lives in danger, especially when the housing environment is not habitable [10]. If we talk of housing conditions, poor housing quality and non-functioning or inadequate indoor facilities were related to current and lifetime depressive and social anxiety [11]. The new crisis has significantly affected young people living with their parents due to isolation from the belonging group and the generation gap. On the one hand, parents are pressured to maintain a working atmosphere in their home. At the same time, young people are educated remotely in these conditions, often without the possibility of physically isolating themselves in a separate room.

While COVID-19 may no longer be classified as a global health emergency, countries must continue to enhance their efforts in addressing the disease and be ready for future pandemics and other potential risks. The pandemic underscores the importance of improv-

ing the resilience of our built environment, with a particular focus on outdoor areas, and most critically, our homes [12]. In the pandemic conditions, the term “resilient architecture” got a new and broader connotation—the unpredictability of living and working patterns requires long-term and sustainable design measures and a greater degree of independence and neutrality of elements in the self-adaptable spatial system. Security layers that will respond to the current health crisis should be developed [13].

Housing scholars, housing policy, and living environment play a crucial role in this health crisis. The pandemic encompasses various health, economic, and political challenges [14]. The link between inadequate housing and poor health is increasingly well-documented [15]. Poor-quality housing and overcrowding directly relate to poor mental health, developmental delays, and social conflicts. Housing is a pivotal life domain that has been affected by the pandemic. Confining people to their homes in this manner presents a wide array of issues and challenges. There is evidence from some cities of a rise in domestic violence as households endure extended lockdowns and financial stress due to income loss [16–18]. Cities demonstrate resilience to shocks, including pandemics, but not necessarily to trends [19]. The urgency of addressing these issues is apparent. Climate change represents constant shifts rather than permanent shocks, as do technological, economic, and demographic trends. The pandemic has been a shock but has raised numerous new questions regarding improving housing and healthcare policies. Hence, this issue is crucial for all future trends and shocks.

Central to the category of social sustainability is the concept of spatial sustainability of housing. This concept underscores the flexibility of the spatial anatomy of housing being adaptable to the evolving needs of users, while also considering the socio-economic and cultural aspects of the environment. The information revolution, which has enabled professional tasks to be performed from various temporal and spatial positions, has been further accelerated by the pandemic. Its overall impact on the organization of housing space is yet to be fully understood. The understanding of everyday life and habitation is changing, from the loss of clear boundaries of criteria previously considered unquestionable determinants, to an entirely new perspective on human housing needs. The specifics of the produced housing crisis are reflected in the fact that the shortcomings of the built environment, under conditions of forced and prolonged cohabitation, more rapidly and intensely affect the psycho-physical health of individuals, lead to family conflicts, and increase the risk of virus spreading. This problem especially refers to multi-family housing. Given the significant impact of the pandemic, multiple studies are already suggesting ways to enhance urban housing in the post-pandemic era [20]. The conducted research on future changes in architectural and urban spaces, based on experts, derived keywords for trends and issues related to buildings. Among these, the most significant are ‘flexible buildings’ and ‘complexification of housing functions’ [21]. The characteristics of the housing environment, such as dimensions, access to the facades, natural light, terraces, indoor space quality, and use value can affect resident’s mental and physical health issues [22]. Therefore, understanding the nature and changes of the physical components which affect COVID-19 spread is crucial for the future development of resilient cities [23]. In light of the new changes that characterize the intensive and prolonged use of housing, current housing trends should be reviewed to prevent the harmful effects of changing dynamics of work and life functions on human and community health.

New generations of homes will certainly integrate apartments and yards after the pandemic, as it has been demonstrated that open areas enhance ventilation within buildings. However, it has also been found that increasing the depth of the terrace does not positively affect internal ventilation [24]. Following post-pandemic sustainability requirements, a correlation between adequate housing and reliance on individual motor transport has been observed. Analysis of this relationship suggests that instead of staying at home, cycling can serve as a tool for reducing environmental carbon emissions and enhancing resilience [24].

Before the pandemic crisis, research was conducted analyzing inadequate housing in Serbia and proposing the affirmation of multi-family housing models characterized

by adaptability and flexibility [25]. According to this research, space limitations and unsuitability are two essential criteria influencing the degree of conflict and potential risk. Insufficient housing refers to the problems of spatial deficit, i.e., overcrowding, often caused by economic impotence of users, but also by other external influences of life in the city. On the other hand, unsuitability mainly stems from inadequate planning and construction policies that do not recognize differences in housing exploitation, i.e., the variability of users' needs during the exploitation cycle. Furthermore, the issues observed before the pandemic crisis are now becoming increasingly complex. While housing issues during the pandemic and the significance of resilient housing have been discussed in the literature, few studies in Serbia focus on this topic. In the realm of urban design, methods for its implementation have been proposed [26]. The significance of public green spaces during the pandemic has been thoroughly examined [27], as well as the challenges posed by COVID-19 in Serbia [20]. Therefore, this research addresses the issue of resilient housing in Serbia, building upon previous research conducted in 2017 [25]. During the pandemic that caused intensive and prolonged housing exploitation, sensitivity to one's own physical and social environment proved to be a prominent symptom of a lack of adequate space for living, working, and education. Hence, it is necessary to review existing conditions and provide new ones in response to new changes in the exploitation mode. To better understand the complexity of these changes, the paper considers aspects of quality of modern living, considering the parameters of flexible plan potentials, space and density relationships, air and light comfort, space use, open space treatment and living–working relationships. The fundamental assumption in this study is that resilient housing in Serbia can be achieved through greater space adaptability to current and future crises. The primary objective of the research is to propose methods for creating a resilient housing model in Serbia in the post-pandemic era.

Architectural education extensively covers lessons on housing, so it is advisable to expand educational programs in these areas. To effect changes or additions to architectural curricula, it is necessary to initially gather information from young individuals related to the topic of this study. Formulating recommendations for innovating the education process at architecture faculties is justified only after analyzing their responses, which aligns with the aim of the research in this article.

The prolonged period of time spent indoors brings various challenges in the design of post-pandemic housing [13]. In this context, it is crucial to examine the spatial aspects of the impact, particularly on the increase in family and personal conflicts and the risk of the virus spreading. It is imperative to reconsider whether the modern trend of space rationalization which includes the open plan concept, compression and overlap of functions, and reduced areas is still a desirable solution. By setting social distancing and quarantine as design problems, we can explore which current housing trends need revision and which have to be improved in the post-pandemic period.

The COVID-19 pandemic has affected various countries, cities, and communities differently. Areas characterized by limited resources and ethnic and racial minorities have faced the most severe consequences of this crisis [28]. Therefore, it is essential to consider the economic, social, and cultural context of the relationship between housing and the negative effects of the pandemic crisis. The issues of resilient design and the future of architectural education, considering the contextual specificity of housing, form the basis for defining the research methodology.

2. Materials and Methods

The research methodology comprises three sections (Figure 1). The first section examines current trends in the spatial organization of living spaces, analyzing their main characteristics and the motives behind their implementation. The current trends refer to those that dominated the market at the time of the pandemic's onset. The identified housing patterns under analysis are 'life and work merge', 'overlapping functions', and 'integrated

living space'. The scientific background of the identified housing patterns is constituted by a comprehensive study of contemporary housing trends in Serbia and worldwide [25].

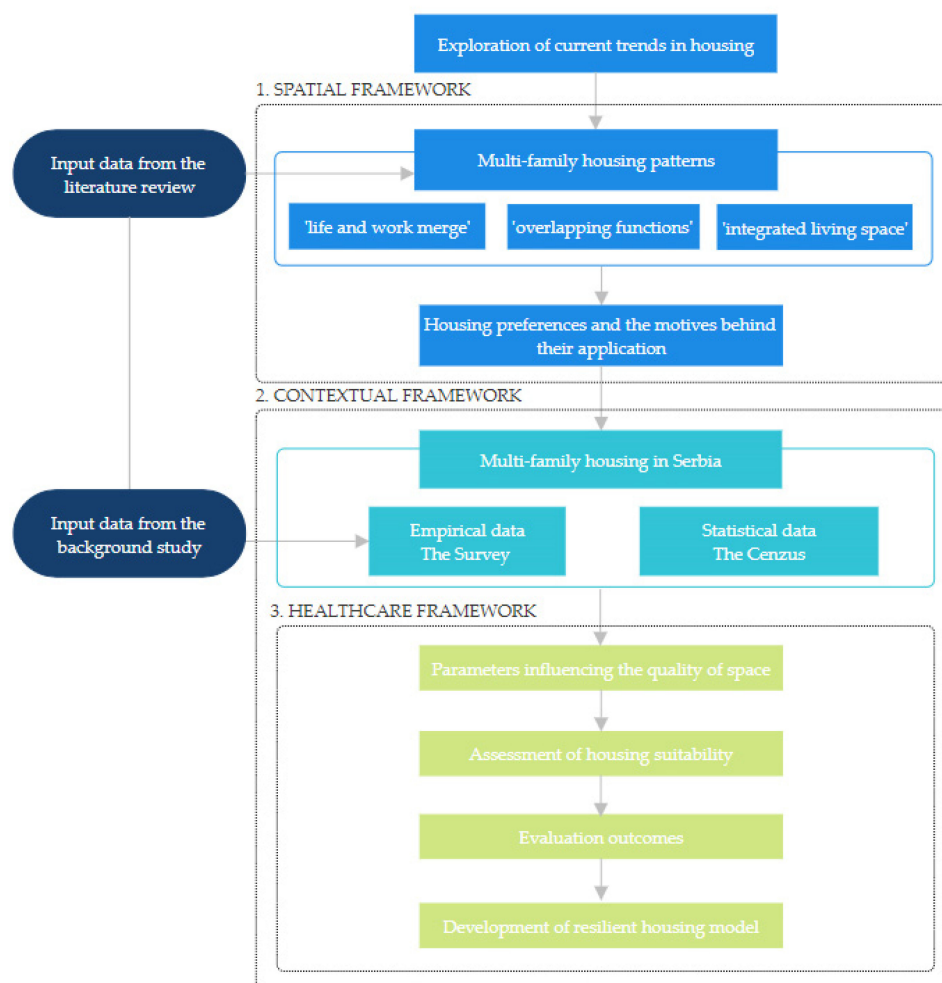


Figure 1. Methodology (drawn by the authors).

The second part defines the contextual framework of the research and analyzes the specifics of multi-family housing in Serbia, using empirical and statistical data. Housing was empirically evaluated taking into account the previous study [25] and survey of users. The mentioned study from 2017 included, among other things, a survey of residents of multi-family residential buildings located in the territory of the city of Nis. The survey model was based on the professional views of the authors (teachers at the Housing Department of the Faculty of Civil Engineering and Architecture) on relevant aspects of housing comfort and potential priorities of quality housing. Data collection was carried out through direct interviews with respondents in their households. Senior students of the Department assisted in gathering survey data. These students were familiarizing themselves with the methodological foundations of sustainable housing as part of the current study program. Interviewers were thoroughly briefed on the specifics of the questionnaire and the conduct of the survey. The characteristics of the living space were being re-examined in the current health crisis conditions using a survey of the tenants who live in the subject area. The respondents were first-year architecture students of the Faculty of Civil Engineering and Architecture at the University of Nis, Serbia, engaged in distance learning programs during the pandemic. The survey was anonymous, and students voluntarily participated in the research. It was conducted using the Microsoft Teams platform, which was also used for online education [29]. The statistical data were taken from the 2011 Census of the Republic Statistical Office of Serbia [30]. By synthesizing and systematizing the obtained data, the

article examines both the objective and subjective parameters influencing the quality of space utilization within the defined health and social frameworks.

The primary objective of the third section is to evaluate layout preferences, considering current housing needs and the risk of virus transmission. The evaluation criteria were defined as follows: air comfort, light comfort, the ratio of shared and individual spaces, apartment occupancy, the regime of space exploitation, the intersection of paths and risk zones in case of infection. In the form of a discussion, the critical spatial aspects of increasing conflict and the spread of infection during the pandemic were identified, and guidelines for creating a resilient housing model were formulated. The created models provide recommendations for innovating architectural curricula that will address the issue of resilient housing.

3. Results

3.1. Identifying the Concept of Modern Living

Housing patterns are constantly changing physically and mentally [31]. Social movements and the evolutionary progress of society at the beginning of the 21st century conditioned changes in the concept of modern housing. The rapid development of technology shapes both our progress and our perception of the world. Higher speed, efficiency, and mobility in everyday activities have transformed and programmatically redefined the classic notion of housing. The dynamism of life has initiated new tendencies in furnishing and spatial arrangement, primarily characterized by the rationalization of space through the reduction of areas, summarizing and overlapping functions and openness of the plan—especially in the living room. Applying the all-in-one space concept is especially pronounced in smaller apartments because, in that manner, integrating of different housing functions enhances the feeling of spaciousness [32]. The article further explores current global housing trends and that in Serbia through concepts such as ‘life and work merge’, ‘overlapping functions’, and ‘integrated living space’. To better understand these concepts and align them with contextual specifics, a representative example of multi-family residential development in Serbia is presented, encompassing all the preferences as mentioned above (Figure 2). These findings stemmed from a more comprehensive study of the characteristics of contemporary multi-family housing in Serbia [25].



Figure 2. Representative example of apartment layout arrangement in Serbia (drawn by the authors).

The “transitional apartment” that has marked housing construction in Serbia over the past 20 years results from the influence of a liberal market and the absence of a stable professional code. Deregulation and the collapse of the value system in Serbia have consequently undermined the authority of institutions and societal roles, especially architectural ones. The design of residential complexes largely falls into the domain of private investor-entrepreneurs, aiming primarily to maximize the fulfillment of parameter characteristics rather than other qualities of residential comfort. This often leads to an imbalance in the

basics of apartment layouts and a significant undersizing of certain rooms. The imperative of fully utilizing the available space on the plot dictates a higher number of apartments and more residential rooms within the smallest possible area, often sacrificing open spaces and auxiliary functions. A concrete example demonstrates this and proves that most rooms fall below prescribed surface standards, and the requirement for two bathrooms in apartments with three or more beds is often ignored. The integration of the kitchen, dining area, and living room has roots in the rural tradition of combining these functions. Overly extensive and restrictive norms likely stem from the previous socialist-communist era and the doctrinal nature of the social organization, which, due to the inertness of the environment, still represents a determining factor that requires overcoming predetermined reactions to prescribed conditions [1].

3.1.1. Life and Work Merge

The trend of a decrease in full-time employees and more and more of those who perform their work activities from home has influenced the emergence of concepts in which the functions of housing and work are compounded in space. The main characteristic of modern global society is greater flexibility in performing housing, work, and other functions, while the division into public and private contents is increasingly blurred. Upgrading the living environment with work functions is a trend that aims to create multi-purpose spaces for more intensive and efficient exploitation. Merging of housing and work functions abolishes clear boundaries between personal, business, and social (Figure 2, living and working frames). Living space acquires a broader meaning as a place to live, work, and engage in leisure activities. The desire to create an intimate environment is replaced by an open and universal concept in which all functions are treated equally.

3.1.2. Overlapping Functions

Accelerated population growth and changes in the structure of households and the increase in land value result in an increasingly frequent housing concept with spatially reduced and rationalized contents that are compressed and overlapped in space. The current housing trend of living in small spaces represents not only the need to reduce the floor area, but also the response to the modern lifestyle and increased environmental awareness of the population in overcrowded urban centers. Rationalized use of space usually means compressing and overlapping functions in the daily zone, where various activities in open communication occur in parallel. In this zone, the functions, including food preparation, dining, and sitting, are often joint (Figure 2, dining and kitchen areas), resulting from the changed regime of space exploitation, which assumes that all these activities are performed simultaneously in the communion of family members and their guests.

3.1.3. Integrated Living Space

The open plan concept responds to the modern way of living which, among other things, causes the lack of shared free time. Due to its size, spaciousness, and social-friendly (integrative) preferences, an entire space of specific functional groups is more comfortable than an assembly with smaller and physically separate subunits. The plan, which is free of walls, intensifies the feeling of spaciousness and comfort, especially in the kitchen and living room (Figure 2, open plan concept frame). Isolation of usually one family member in a separate kitchen space in the earlier concept of strict functional fragmentation no longer corresponds to society's current living conditions and aspirations. The kitchen island is often the central motive for organizing a living room. Its increasingly frequent application has resulted from a changed housing philosophy, which implies cooking as a joint activity, which fosters a sense of community and belonging.

3.2. Contextual Background of the Study

The characteristics and quality of housing are directly related to society's economic and socio-cultural image. Representation of specific housing typologies, manner of exploitation

and organization of space, average apartment size, and usable area per user define the standard and quality of construction and directly indicate the socio-economic status of a country. Understanding the motives for applying a particular concept requires considering the contextual background of the research.

3.2.1. Characteristics of Multi-Family Housing in Serbia

At the turn of the 21st century, in Serbia, the functional organization diversity of the plan was mostly not a topic of design consideration. Premises with a clearly defined purpose and regime of exploitation with areas reduced to a minimum resulted from a construction policy in which the quantitative prevails over the qualitative. The market-based system has reduced housing quality, with space shortages, overcrowding, and substandard living conditions [33]. Certain apartment zones, such as the entrance, the dining area, and the terrace, are gradually being lost in the plan, with a significant reduction in their areas. The organization of the living, kitchen, and dining areas within one space is widespread in many countries, without differences in the state's economic power, but again with significant differences. The trend of unifying these functions is ubiquitous in Serbia, but the motives for its application are rationalization rather than the modernization of space. Undeveloped land intended for housing is mostly located in expensive locations, so as many apartments as possible are imperative for building development. Combining these three functions in one space reduces the required area of the apartment and enables the production of a more significant number of apartments within the building. In developed countries, the area occupied by these three zones is significantly larger than that in Serbia, and thus, the possibilities of organizing and exploiting such areas are incomparably greater. Due to frequent under-dimensionality and lack of flexibility in the organization, the daily zone of housing units in Serbia gives an objective and subjective feeling of overcrowding.

3.2.2. Characteristics of Households in Serbia

Although there is a noticeable tendency to weaken the nuclear family concept globally, the contextual specifics resulting from the slow reform and modernization processes in Serbia affect the still dominant representation of traditional values and inherited life patterns. On the other hand, the quality of social relationships in the family largely depends on the characteristics of the physical environment, i.e., family residences. Undersized apartments, as well as the inadequate organization and room capacity of the unit negatively affect the behavior of family members and their relationships, especially in the case of psychophysical development of youth. Overcrowded and expanded family structures are widespread, and, for many, are the only option for overcoming poor financial situations and stabilizing living standards through a mutual budget [25]. The small number of available resources in life options contributes to developing adaptable lifestyles in an extended community. It also affects the longer retention of traditional family norms and slows youth independence.

3.2.3. Statistical Data

Measured by the accepted EU standard of over 25 m² useful floor area per person, only 38% of the occupied stock would qualify. Another 32% have 15–25 m² of useful space per person. The remaining 30% have an extremely low standard of space consumption [34]. The housing deficit is also expressed through the lack of large housing units, the share of which is lower than that of the households with five and more members [30]. According to the 2011 Census, the average apartment size in Serbia amounts to 64 m² with the corresponding floor area of 22 m² per person, for an average household of 2.88 members. The average apartment area per tenant is much lower in Serbia than in EU countries with a floor area of 42.56 m² per person [35]. In addition, the average apartment size is noticeably lower than that in the EU countries where the floor area ranges from 77 m² in Finland to 125 m² in Luxembourg. The apartments in the United States are even larger, with an average size of 145 m² [36].

3.3. Empirical Research on the Impact of COVID-19 on Living Conditions in Serbia

The survey was conducted in the category of youth living and studying in Serbia. Young people are particularly vulnerable because they are in the psycho-social and physical sense in the stage of progressive development and suffer the tremendous consequences of space dysfunction. By surveying architecture students with specific knowledge of housing quality standards and age qualifications, the authors examined how spatial qualities influenced the quality of life, work, and leisure during the pandemic.

3.3.1. Data Collection

A web-based survey questionnaire was posted to the first-year students of architecture (Faculty of Civil Engineering and Architecture, University of Nis, Serbia) via the Microsoft Teams platform on 1 February 2021. The survey included questions about students' opinions about the qualities and limitations of the living environment perceived during the lockdown (March–May 2020) and after that time (from May until the time of the survey). The total sample consisted of 177 students aged 19–20 who were invited to participate online in a research survey. The survey was anonymous, and the confidentiality of information was assured. Participation in the survey was entirely voluntary, with informed consent obtained and clearly documented in advance. No sensitive participants' personal data were collected. According to the Code of Professional Ethics of the University of Nis, consent of the University Ethics Committee was not required for this research.

The first section of the questionnaire investigated the general features of the respondents and their families: (a) gender, (b) current age, (c) educational level, (d) number of family members, (e) structure of family households. The second section consisted of questions about the physical preferences of the unit: (a) construction period, (b) unit size in square meters, (c) number and type of the rooms, (d) living room size; (e) organization of the living room; (f) living room functions; (g) bedroom type; (h) number and type of technical blocks, (i) belonging outdoor space preferences, (j) indoor quality in terms of natural lighting and ventilation. The third part referred to the patterns of living space exploitation during isolation and eventual self-isolation of some of the household members: (a) working and (b) educating from home modalities, (c) focusing on a task and cognitive potentials (d) observed shortcomings of spatial organization, (e) space exploitation during self-isolation.

3.3.2. Data Synthesis and Statistical Analysis

Only the data relating to multi-family residential buildings were analyzed within the specific study. The most represented type of household within the examined sample was a family of four (parents and two children) with 40%. It is followed by expanded and three-generation households with 35%, 3-member households with 11%, 5-member nuclear households with 7%, and incomplete nuclear households with 7%. In the case of 4-member households, the average area of a unit was 70.78 m², or 17.69 m² per person. From the hygienic, psychological, and sociological aspects, the apartment should be an appropriate area, depending on the number of family members, from 18 to 20 m² per member [37]. In the case of five-member households, even more pronounced overcrowding was recorded within the survey (the average area was 61.75 m², i.e., 12.35 m² per user).

The functional scheme where the living room, dining room, and kitchen were located within the open plan (without partitions) was represented in 52% of cases (Figure 3). The average area of such spaces in apartments was 25.25 m². According to the current rulebook on conditions and norms for designing residential buildings and apartments in the Republic of Serbia [38] the minimum allowed areas of these spaces are as follows: living room—16 m², kitchen—4 m², dining room—4 m². In total, the minimum area would be 24 m², meaning that the obtained results correspond to the minimum allowed areas.

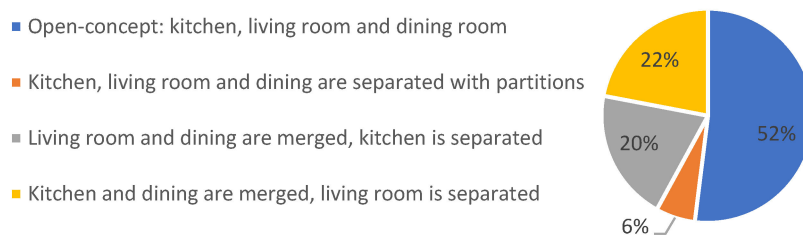


Figure 3. The relationship between the living room, dining, and kitchen.

Previous research on living conditions in Serbia [13] and a specific survey showed that many households use the living area for sleeping (36%). This is a result of the fact that one bedroom is missing in many households, so the living room is forced to accept the function of sleeping (Figure 4). A significant number of households use the living room for work (46%) or learning (38%). Of the respondents (young students), as many as 39% share a bedroom with a brother or sister.

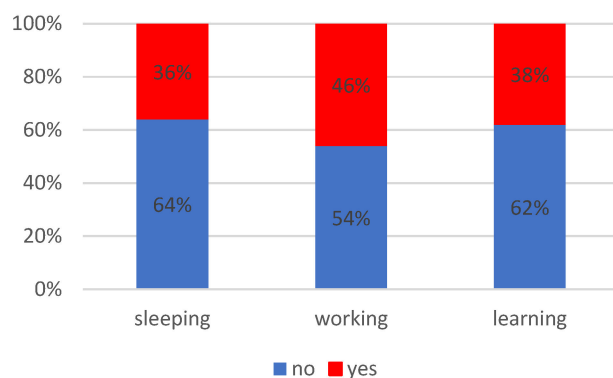


Figure 4. Living room additional functions.

In 25% of cases, virus infection was present in the family, and in most cases, the bedroom was used for self-isolation (78%), further complicating the problem of sharing a room. The room that is most often the meeting place with the infected is the bathroom, which is the expected answer, considering that in a multi-family building, a second toilet is most often sacrificed for reducing space (47% of respondents have one toilet). In nearly half of the cases, the toilet is not naturally ventilated. Another area that is often sacrificed regards open spaces. In addition to the fact that a certain number of respondents do not have open areas in the apartment, most terraces have an insufficient area (4–5 m²). In 20% of cases, the units do not have access to the open area from the daily zone, but from the night zone and auxiliary rooms, which limits their use. The main areas for improvement in the spatial organization noticed during the pandemic are the need for more work and education space and isolation. As many as 30% of young people use the living room, i.e., shared bedroom (29%) for educational purposes. Regarding the critical question of the extent to which the pandemic changed the living conditions, education, and work of the family, the largest number answered “to a certain extent” with 36%, and “significantly” with 25% (Figure 5).

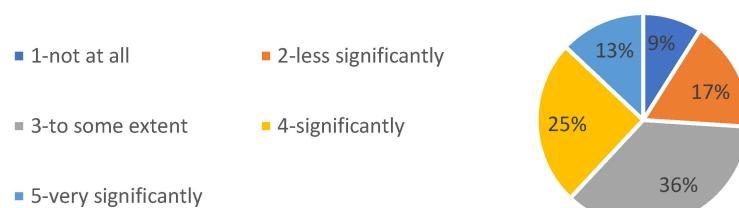


Figure 5. The extent to which the pandemic impacted living, education, and work.

4. Discussion

Responsive, adaptive, and resilient architecture is required in the twenty-first century [39]. The results of the literature review addressing changes in housing after the pandemic indicate the benefits of staying at home, but it has also been observed that most existing plan arrangements are not prepared to deal with epidemics. This has prompted architects to modify or supplement apartment designs, supporting residents' physical and mental health in spaces that can cope with sudden crises [40]. Such conclusions are in line with the results obtained in this study. The problem in Serbia, however, lies in the minimal possibility of implementing such advanced interventions. Although improvement measures for sustainability are outlined in the legal framework, they are reduced to the level of non-binding recommendations [41–43]. For this reason, the issue of 'inherited genetics of housing organization' [1], stemming from system inertia, becomes fertile ground for various manipulations. Market laws dominate the profession, which is left solely to the professional ethics of individuals, since it is not adequately supported legislatively. The main characteristics of actual planning policy in Serbia include the chaotic residential development on small and inadequate building plots and the neglected spatial quality caused by investors' desire for large and fast profits. The global trend of uniting daily functions within one zone has arisen due to the changing way of life, which implies a fast life and performing activities in the company of other members. In Serbia, however, this trend is primarily motivated by the desire to save space and provide the necessary lighting of the space, due to the high number of built-in apartments, which implies a one-sided, possibly two-sided orientation to the outside. As a result, the internal space is often poorly ventilated, accelerating the spread of infection within the family. Furthermore, a decrease in output facades reduces space rearrangement and adaptability. The isolation period has conditioned the more intensive use of terraces. An inadequate open area or the absence of an open area further complicates the psycho-social and hygienic living conditions.

Many current architectural trends are being questioned in conditions of isolation and forced communion because homes have become the only place where people sleep, eat, work, and socialize [44]. The permanent and prolonged housing crisis in Serbia has led families to consciously choose an apartment in which certain housing functions are initially or overtime performed within the same space, thus sacrificing the overall quality of life. A multi-purpose living room with an additional sleep function is usually a solution for overcoming the problem of room deficit. During quarantine, problems are further complicated by incorporating work functions into everyday living activities. Bedrooms are transformed into workspaces, kitchens into internet meeting rooms, and balconies and terraces (if available) became the primary areas for relaxation and leisure [45]. A living room where sleeping or multi-hour work is planned cannot be considered a standard room for gathering family members, nor an individual room in which, following psycho-physiological needs, it is possible to separate members from the group occasionally. In conditions of intensive exploitation, such spaces can lead to severe conflicts in the performance of life and work functions, if the possibility of occasional division of space is not foreseen in advance. The tendency to expand personal and narrow common space becomes problematic with no explicit zoning and incompatible intertwined functions. This practice can lead to serious problems and outages in the developmental cycle of the family, as well as to an increased risk of the virus spreading.

Ensuring sufficient space relative to the number of occupants is also a critical aspect in this domain [45]. However, in practice, the rationalization of space often means reducing the organizational and dimensional qualities such as size, connections, and relationships of individual rooms, zoning concepts, etc. For most tenants, living in an overcrowded area is a harsh reality due to economic constraints. This situation, coupled with all the above, and the findings of other research [46–49], highlights household crowding as a significant risk factor for COVID-19 transmission. The safety of homes is compromised, as the infection of just one person could render the house a direct source of virus transmission, facilitated by the close interactions among residents [50]. The health and hygiene criteria for

staying in an overcrowded and reduced space are further endangered by the fact that in the case of infection, in many cases, the paths of the infected and other family members often intersect, especially in shared spaces like the bathroom and hallway. The layout plan shown in Figure 1 is a stark example for demonstration of space exploitation in the case of one infected person in the nuclear family (Figure 6). If one parent were infected, the other parent would be forced to perform most functions in a single space (living/sleeping/working). The bathroom is used by all family members.

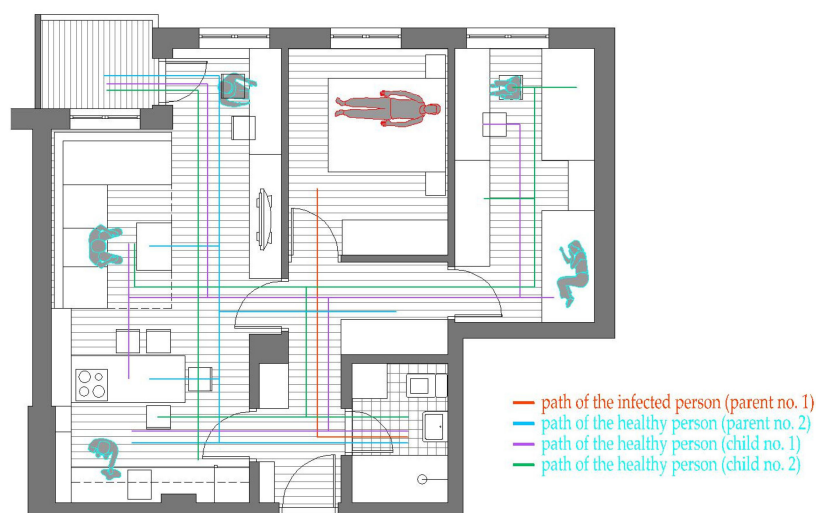


Figure 6. Space exploitation—infected/uninfected paths (drawn by the authors).

Establishing a proper isolation space at home involves addressing various concerns like separating the space effectively, ensuring thorough cleaning, having multiple bathrooms, and waste disposal [35]. The results of the research are systematized and demonstrated through previously defined evaluation criteria (Table 1).

Table 1. Characteristics of a modern apartment: evaluation outcomes.

Evaluation Criteria	Description
Air comfort	The internal space is often poorly ventilated, which accelerates the spread of infection within the family. Inadequate surface or the absence of an open surface further complicates the hygienic living conditions.
Light comfort	Due to the high amount of built-in apartments, which implies a one-sided orientation to the outside, many areas lack proper lighting.
Ratio of mutual and individual zones	The tendency to expand personal and narrow common space becomes a problem with no explicit zoning and incompatible intertwined functions.
Occupancy of the apartment	For most tenants, living in an overcrowded area is acceptable due to the poor economic situation.
Regime of space exploitation	The permanent and prolonged housing crisis has led families to consciously choose an apartment in which certain housing functions are initially or over time performed within the same space, thus sacrificing the overall quality of life.
Intersection of paths and risk zones in case of infection	Health and hygiene criteria for staying in an overcrowded and reduced space are endangered by the fact that in the case of infection, in many cases, the paths of the infected and other family members intersect, especially in the bathroom and hallway.

Several indicators likely contribute to COVID-19 spread:

- High population density challenges social distancing efforts in urban areas;

- Increased household size can facilitate infections without substantial social contact, as one infected person can spread the virus to others;
- While social distancing globally aids COVID-19 containment, outcomes vary significantly based on regional policies, national development levels, and socio-economic conditions in residential areas [51].

As the research focuses on young people living in conditions of limited movement and social distancing, the sample size and the selected target group (students of architecture) can be limiting factors in obtaining a complete picture of their needs and observations. The selection of the target group was based on the idea that students of architecture bring specific professional perspectives and spatial intelligence to the survey, enabling them to consider the problem from two angles—the user’s perspective and that of the architect. Subsequent research should include a more extensive analysis of the living conditions of young people, encompassing a wider range of needs from various user profiles.

5. Recommendations for Improving Housing Resilience

Current social circumstances and scientific and technological progress are changing the paradigm of housing, characterized by a dynamic and transformable environment. The apartment is a product of the socio-cultural context of the era to which it belongs and simultaneously a cause that directly influences people and their quality of life, determining their behavior. The elementary ambivalence of social life, expressed through the need for occasional separation or togetherness, requires controlled management of spatial and social boundaries. The concept of an open plan in new circumstances requires upgrading through applying the principle of flexibility [32,45]. Flexibility in the open plan is based on the neutrality and uncertainty of space (Figure 7). Neutrality and uncertainty are the essence of accepting new and different functions in changing program conditions. Sliding partitions that, if necessary, divide the space into smaller sub-units, achieve the possibility of controlling the openness of the plan. The trend of merging housing and work requires such spatial conditions. Living in small units without designated work-space zones and difficulties in defining work and leisure times may lead to reduced productivity [11]. Modern equipment such as sliding walls, sliding doors, and built-in furniture enables flexibility and maximum exploitation in minimal space conditions. Incorporating modular furniture such as sofas and seating units in living spaces enables effortless reconfiguration to foster expansiveness suitable for social gatherings or intimate settings. Similarly, modular desks and shelving units offer adaptability, adjusting to diverse living arrangements in response to evolving work habits or household demands. When integrated into wall units, wall beds and other space-saving furniture optimize floor space utilization during daytime hours, accommodating varied activities in small living spaces. Furthermore, using sliding partition walls or screens provides a flexible architectural solution, allowing residents to temporarily divide a room for privacy or to create distinct zones for different activities. In the pandemic requirements, flexibility would also allow for the partitioning of the space so that the infected person would really be in situations of self-isolation, without endangering other residential functions. For this division in space to be possible, it is necessary to articulate the treatment of the openings on the facade, taking into account the variable program scenarios. The concept of “space within space”, where subunits, micro-spaces of a specific purpose are formed within one spatial whole: space for hobbies, solitude, relaxation, personal hygiene, work, etc., in a psychological sense, would contribute to the feeling of being separated from the group. What needs to be taken into account are the lighting requirements for such a space, which can be regulated by the size of the openings in the partitions. The treatment of open areas is also essential in the conditions of prolonged exploitation of space, but also for improving health and hygienic living conditions. The choice of one open area of adequate size with an exit from the living area is a better solution than two smaller terraces with limited exploitation possibilities. In addition, since the facade exit is typically one-sided, planning a glazed transformable and multifunctional

loggia as a central motif of space arrangement could potentially enable the expansion or reduction of the surrounding area while providing additional air and lighting.

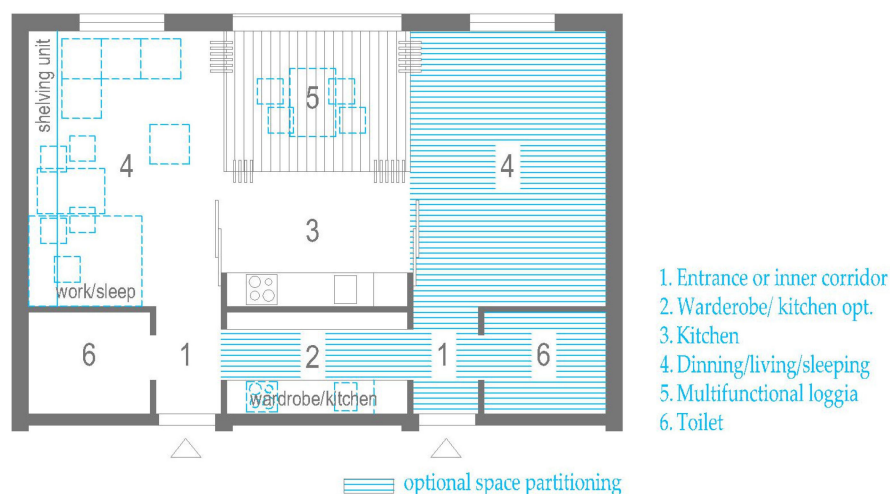


Figure 7. Apartment with premises of enhanced resilience (drawn by the authors).

The recommendations provided for improving housing resilience are universally applicable, but the implementation tools are directly influenced by socio-economic conditions, and the level of environmental and social awareness within the given community. In this particular case, due to various limitations, ranging from legal to spatial constraints, radical changes are necessary, involving the application of systemic measures at all levels. The process of aligning strategic sustainability policies would involve innovating national and local programs and strengthening the role of the architectural profession in housing construction.

In higher education, special attention should be devoted to the issue of resilience and raising awareness among students about the significance of this topic for the future of housing. This requires a multidisciplinary approach that incorporates not only established ecological and economic aspects but also the social aspects of housing resilience. Architectural curricula should be supplemented with thematic units that provide methodological guidelines for resilience-based architectural design.

6. Conclusions

The main characteristic of modern society is greater flexibility in performing housing, work, and other functions, which is why these functions are often compressed in the open plan. The division into public and private zones is losing importance with the increased utilization of the so-called mixed zones. As a spatial framework, the housing unit gained a broader meaning, so it has undergone significant transformations in the previous period. The modernization of society and the modern lifestyle, characterized by fast living and lack of free time, has brought new standards in construction that implement minimalism in interior design. There is a tendency to accept as many functions as possible in the smallest possible area, with the inevitable intersection of the paths at the apartment and the building level. Rationalization of space, the concept of open and flowing space, and merging live and work functions are some of the dominant motives for space organization.

The new circumstances of the global crisis of society place a demand for the reconceptualization of modern housing and the research of new development models and housing typologies. Therefore, it is necessary to organize the residential space according to the principles of flexibility, which allows the implementation of various housing programs in a changing social environment. Implementing flexibility based on openness and neutrality of space increases its use value and extends the life cycle of housing and its sustainability. Unfortunately, the last decade in Serbia was marked by the evident stagnation in research on sustainable housing, which is especially evident in the current health crisis. The uniqueness of the presented study lies in the specific relationship of ideological, cultural, social, and

economic aspects that largely do not deliberately regulate and recognize the goals and measures of social sustainability, under the dominant influence of market conditions in housing construction. In the current market and social circumstances, there is a noticeable tendency to reduce architectural standards, which reduces the organizational and functional qualities of the space. In a pandemic, a congested and overcrowded area poses a potential risk for spreading infection, and for increasing conflict due to confrontational activities performed in the same area. The entire situation significantly impacted young students who, in addition to the fundamental need for solitude, required education in an often unconditional housing environment. Uniformity in expression, which implies a simplified and somewhat reduced scheme of using space without clear zoning of content and elaborated dynamics of exploitation, in the new circumstances can be a serious problem and frustration for family members. Treating open spaces and exit surfaces is vital for maintaining health in congested urban patterns. Nevertheless, these spaces should be given more attention. The shortcomings of housing policy in which the interdependence of layers is strong and does not allow flexibility in the spatial system, became most pronounced during the pandemic period. Resilience requires the prevision of possible exploitation scenarios at all spatial levels. Rethinking existing and defining new housing models that will provide greater adaptability of space to current and future crises is an urgent requirement in the framework of professional action. Controlled exploitation of space with the possibility of occasional fragmentation that provides a certain degree of privacy requires anticipation of program scenarios at the earliest stage and articulation of all components of architectural space.

Author Contributions: Conceptualization, M.Z. and M.S. (Mirko Stanimirovic); methodology, M.Z. and M.S. (Mirko Stanimirovic); validation, S.K., M.S. (Marija Stamenkovic), and V.P.; investigation, M.Z. and M.S. (Mirko Stanimirovic); resources, M.Z. and M.S. (Mirko Stanimirovic); data curation, M.Z.; writing—original draft preparation, M.Z. and M.S. (Mirko Stanimirovic); writing—review and editing, M.Z. and S.K.; visualization, M.Z. and S.K.; supervision, M.Z. and M.S. (Mirko Stanimirovic); project administration, M.Z. and M.S. (Mirko Stanimirovic); funding acquisition, M.Z. and M.S. (Mirko Stanimirovic). All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Ministry of Science, Technological Development and Innovation of the Republic of Serbia (grant number 451-03-65/2024-03/200095; University of Nis, Faculty of Civil Engineering and Architecture).

Data Availability Statement: The data presented in this study are available on request from the corresponding author due to ethical reasons.

Conflicts of Interest: The authors report there are no competing interests to declare.

References

1. Petrovic, B.; Raskovic, I.; Stojanovic, D.; Stamenovic, P.; Dukanac, D. *Budućnost Stanovanja—Aspekti Održivosti Budućeg Stanovanja u Srbiji*; AGM Knjiga: Belgrade, Serbia, 2021.
2. Shafi, K.; Arif, F.; Haroon, S.; Balagamwala, M. Impact of Housing Conditions on Psycho-Social Health of Residents. *J. Psychiatry Behav. Sci.* **2019**, *2*, 1029.
3. Rolfe, S.; Garnham, L.; Godwin, J.; Anderson, I.; Seaman, P.; Donaldson, C. Housing as a Social Determinant of Health and Wellbeing: Developing an Empirically-Informed Realist Theoretical Framework. *BMC Public Health* **2020**, *20*, 1138. [CrossRef] [PubMed]
4. Zhu, Y.; Holden, M. Housing and Psychosocial Well-Being during the COVID-19 Pandemic. *Habitat. Int.* **2023**, *135*, 102812. [CrossRef] [PubMed]
5. Ejiogu, A.; Denedo, M.; Smyth, S. Special Issue on Accounting for Housing, Housing Crisis and Pandemic. *Crit. Perspect. Account.* **2020**, *70*, 102205. [CrossRef]
6. Martino, E.; Mansour, A.; Bentley, R. Housing Vulnerability and COVID-19 Outbreaks: When Crises Collide. *Urban. Policy Res.* **2023**, *41*, 6–21. [CrossRef]
7. Rogers, D.; Power, E.R. The Global Pandemic Is Accelerating Housing Crises. *Int. J. Hous. Policy* **2021**, *21*, 315–320. [CrossRef]
8. Eichenberger, R.; Hegselmann, R.; Savage, D.A.; Stadelmann, D.; Torgler, B. Certified Coronavirus Immunity as a Resource and Strategy to Cope with Pandemic Costs. *Kyklos* **2020**, *73*, 464–474. [CrossRef]
9. Chan, H.F.; Skali, A.; Savage, D.A.; Stadelmann, D.; Torgler, B. Risk Attitudes and Human Mobility during the COVID-19 Pandemic. *Sci. Rep.* **2020**, *10*, 19931. [CrossRef]

10. Oluwatosin, A.A.; Olugbemiga, O.S.; Olugbenga, A.T.; Ajibade, S.-S.M.; Moveh, S. Housing Quality Standard and COVID-19 Pandemic: A Call for Attention in Nigeria. *J. Sci. Eng. Technol. Manag.* **2020**, *1*, 44–53. [CrossRef]
11. Amerio, A.; Brambilla, A.; Morganti, A.; Aguglia, A.; Bianchi, D.; Santi, F.; Costantini, L.; Odone, A.; Costanza, A.; Signorelli, C.; et al. COVID-19 Lockdown: Housing Built Environment's Effects on Mental Health. *Int. J. Environ. Res. Public Health* **2020**, *17*, 5973. [CrossRef] [PubMed]
12. Kaklauskas, A.; Lepkova, N.; Raslanas, S.; Vetloviene, I.; Milevicius, V.; Sepliakov, J. COVID-19 and Green Housing: A Review of Relevant Literature. *Energies* **2021**, *14*, 2072. [CrossRef]
13. Megahed, N.A.; Ghoneim, E.M. Antivirus-Built Environment: Lessons Learned from COVID-19 Pandemic. *Sustain. Cities Soc.* **2020**, *61*, 102350. [CrossRef] [PubMed]
14. Rogers, D.; Power, E. Housing Policy and the COVID-19 Pandemic: The Importance of Housing Research during This Health Emergency. *Int. J. Hous. Policy* **2020**, *20*, 177–183. [CrossRef]
15. Thomson, H.; Petticrew, M.; Morrison, D. Health Effects of Housing Improvement: Systematic Review of Intervention Studies. *BMJ* **2001**, *323*, 187–190. [CrossRef] [PubMed]
16. Piquero, A.R.; Jennings, W.G.; Jemison, E.; Kaukinen, C.; Knaul, F.M. Domestic Violence during the COVID-19 Pandemic—Evidence from a Systematic Review and Meta-Analysis. *J. Crim. Justice* **2021**, *74*, 101806. [CrossRef] [PubMed]
17. Ashby, M.P.J. Initial Evidence on the Relationship between the Coronavirus Pandemic and Crime in the United States. *Crim. Sci.* **2020**, *9*, 6. [CrossRef]
18. Boserup, B.; McKenney, M.; Elkbuli, A. Alarming Trends in US Domestic Violence during the COVID-19 Pandemic. *Am. J. Emerg. Med.* **2020**, *38*, 2753–2755. [CrossRef] [PubMed]
19. Malpezzi, S. Housing Affordability and Responses during Times of Stress: A Preliminary Look during the COVID-19 Pandemic. *Contemp. Econ. Policy* **2023**, *41*, 9–40. [CrossRef]
20. Stojiljković, B. Social Cohesion and Neighbor Interactions within Multifamily Apartment Buildings: Challenges of COVID-19 and Directions of Action. *Sustainability* **2022**, *14*, 738. [CrossRef]
21. Son, D.; Kim, M.; Cho, Y. Predictions for Architectural and Urban Spaces in Response to the COVID-19 Pandemic: Delphi Survey of Korean Experts. *J. Asian Archit. Build. Eng.* **2023**, *22*, 327–338. [CrossRef]
22. Shahbazian, D. Housing and Urban Design for COVID-19 Pandemic; Design for Prevention of Virus Spread. *J. Prev. Epidemiol.* **2021**, *6*, e02. [CrossRef]
23. Li, B.; Peng, Y.; He, H.; Wang, M.; Feng, T. Built Environment and Early Infection of COVID-19 in Urban Districts: A Case Study of Huangzhou. *Sustain. Cities Soc.* **2021**, *66*, 102685. [CrossRef]
24. Saadatjoo, P.; Badamchizadeh, P.; Mahdavinejad, M. Towards the New Generation of Courtyard Buildings as a Healthy Living Concept for Post-Pandemic Era. *Sustain. Cities Soc.* **2023**, *97*, 104726. [CrossRef]
25. Zivkovic, M. *Defining and Applying the Method for Evaluating the Flexibility of Spatial Organization of the Flat in Multi-Family Residential Buildings*; University of Nis: Nis, Serbia, 2017.
26. Vaništa Lazarević, E.; Keković, Z.; AntoniĆ, B. In Search of the Principles of Resilient Urban Design: Implementability of the Principles in the Case of the Cities in Serbia. *Energy Build.* **2018**, *158*, 1130–1138. [CrossRef]
27. Gubić, I.; Wolff, M. Use and Design of Public Green Spaces in Serbian Cities during the COVID-19 Pandemic. *Habitat. Int.* **2022**, *128*, 102651. [CrossRef] [PubMed]
28. Jones, A.; Grigsby-Toussaint, D.S. Housing Stability and the Residential Context of the COVID-19 Pandemic. *Cities Health* **2021**, *5*, S159–S161. [CrossRef]
29. Microsoft Corporation. Microsoft Teams (Version 23247.720.2421.8365). Available online: <https://www.microsoft.com/en-us/microsoft-teams/group-chat-software-b> (accessed on 15 October 2023).
30. Statistical Office of the Republic of Serbia. Census of Population, Households and Dwellings in the Republic of Serbia. 2011. Available online: <https://www.stat.gov.rs/en-us/oblasti/popis/> (accessed on 5 March 2024).
31. Bech-Danielsen, C. The Kitchen: An Architectural Mirror of Everyday Life and Societal Development. *J. Civil. Eng. Archit.* **2012**, *6*, 457–469. [CrossRef]
32. Alfirevic, D.; Simonovic-Alfirevic, S. Open-Plan in Housing Architecture: Origin, Development and Design Approaches for Spatial Integration. *Arhit. Urban.* **2016**, *2016*, 45–60. [CrossRef]
33. Tsenkova, S.; Polanska, D.V. Between State and Market: Housing Policy and Housing Transformation in Post-Socialist Cities. *GeoJournal* **2014**, *79*, 401–405. [CrossRef]
34. United Nations Economic Commission for Europe UNECE. Sustainable Development Goals. Available online: <https://unece.org/2006#> (accessed on 5 March 2024).
35. Dol, K.; Haffner, M. (Eds.) *Housing Statistics in the European Union*; Ministry of the Interior and Kingdom Relations: Hague, The Netherlands, 2010.
36. Begovic, B.; Matković, G.; Mijatović, B.; Paunović, M. *Socijalno Stanovanje u Srbiji*; Službeni Glasnik: Belgrade, Serbia, 2010.
37. Perunović, P.; Timotić, B.; Obradović, M.; Anđelski, H. Socio-Economic and Hygienic Characteristics of Housing in Serbia. *Zdr. Zaštita* **2011**, *40*, 43–54. [CrossRef]

38. Ministry of Construction, Transport and Infrastructure of Republic of Serbia. Rulebook on Conditions and Standards for the Design of Residential Buildings and Apartments. Official Gazette of the RS 2015, 74/2015. Available online: <https://www.mgsi.gov.rs/lat/dokumenti/pravilnik-o-uslovima-i-normativima-za-projektovanje-stambenih-zgrada-i-stanova> (accessed on 5 March 2024).
39. Radha, R.K. Flexible Smart Home Design: Case Study to Design Future Smart Home Prototypes. *Ain Shams Eng. J.* **2022**, *13*, 101513. [CrossRef]
40. Adeeb Fahmy Hanna, H. Towards Domestic Space Design in the Post-COVID-19 Era: A Review of Relevant Literature. *Alex. Eng. J.* **2023**, *73*, 487–503. [CrossRef]
41. Stambena Strategija Grada Niša. Available online: <https://www.gu.ni.rs/wp-content/uploads/file/Stambena0609.pdf> (accessed on 29 April 2024).
42. Nacionalna Stambena Strategija od 2020 do 2030. Godine. Available online: https://www.mgsi.gov.rs/sites/default/files/Nacionalna%20stambena%20strategija_NACRT_0.pdf (accessed on 29 April 2024).
43. Strategija Održivog Urbanog Razvoja Republike Srbije do 2030. Godine. Available online: <https://pravno-informacioni-sistem.rs/SIGlasnikPortal/eli/rep/sgrs/vlada/strategija/2019/47/1/reg> (accessed on 29 April 2024).
44. Rubin, G.J.; Wessely, S. The Psychological Effects of Quarantining a City. *BMJ* **2020**, *368*, m313. [CrossRef]
45. Drury, A. *Housing Space Standards*; A Report by HATC Limited for the Greater London Authority; Greater London Authority: London, UK, 2006. Available online: www.london.gov.uk (accessed on 3 March 2024).
46. Hu, M.; Roberts, J.D.; Azevedo, G.P.; Milner, D. The Role of Built and Social Environmental Factors in COVID-19 Transmission: A Look at America's Capital City. *Sustain. Cities Soc.* **2021**, *65*, 102580. [CrossRef]
47. Aldridge, R.W.; Pineo, H.; Fragaszy, E.; Eyre, M.T.; Kovar, J.; Nguyen, V.; Beale, S.; Byrne, T.; Aryee, A.; Smith, C.; et al. Household Overcrowding and Risk of SARS-CoV-2: Analysis of the Virus Watch Prospective Community Cohort Study in England and Wales. *Wellcome Open Res.* **2021**, *6*, 347. [CrossRef]
48. Varshney, K.; Glodjo, T.; Adalbert, J. Overcrowded Housing Increases Risk for COVID-19 Mortality: An Ecological Study. *BMC Res. Notes* **2022**, *15*, 126. [CrossRef]
49. Villela, D.A.M. Household Crowding Hampers Mitigating the Transmission of SARS-CoV-2. *Rev. Soc. Bras. Med. Trop.* **2021**, *54*, e08212020. [CrossRef]
50. Signorelli, C.; Capolongo, S.; D'Alessandro, D.; Fara, G. The Homes in the COVID-19 Era. How Their Use and Values Are Changing. *Acta Biomed.* **2020**, *91*, 9294.
51. Bashir, M.F.; MA, B.; Shahzad, L. A Brief Review of Socio-Economic and Environmental Impact of COVID-19. *Air Qual. Atmos. Health* **2020**, *13*, 1403–1409. [CrossRef] [PubMed]

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The Impacts of COVID-19 on Real Estate Market Dynamics: A Systematic Literature Review of Emerging Trends

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Abstract: The real estate market constitutes one of the major sectors that was influenced by the COVID-19 pandemic. It is therefore useful to understand the ways in which COVID-19 has changed the dynamics of the real estate market, establishing new trends in different market segments. The health crisis has upset the consolidated “human normality” by spreading new behaviors and involving almost all sectors. Among economic fields, the identification of temporary and permanent impacts on the real estate market is fundamental to assess the consequences worldwide and to evaluate countries’ resilience ability. The aim of the research is to provide a systematic literature review on the existent academic insights in order to identify the aspects that have been mainly addressed regarding the real estate market’s impacts from COVID-19 and to grasp how the real estate market dynamics have changed. Thus, through five structured steps—from the formulation of research questions formulation to an analysis and discussion of the selected papers for drafting overall conclusions—102 research papers published in the period between the second half of 2020 and the first half of 2023 collected from Scopus and Google Scholar were reviewed and examined. The findings reveal that (i) the housing market has been the most analyzed, (ii) the period between 2021 and 2022 has been the most scientifically prolific, (iii) the US real estate market has been the most studied, (iv) American authors have been the most active on the subject, (v) and the “article” type of research paper has been the most published. These results provide the basis for future research developments on COVID-19 and real estate market dynamics, supporting the implementation of recovery plan strategies and decision-making processes of the market operators for improving the sector.

Keywords: COVID-19 effects; literature review; real estate market; housing market; commercial market; offices market; global real estate dynamics

1. Introduction

During the last several years, the COVID-19 pandemic has not only represented a global health emergency but has also led to a serious economic and labor market crisis, which has had a huge impact on communities. The timely adoption of effective and coordinated measures by central governments sought to limit the large-scale effects as much as possible in order to strengthen employment and income and support the economies of different countries. In this sense, the International Labour Organisation has established four fundamental pillars on which strategic policies for economic recovery in response to the emergency from COVID-19 should be based. These pillars concern (i) incentives for employment through expansionary fiscal and monetary measures and loans for most affected sectors, (ii) support for enterprises with income safeguarding actions, (iii) protection for workers through the adoption of remote work, (iv) and the development of job solutions based on social dialogue in order to strengthen work resilience to new social dynamics [1].

1.1. Overview of the Overall Effects of COVID-19

The effects that the pandemic has generated concern all fields, starting from the demographic one (population and health), passing through the detected high excess of mortality, to the contraction of migratory movements, the upheaval of the population's habits and free-time activities, including the use of leisure facilities [2–8]. Moreover, all economic sectors—agriculture, energy, transport, tourism, etc.—have been affected by the pandemic, both from quantitative and qualitative points of view, with the exacerbation of inequalities to the detriment of segments of the population already in a vulnerable condition before the pandemic. On the one hand, in 2020, this caused huge losses due to the forced stop periods; on the other hand, it led to a strong impulse to experiment with important technological and organizational changes destined to consolidate over time and still visible today (following the declaration of the end of the health emergency made official on 5 May 2023 by the World Health Organization [9]). In fact, an important role was assumed by the consequences of the measures aimed at containing the infection spread, including those on territorial mobility, especially during the first pandemic phase in 2020 [10–12]. In this sense, the impact of the pandemic on migratory flows is closely linked both to the direct effect of the restrictions on international mobility, implemented to counter the fast-spreading virus, and to the negative influence of the climate of uncertainty that has hindered migratory projects. Therefore, the impact of the pandemic has resulted in diversified implications for human behaviors and activities, which, overall, have profoundly transformed and consolidated some habits. Although some impacts have diminished and neutralized in the months following the forced confinement periods, allowing for a return to a life closer to the pre-crisis one, some others, instead, have determined a rise in new behavioral mechanisms that could last over time [13]. For example, in Italy, starting on 26 April 2021, a progressive easing of the confinement measures regarding restaurants, events open to the public, school activities, etc. has been established. As the vaccinated population increased, the spread of COVID-19 decreased. In the formation of these transformative processes, the digital industry has strongly imposed itself, accelerating dynamics that had already started or were ongoing (e.g., smart working), stabilizing alternative only tested models, and showing the numerous potentialities of the use of digital technologies during the restriction measures [14–16]. The deep and widespread crisis connected to the COVID-19 pandemic was limited in time for most of the business system and highly differentiated from the involved production or service sectors. In absolute terms, the most affected markets have been the sectors of tourist services (accommodations and catering) and recreational services (gyms, cinemas, theatres, and discos) due to prolonged administrative closures, restrictions on mobility, and a widespread prudential attitude of people. Conversely, considering the entire pandemic period, which started 11 March 2020 (when the WHO declared pandemic status), the industrial activities have been less affected by the health crisis due to the fact that in the subsequent periods of acute phases, general recovery has been observed. Economic activity has mainly returned to pre-crisis production levels, despite the new weakening factors induced by the acceleration of input and consumer prices strictly associated with the geopolitical situation caused by the Ukraine conflict. The economic [17–22], social [23–25], environmental [26–28], cultural [29–33], and demographic [34–37] impacts of the COVID-19 pandemic, which have also triggered imbalances in the financial global sphere, have been especially reflected in the stock [38–41] and real estate markets. The variations caused by the lifestyle changes have turned into new supply and demand dynamics within all the different real estate segments, such as residential, commercial, retail, offices, etc. In this global scenario, characterized by relevant uncertainty, a “new normal” approach has been defined in order to meet the changing community needs. Also, in this field, technology has played a key role, becoming an integral part of the real estate sales processes in order to build a communication strategy capable of adapting to the new needs of potential buyers and satisfying the requests of sellers, in the cases of sales, leases, and investments.

1.2. Aims of the Review

The relevance of the present review is strictly related to the current need to develop investigations into the effects caused by the pandemic on the economic sectors and, in particular, on the real estate market. The urge to identify the COVID-19 *temporary* impacts and the *permanent* ones could help the definition of an overall framework of the main consequences on the real estate market mechanisms in order to summarize new trends and behaviors. In this sense, the attention paid by the academic community to the analysis of the emergency implications in the different fields (social, health, economic, tourism, labor, etc.) attests the high significance of the topic in the last four years (2020–2023). The world of research has focused—and currently continues to focus on—the debate on the fundamental changes derived from the COVID-19 outbreak. One especially crucial issue addressed by scholars from various scientific disciplines concerns the ‘ordinary’ reaction to the exogenous impact. The need to create more livable and sustainable cities is connected to the notion of “resilience”, i.e., the ability to resist exogenous events deemed unpredictable and to adapt to the modifications of the social and economic structure that may occur [42,43]. Future cities, in fact, should be able to adapt to ongoing transformation processes and unexpected and sudden events, based on the definition of an urban system in which each part is connected to the others and is included in a holistic vision of human settlements. Sudden event management models should provide more resilient responses in the presence of exogenous impacts in order to reduce the impacts generated on social and economic structures. The research on the topic allows for exploring several aspects of the COVID-19 pandemic in order to outline a general overview of the main questions and to give useful guidelines to address likely new and future exogenous impacts and related replies and solutions. The need to prepare to face challenges (environmental, social, health, cultural, etc.) and to vary long-standing dynamics represents a current prerogative of resilient future cities.

This review is part of an illustrated framework and provides a systematic analysis of the literature aimed at identifying the aspects that have been mainly addressed regarding the impacts of COVID-19 on the real estate market and grasping how the real estate market dynamics have been changed. To successfully achieve the fixed literature review’s goals, this paper is articulated as follows. The second section presents the phases of the method carried out for identifying the papers. The third section consists of the analysis of the records included in the review according to the year of the publication, the geographical origins of the authors, the examined geographical context, the type of the research paper, and the investigated real estate market segment. The fourth section summarizes the most relevant selected contributions regarding the global real estate market and the residential, commercial, and office segments. In the fifth section, the conclusions of the work are provided.

2. Methods

In the present study, a systematic literature review structured into five phases was carried out to assess the implications of COVID-19 on the real estate market dynamics. The five phases were: (i) formulation of the questions according to the purposes of the work, (ii) Scopus and Google Scholar searches; (iii) research paper selection; (iv) analysis and synthesis of the selected papers; (v) discussion and conclusions.

The first phase involved the development of two research questions in order to support and better guide the achievement of the research’s purposes, specifically indicated as follows:

Q1: Which aspects have been mainly addressed regarding the impacts of COVID-19 on the real estate market?

Q2: How have the real estate market dynamics changed due to the spread of COVID-19?

The second phase consisted of the identification of the databases to be used in the bibliographic research and in the selection of the keywords capable of identifying the research papers that met the aims of the work. Thus, Google Scholar and Scopus were selected

in this study as the most suitable. Google Scholar is a freely available search engine that searches across a wide range of academic sources, including journal articles, book chapters, dissertations, and conference papers. Scopus is the largest multidisciplinary abstract and citation database of peer-reviewed literature and includes about 6.8 million conference papers and 21,000 peer-reviewed journals. For these reasons, both databases were used based on their reliability and accuracy. The keyword combinations used for searching in both the databases were: COVID-19 effects on housing/commercial/office/industrial/hospitality market—COVID-19 impacts on real estate dynamics—COVID-19 impacts on global real estate market—COVID-19 effects on housing selling prices—COVID-19 effects on rental housing/commercial/office market—COVID-19 housing/commercial/real estate demand variations. The mentioned terms were used to initially identify papers by title, abstract, and keywords. The designated timespan refers to the time between the initial outbreak of the pandemic in 2020 and when this research was carried out, i.e., June 2023.

The third phase applied exclusion criteria, meaning that only research papers that studied the real estate market during COVID-19 were included in the collection phase, and papers lacking coverage of this were excluded. Only English language papers with accessible full text were analyzed in order to ensure—through the content analysis—that the papers responded to the established research questions, Q1 and Q2. In this way, an initial overall database of 360 research papers was obtained. The application of the exclusion criteria allowed us to acquire a final dataset of 102 research papers.

The fourth phase concerned the analysis of the contents of the final 102 research papers from the following points of view: no. of publications per year, geographical provenance of the authors, geographical context of analysis, research paper type and real estate segment. In the fifth phase, discussions about the content analysis were carried out, and the conclusions of the work are provided in order to outline an overall overview of the impacts of COVID-19. Figure 1 summarizes the literature review procedure for the current study.

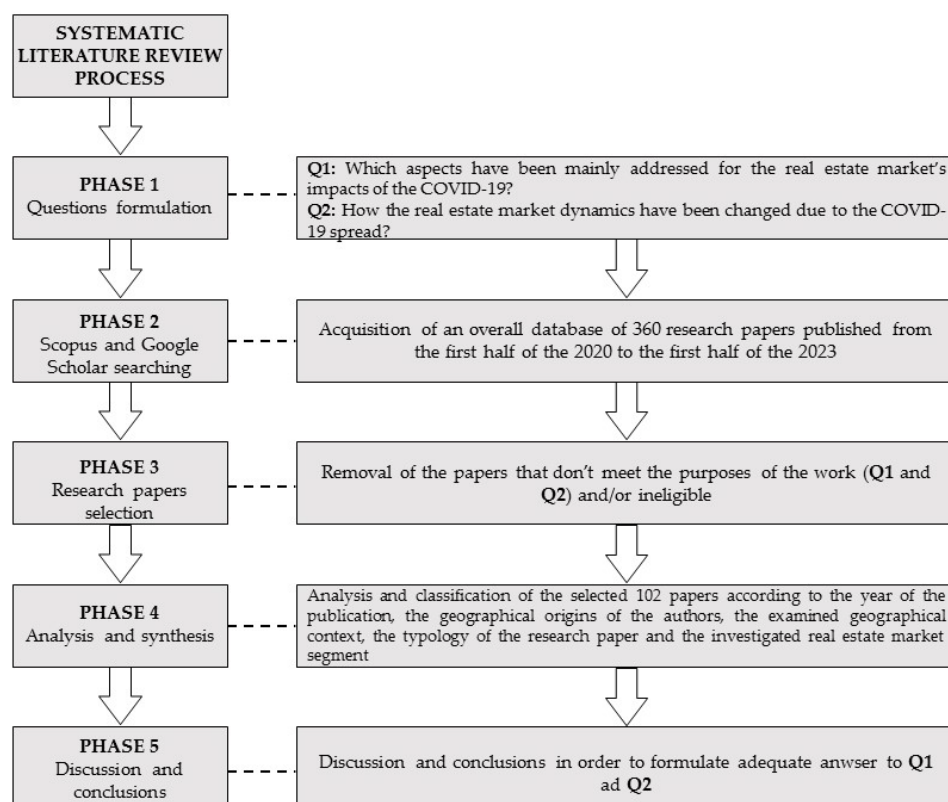


Figure 1. Flow chart of the literature review procedure developed in the present analysis.

Figure 2 presents the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) flow diagram for the current study.

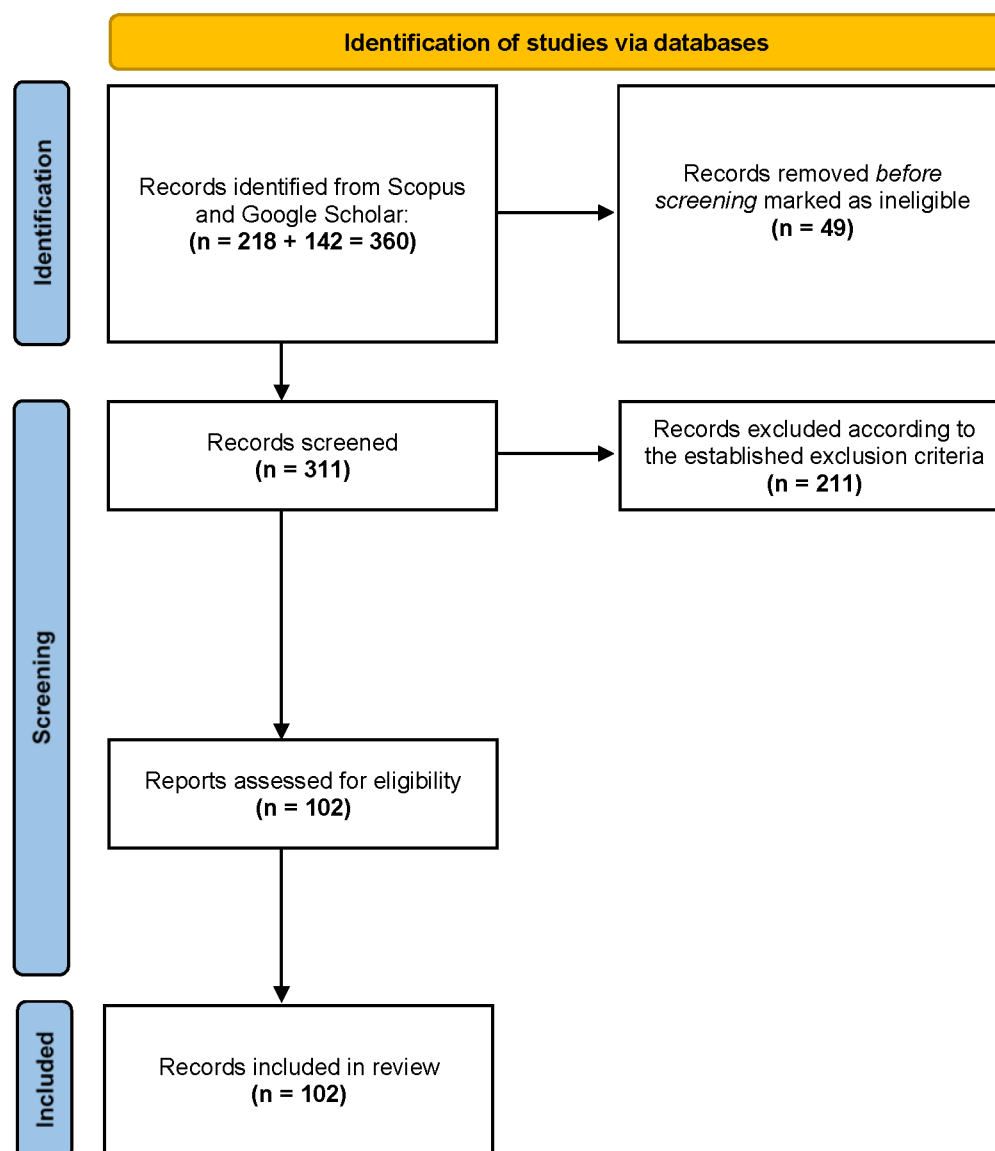


Figure 2. PRISMA flow chart of the literature review.

The “Identification” step involved record identification from the Scopus and Google Scholar titles, abstracts, and keywords of the 360 contributions retrieved, and we identified studies that were ineligible for screening (49 papers). The subsequent step, “Screening”, focused on the filtering of the 311 papers identified using the exclusion criteria. The exclusion criteria relate to the characteristics of the papers, including their language (different from English), full-text availability, and their relevance to the effects of COVID-19 on the real estate market, resulting in the exclusion of 211 studies. Finally, of the initial 360 academic papers identified in the databases, 102 were found to be consistent with research questions Q1 and Q2, and their contents were analyzed.

3. Analysis of the Records Included in the Review

Based on the PRISMA results, 102 papers meeting the purposes of the work were identified. This section describes these papers, providing a general overview of their relevant features. In particular, each research paper was analyzed in terms of its year

of publication, the authors' provenience, the examined geographical context, type, and investigated real estate market segment.

3.1. Numbers of Papers per Year

The 102 analyzed articles cover the period between the first half of 2020, the time of the initial spread of COVID-19 around the world, and the end of the first half of 2023, the time of this study (June 2023). In these three years, 37% of the 102 considered papers were published in 2021, followed by 35% in 2022, 19% in 2020, and only 9% in 2023. This temporal distribution seems to follow the natural development of the COVID-19 pandemic: the pandemic has been declared over (2023), and therefore, the smaller number of studies found in the literature is justified by the change in research topics towards more urgent problems, including the effects of the war in Ukraine on global markets. Moreover, it should be highlighted that for 2023, only six months were considered for the paper collection. Several papers were published in the second half of 2020, right after the spread of the pandemic, but for 2021 and 2022, it was possible to find most of the studies, specifically 74, due to the fact that these years can be considered the core of the pandemic disease. In particular, in order to efficiently and clearly detect the tangible effects of the health crisis on the real estate market dynamics, especially those that are not immediately measurable and visible, many authors conducted their works in the period between 2021 and 2022. In this period, the extent of the effects on the real estate market and, simultaneously, the different phases of the pandemic's evolution have allowed for the development of research. Figure 3 shows the distribution of the number of papers per year with reference to the sample of 102 articles analyzed. With reference to the last four years (2020–2023), the graph reports the percentages of published scientific contributions. The analysis allowed us to attest to the significance of the topic for academic communities during the full duration of the pandemic (2021 and 2022) while also considering the generally long publication time and the time during which the present review was written.

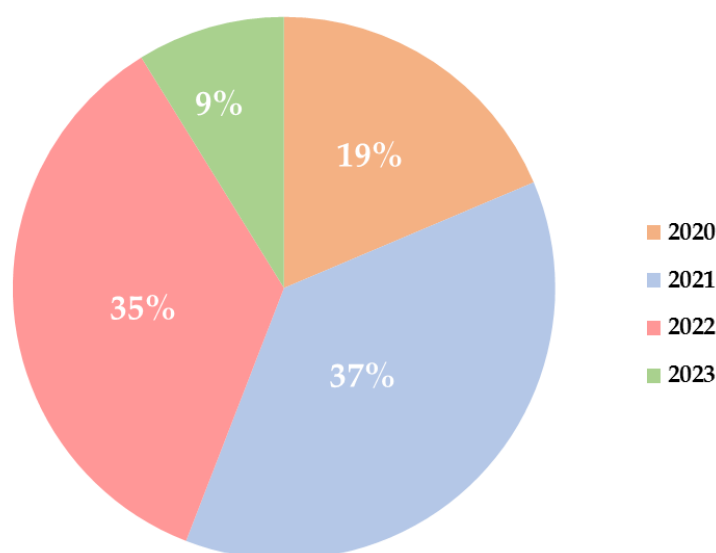


Figure 3. Percentage distribution of the 102 analyzed papers per year (2020–2023).

3.2. Number of Papers per Type

In the Scopus and Google Scholar databases, it is possible to find several academic papers which differ in the type of contribution. Among the 102 sample papers, four different types of academic contributions were identified: (i) reviews, (ii) opinion papers, (iii) proceedings or volume contributions, and (iv) articles. The “opinion paper” type included studies that contain relevant reflections or data examinations of the first evidence of variations in the property market following the spread of COVID-19. Most of the papers belonging to this category were published in the second half of 2020. The reason can

easily be traced back to the scarcity of analytical data at the beginning of the pandemic. Many authors have provided their contributions to the subject, sharing interesting and critical reflections on: (i) how the residential market is changing, (ii) how the global real estate market is being impacted by COVID-19, (iii) how the economic recovery policies of local governments should be set up to curb serious repercussions on the real estate market. A total of 4 studies pertained to this type, out of the 10 proceedings and volume contributions and 8 reviews that were selected. Most of the collected papers were research articles, with 80 out of 102. This composition allows us to say that both the conferences, with an additional collection of contributions to volumes, and the journals, with special issues and dedicated topics, have given great attention to the issue of COVID-19 in the construction sector, resulting in widespread discussion. The fact that most of the research papers were articles could be due to the complexity of the analyses necessary for the study of the effects of COVID-19 on the real estate sector, requiring articulated and structured research works and not suitably adequate to be traced back to the form of proceedings or volume contributions. In Figure 4, the distribution of the analyzed papers within the four mentioned typologies is reported. With reference to the graph, the largest number of scientific contributions is constituted by article; this is in line with the relevance of the topics dealt with in the different studies that were fit for this type of paper. In this sense, it should be outlined that numerous special issues promoted by prestigious journals have been launched in the last several years concerning the analysis of specific aspects of the COVID-19 pandemic.

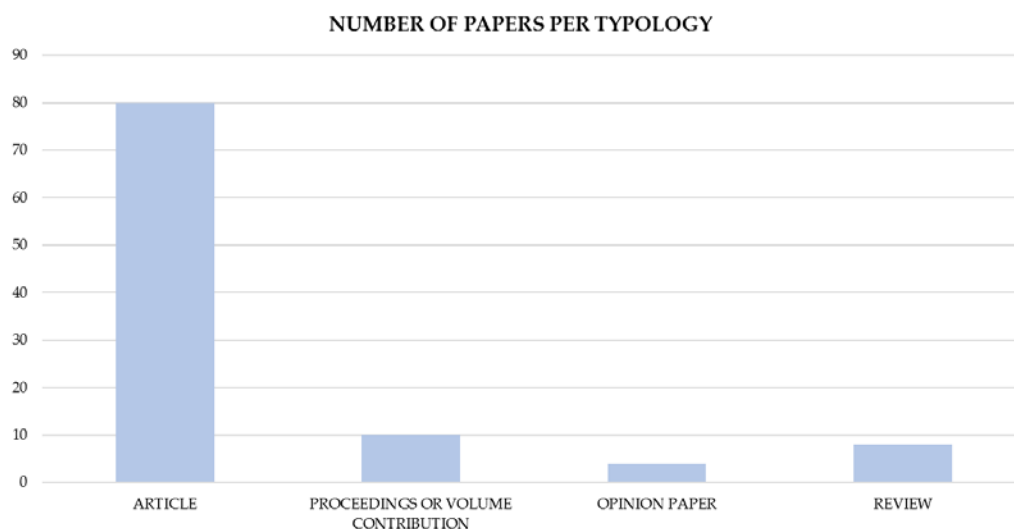


Figure 4. Number of papers per type among the 102 analyzed.

3.3. Number of Papers per Geographical Provenance of the Authors

Another important issue that helps to identify the main effects of COVID-19 on real estate dynamics is investigating the geographical provenance of the authors. This analysis provides the possibility of understanding in which state the relationship between the real estate market and COVID-19 has received more academic attention. As shown in Figure 5, contrary to what is generally expected about the prevalence of China in studies on the building sector, the United States of America (USA) had the most. Among the 102 papers, 114 origin states were identified. Exactly 26 authors came from the USA, followed by 14 from the United Kingdom, and China came in third with 11 authors. Less attention has been paid by the authors of academic institutions based in Slovakia, Germany, Serbia, Kosovo, Russia, Japan, Portugal, Sweden, Netherlands, Ireland, Korea, Pakistan, Israel, Turkey, and Switzerland. Several reasons that support these findings can be proposed. First of all, the political attention given to the topic and public opinion may have played a crucial role in the early research on the real estate sector, and the USA and the United Kingdom are certainly particularly focused on this issue. Moreover, it is important to highlight that there

is not always an overlap between the origin of the authors and the geographical context of the analysis (described in the following subparagraph), and therefore, it is good to consider the origin of the authors as a proxy element of the socio-economic attention paid to the real estate sector in this period. This in turn reflects the importance that the property sector holds in the economies of the authors' country of origin, and these are useful data for understanding the significance of the modifications that COVID-19 caused in the relevant real estate market.

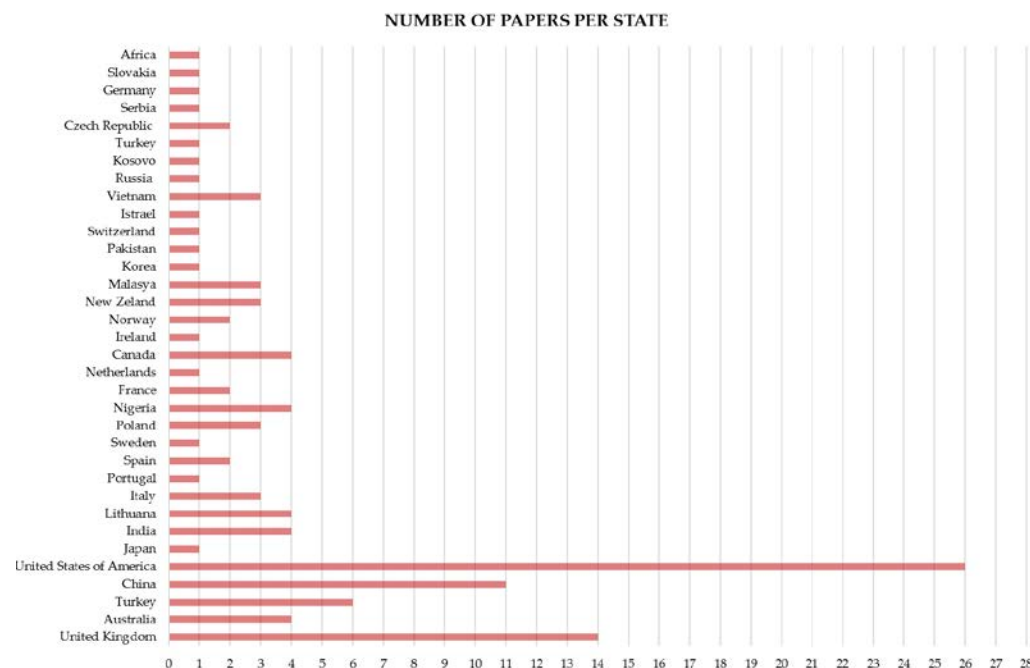


Figure 5. Number of papers per geographical provenance of the authors among the 102 papers.

The various states of origin of the authors of the analyzed works are shown in the ordinate axes, and a number of contributions is associated with each one. It should be emphasized that numerous studies have been conducted by authors from different countries; these demonstrate the relevant collaborations between different academic communities aimed at integrating and improving the “local” knowledge of each working group on the topic of COVID-19. In this regard, comparisons on such a global issue are highlighted.

3.4. Number of Papers per Geographical Context of Analysis

In the examination of the geographical context of the analysis, it is important to understand which real estate markets were considered the most relevant during the spread of COVID-19 and which of them was the most transparent in terms of available data necessary to carry out the research development. The findings shown in Figure 6 suggest that in absolute terms, the USA's real estate market is the most studied, followed by those of China and of United Kingdom. It should be pointed out that 13 out of 102 papers analyzed multiple countries within the same study. This is an interesting result, consistent with the empirical evidence. According to this, the USA, China and the United Kingdom are the countries that have contributed the most to the research on the effects of COVID-19 on the dynamics of the property market. At the same time, these markets, representing the main global real estate markets, have allowed us to analyze the mechanisms of the major world markets in terms of the potential repercussions on local ones, understand the extent of the implications of COVID-19 on the construction sector, and establish the trends and changes to carefully determine economic recovery policies.

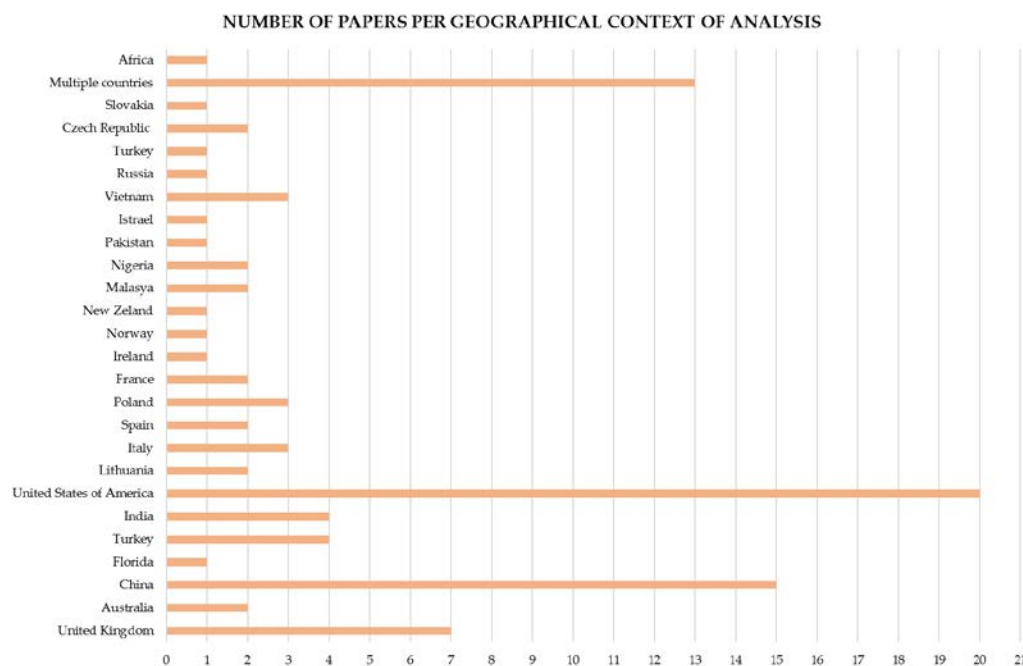


Figure 6. Number of papers per geographical context of analysis.

The graph reports the countries in which the analysis of COVID-19 effects has been most addressed (United States of America and China). In particular, these countries are those in which the highest impacts on the economic market have been detected: in fact, on 1 January, the USA was the most affected country in the world (in absolute numbers), with over 102 million confirmed cases and over 1,117,000 deaths, and China was the first nation from which the virus spread worldwide. The large number of studies carried out on multiple countries demonstrate the attention given by academic communities to the comparison of the effects of COVID-19 in different geographical contexts, in order to define a framework for the observed implications.

3.5. Number of Papers per Real Estate Market Segment Analyzed

The real estate market can be subdivided into different segments according to the features of the properties and the intended use. The principal real estate market segments are residential, commercial, and retail. Nevertheless, this distinction is sometimes not so clear-cut, especially for income-producing properties. For explanatory purposes, and on the basis of the declarations found in the 102 papers, three types of market segments were identified: (i) residential, (ii) commercial, and (iii) offices. Given the presence of several papers concerning the global real estate market and the examination of mixed intended uses in the same studies, two other “segments” were created. It should be specified that in the “mixed uses” segment, the studies that simultaneously analyzed the impact of COVID-19 on offices and residential properties or industrial and hospital buildings were included. However, the “global real estate market” segment is proposed for collecting studies that explore the trends and dynamics of global real estate indexes in order to detect the wider COVID-19 influences and not investigating a specific intended use.

Specifically, 58 research papers out of 102 focused on the residential segment, followed by global real estate, with 16 out of 102, the commercial segment with 14 out of 102, and the offices and mixed-use segments with 8 and 6, respectively, out of 102. These findings can be linked to several possible reasons, but they appear to be consistent with the empirical evidence. Firstly, the residential properties are strongly associated with the health restrictions introduced by governments to limit the transmission of infections, and therefore, many studies have examined different housing issues, such as the flexibility of spaces for remote working, the quality of environments, the healthiness of the buildings, and

appreciation for the presence of gardens and green spaces or changes in the appreciation for various characteristics of the surrounding urban context, such as proximity to public transport. Secondly, due to the introduction and the spread of different modalities of remote working and the improvement in the logistics sector to guarantee the delivery of goods and services despite the imposed restrictions, the commercial and office real estate market dynamics have been largely investigated.

In Figure 7, the distribution of papers according to the analyzed real estate market segment is represented. The histogram presents the relevance assumed by the residential market for which (i) the selling prices and rental fees trends, (ii) the transaction volume changes, and (iii) the variations in the housing demand have been mainly examined in the selected studies. For the time horizon considered in the present research, the analysis of the other real estate market segments confirms the lower interest of scholars in investigating the effects connected to the COVID-19 pandemic, especially due to the fundamental role played by the residential sector in the economic dynamics. Moreover, another possible reason for these findings could be related to the central role that the residential properties have assumed during the restrictions imposed by the governmental measures.

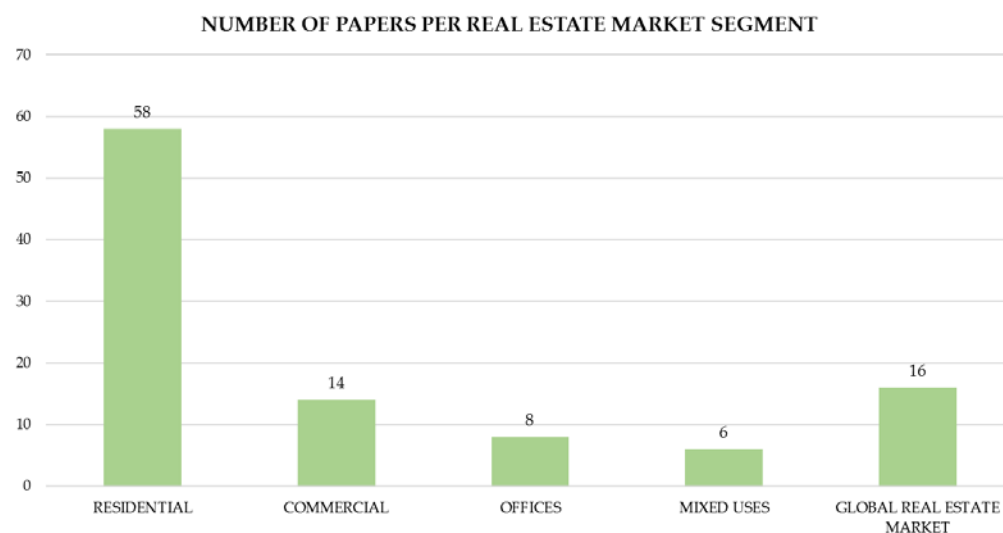


Figure 7. Number of papers per real estate market segment.

4. Discussion of the Results

In order to detect the aspects that have been mainly addressed regarding the impacts of COVID-19 on the property market and to grasp how the real estate market dynamics have changed, in the following sub-sections, an overview of the papers that support the achievement of these aims is provided.

4.1. Residential Market

The analysis of the implications of the COVID-19 pandemic on the residential market segment mainly concerned the exploration of housing price variations and changes in the market dynamics in terms of demand and supply [44–80]. It is possible to identify works that both report positive and negative impacts of this exogenous event on the real estate market's dynamics in several countries, as shown in the literature review of Mohammed et al. [81]. For example, Li and Zhang [82] studied spatial models and the heterogeneous allocation of housing price differentials in different contexts of the USA property market during the crisis and concluded that the effects of COVID-19 on housing prices have changed across space, not only from central metropolitan areas to rural ones, but also from one urban area to another. Similarly, Nelson and Frost [83] studied the spatial and temporal patterns of transfers in the urban hierarchy since the beginning of the COVID-19 pandemic in New England and confirmed movements of the population from

metropolitan central areas to micropolitan and noncore counties, which might be initiating a new rural gentrification phenomenon. Likewise, Desmet and Wacziarg [84] showed a more severe impact of COVID-19 on densely populated areas through the analysis of the correlations of infection cases and deaths across USA counties.

In the UK, the impacts of COVID-19 have been assessed with reference to the financialization of housing by Blakeley [85], arguing that significant reforms are fundamental as the pandemic could determine an increase in wealth inequality and exacerbate the housing crisis. Within the Chinese context, the impact of COVID-19 on the housing market constituted the focus of the research carried out by Yang and Zhou [86], who used the average housing price to capture the trends of local housing markets. Their findings showed considerably positive impacts of the pandemic on residential prices in the Yangtze River Delta region and they have suggested the use of effective price control by the central government. Tsai et al. [87] examined the fluctuations in the performance of city-center and peripheral housing markets in regions with popular tourist attractions after the COVID-19 restrictions, using a hedonic model to reveal that a substantial structural change was found in the suburban residential market; the volatility risk of the prices substantially decreased, triggering an increase in transaction premiums. In addition, because sellers raised their asking prices and the transaction time becomes longer, the sellers in the city-center housing market are particularly influenced by the dispositions' impacts.

With reference to Turkey, the impacts of the COVID-19 pandemic, loan packages, and other macroeconomic variables on the abnormal returns of residential prices were identified using three econometric steps, in which an event study, panel data examination for the regional and city levels, and a regression model were implemented [88].

The same methodology was applied for the determination of the factors affecting real estate prices during COVID-19 in the Nam Tu Liem and Cau Giay districts in Hanoi (Vietnam) [89].

Moreover, Hromada [90] analyzed the effects of the measures on the COVID-19 pandemic on the property market in the Czech Republic and evaluated real estate price offers published on specific servers, expecting a demand growth particularly for low-cost flats and rooms for rent with good public transport access to the city of Prague center and recognizing the higher importance of the quality of housing compared to the price factor. In addition, the same author [91] investigated the development of the construction market in the same geographical context (Czech Republic) during the years of the health emergency, providing useful outputs for professionals, researchers, and small and large investors through basic statistical methods of processing a large dataset. The variations in housing demand connected to the crisis are at the core of the research carried out by Tajani et al. [92], who aimed at structuring a methodology to evaluate the change that has occurred in the residential market demand as an outcome of anti-contagion measures, exploring six metropolitan Italian cities.

With regard to the housing green features, some authors, like Kaklauskas [93], have carried out a systematic analysis of the articles that provide a perspective on green housing before, during, and post-COVID-19, highlighting that building hygiene and comfort, the indoor environment, the design concept, and the household energy source are among the factors with a major impact on the preference towards green buildings.

Zhang and Pan [94] found evidence for the permanent asymmetric impacts of economic supports on real estate prices only in Austria and Switzerland among 58 examined countries during the period from 1 January 2020 to 3 September 2022.

The effects of the pandemic on the rental housing prices were carefully addressed by Subaşı and Baycan [95] in 81 provinces of Turkey through the use of a descriptive analysis and comparison of the exchange of unit rental prices and unit selling prices at the provincial scale. The findings demonstrated that the rental prices grew from March 2020 to December 2021 in the whole country. Furthermore, the outputs pointed out that the highest rental price increase arose in provinces located in Central and Eastern Anatolia. More attention to the short-term rental market was given by Sequera et al. [96], who analyzed how the

COVID-19 emergency caused changes in the supply of short-term rentals and the type of demand of such rentals in Spain. The platform suppliers were able to mainly survive despite the sudden end to tourism demand, which was essentially stopped. Also, Shen and Wilkoff [97] empirically studied the implications of the spread of COVID-19 on the short-term rental market with a machine-learning algorithm to create a wide “cleanliness dictionary” to detect whether an *Airbnb* unit is clean. They found that properties that were perceived to be clean increased their income by 17.5% and their occupancy by 16.5%, moderating the negative impact due to the pandemic. Within this field, the second homes during and after the pandemic were studied by Zoğal et al. [98]. They observed that a potential change in tourist preferences could place second homes at the center of tourist activity as soon as travel restrictions were limited. Tenants’ adherence to lease obligations is another interesting topic in this line of research on the residential housing market. Gbadegesin [99] used descriptive statistics, factor analysis, and computer-aided qualitative data analysis to reveal that, in Nigeria, except for tenant status and tenant family size, there was no relevant relationship between tenants’ health conditions and the consequences of COVID-19 on tenant non-compliance with lease obligations.

In attempting to identify a likely new 2007–2009-type crisis, Afxentiou et al. [100] compared the current residential market conditions with those of 2007–2009 and concluded that the many of the factors that caused the 2007–2009 crisis are not occurring currently.

The different behaviors of luxury and low-end housing markets have been analyzed by Wang [101] by employing a difference-in-differences method. The findings first show that house prices, demand, and supply all decreased from March to May 2020 and increased in July and August 2020, with demand prevailing in the city of Los Angeles. Second, the drop in overall prices and demand before June mainly originated from the lower-priced market, whereas for the higher-priced market, limited changes in demand have been detected.

How COVID-19 has modified the link between to-metro and by-metro accessibility and housing prices was investigated by Yang et al. [102], who found interesting results using a hedonic price model. COVID-19 strongly influenced the value of to-metro accessibility, and the flattening of the to-metro price gradient is more discernible for big or high-priced houses. The shifting preference of residents has also been verified by a reduction in the quantity of house transactions in metro-adjacent areas. Bangura et al. [103] highlighted both the positive and negative effects generated by Australian economic policies for the recovery of the post-pandemic period on first-home buyers’ dynamics. Table A1 in the Appendix A presents each analyzed reference examining the effects of COVID-19, and a summary of the most important findings is shown.

4.2. Commercial Market

The relationship between the COVID-19 pandemic and commercial properties has been examined both in terms of selling and rental price variations and the influencing factors for buyers, sellers, and tenants for the commercial segment [104]. In this framework, Rosenthal et al. [105] estimated a drastic decline in the rent premium associated with employment density, quantifying a commercial rent gradient drop of roughly 15% in transit cities. Furthermore, the USA commercial real estate loss value caused by COVID-19 was assessed using equity market data and the Real Estate Investment Trusts (REIT) analysis by Chong and Phillips [106]. In the same geographical territory, the liquidity effects measured by the demand–supply gap in terms of asset pricing implications of the health emergency for private commercial real estate markets have been quantified in eight metropolitan cities: the results show the highest predicted average price reduction (between 19% and 30%) in the city of New York [107].

Conversely, Croom et al., in 2020 [108], applied a hedonic method to develop a commercial real estate pricing model in order to compare the situations with and without COVID-19 and found no significant price changes in the considered USA cities when COVID-19 parameters were input data for the model.

The comparison between the urban and suburban commercial property transactions before and after the start of the pandemic carried out by Rolheiser [109] in the USA showed a substantial price decline post-January 2020 (−8%) and a non-constant spread of the effects across cities and building types. At the city level, the highest reduction was shown for buildings in cities with high rates of working from home (−12%) and long shifts (−11%), whereas, at the building level, a significant reduction in prices was observed for the oldest buildings, and for the suburban areas, stable and/or increasing prices in the post-pandemic period was detected.

With reference to a wide context of 23 advanced economies and 7 emerging market economies, the vulnerabilities in the commercial real estate sector following the public health crisis were analyzed by Deghi et al. [110] in order to quantify the extent to which commercial prices reflect macroeconomic fundamentals and to suggest “macroprudential policy” for curbing financial stability risks.

Through timely proprietary data and regression analysis, the changes in the commercial property rent dynamics due to COVID-19 in the Asia–Pacific region led to strong declines in rents of approximately 15% during the first six months of 2020, with the most significant reduction in the most exposed regions and in the retail property sector (for which a drop over 30% was found) [111].

In Spain, the analytical research of Fernández Cerezo et al. [112] aimed at exploring the evolution of commercial real estate transaction numbers and prices by assessing the effects of the pandemic on the activity and stock prices of the Spanish real estate investment trusts specialized in this market segment. For a better understanding of the main results that can be obtained from the analyzed studies, Table A2 in the Appendix A shows their summary.

E-Commerce Market

The analysis of the volatility in the commercial market due to the COVID-19 pandemic has been the topic of different contributions aimed at defining the extent of this exogenous impact on variations in real estate dynamics. The “new normal” introduced in the lockdown phases (smart working, etc.) had relevant implications also in the next phases of the pandemic, transforming the lifestyle and consolidating or creating new ordinary behaviors.

In this scenario, the purposes of various recent studies have concerned the analysis of the acceleration of e-commerce and digitalization on commercial real estate. For example, Nanda et al. [113] discussed strategy event data in the UK and insights obtained from interviews with retail asset managers and property owners using a mixed-method approach to determine the impact of the COVID-19 pandemic on the specific market and high street landscape, highlighting an urgent need to reposition the physical shops and recognizing digital platforms as key functions of multi-channel store businesses. Zhu [114] designed a real estate virtual e-commerce model based on big data technology by combining the advantages of e-commerce and virtual communities to collect platform data for analysis and processing to detect and meet the needs of customers and to encourage the fit and healthy development of the real estate sector. The same issue has been addressed by Sulaiman et al. [115] regarding the explanation of Matterport as a digital platform for a marketing approach through hyper-real 3D virtual tours, which aimed at helping potential buyers make decisions in the real estate business during COVID-19. Meanwhile, the impacts on the professional situation of people working in the real estate market (real estate agents, property managers, and valuers, etc.) in Poland have been analyzed through online surveys based on targeted questionnaires to identify the current and future/expected changes in this business type [116].

4.3. Office Market

The wide number of studies on the effects that COVID-19 has had on substantial modifications to locations at which work takes place, especially due to the widespread use of smart working, confirms the importance of these structural variations in real estate dynamics. In this sense, Hensher et al. [117] examined the relationship between the

considerable growth of remote work and the responses from organizations in reviewing their office capacity requirements using the data of 459 businesses and related work spaces from pre-COVID-19 to April 2022 and stated intentions for 2023 for the Greater Sydney Metropolitan Area.

With a similar aim and through a structured online questionnaire survey, the paper by Barath and Schmidt [118] examined the potential sustainability of offices and identified the willingness of managers to transform or adapt to demands post-pandemic, discussing the changes that employers will make in terms of the work environment and office layout and assessing the attitude of managers toward the variations associated with a flexible office space to propose solutions for more effective work spaces in the future.

In [119], the influence of remote work on the office sector in New York city was determined by observing the high effects on both current and expected future cash flows for these properties and documenting large modifications in lease revenues, office occupancy, lease renewal rates, lease durations, and market rents. An overall 45% reduction in market values in 2020 and of 39% in the longer run were also found. Moreover, the authors pointed out the difference between higher-quality office buildings, for which an attenuation of these trends was detected due to the importance assigned to the quality standards of properties, and lower-quality office properties, for which more dramatic swings were outlined.

With reference to seven major Chinese cities, the research developed by Wang et al. [120] aimed to evaluate the direct effects of COVID-19 on office building rents and vacancy rates on the basis of a sentiment index, detecting an asymmetric effect, for which the COVID-19 sentiment index had a more substantial impact effect on rents where office vacancy was higher.

Also, Oladiran et al., [121] in their work, examined corporate firms across different industry sectors that have a business presence in the UK for analyzing the relationships among COVID-19, remote working, and changes to the firms' office space strategies. Their results revealed that firms were more inclined to make changes to the quantity of their office space rather than the quality. In line with this, how large UK corporate occupiers perceive the potential role of flexible work space in their office portfolios in a post-pandemic context was investigated by Cooke et al. [122]. Semi-structured interviews submitted to a sample of real estate managers indicated that although the pandemic has made corporate occupiers strongly re-assess where and when different work tasks have to be carried out, it is not yet evident whether this has significant implications for the flex space sector. The pandemic has certainly forced most large office occupiers to evaluate the role assumed by their office space. With the purpose of examining whether the shift to remote working during the COVID-19 crisis is going to diminish the need for renting large office space and how this emerging trend will impact the real estate market in Israel, Naor et al. [123] detected a reduction both in procuring office spaces and in their unitary price. Bangura and Lourens [124] analyzed the implications of the hybrid work arrangement on businesses and employee health and safety using the case study of Uni4 Online Westville Durban South Africa, showing that the post-COVID hybrid work modality can negatively affect workers on a psychological level. In Table A3 of the Appendix A, a summary of the main findings enhanced within the analyzed research papers of the office market are shown.

4.4. Mixed Uses

The real estate market is characterized by several segments that, in different ways and to various extents, have been affected by variations in their dynamics due to the onset of COVID-19. Due to the differences in the variations of the effects caused by the specific features and dynamics of each segment, some authors provided an analysis that simultaneously consists of an overview of multiple segments [125]. After the first stage of COVID-19 in 2020, different studies put forward some considerations on (i) variations in the residential, commercial, and financial real estate trends [126]; (ii) the world of real estate locations, in terms of consistent shifts in the location preferences of households and firms [127]; and (iii) the housing, commercial, and mortgage sectors [128].

In the more advanced phases of the pandemic, however, other authors explored in depth the dynamics of more than one real estate market segment. For example, Hoesli and Malle [129] reported that in the USA, UK, France, and Italy, retail and hospitality buildings, and to a minor extent, office properties, were the most impacted by COVID-19, whereas the housing and industrial segments were less affected by the emergency. The volumes of retail, office, and industrial properties of the metropolitan areas in Florida were examined by Wen et al. [130], who determined that the sales quantity of retail properties dropped instantly due to the impacts of COVID-19, but a strong recovery after one quarter was observed. Meanwhile, COVID-19 slowed the increase rate of rent for offices, in the short term, but the office rental market bounced back to about 70% just one quarter later. In comparison, the industrial segment witnessed a rise in the growth rate of sales and rent prices. In Table A4 of the Appendix A, a summary of the main findings of the analyzed research papers for the mixed-use category is reported.

4.5. Global Real Estate Market

The property market mechanisms have been turned upside down by COVID-19, strongly changing the market supply, demand, selling prices, and rental values [131]. Most of the studies aimed at evaluating the consequential pandemic effects on all aspects of the economy, including real estate, to provide recommendations to mitigate the influence of real estate transactions during similar pandemics in the future [132]. In this framework, Oyedele [133] assessed real estate transactions in Lagos (Nigeria) during the health crisis through a systematic random sampling technique on the basis of professional briefs on properties available for letting and sales. The author found that warehouses are in the property class that is “most readily available for occupation and demand”, with the highest selling and rental values during this phase, and identifying bank transactions as the most predominant problem in the study area. By using Zillow’s Observed Rental Index for the measurement of variations in the residential rental rates at the zip code and Metropolitan Statistical Area levels, the implication of COVID-19 on migration models and real estate markets in US cities was quantified in [134], finding a “donut effect” that reflects the emptying of city centers and the growth of suburban outer rings. In addition, the research by [135] addressed the pre-pandemic property market and the COVID-19 effects in the Indian context by analyzing the risks and scenarios for the various real estate industry stakeholders (mortgage holders, real estate workforce, and builders). The global uncertainty within real estate markets due to the COVID-19 crisis was the focus of the analyses carried out by Worzala [136] regarding an examination of the increased risk that is significantly influencing the fields of property investment and finance. Similarly, the construction sector and the real estate development and their interconnections during the periods pre-, intra, and post-COVID-19 represent the core of the literature review by Kaklauskas et al. [137], which was aimed at providing evidence of variations in behaviour regarding investments in construction caused by COVID-19, with reference to many different countries. Along the same line of research, the study by Jovanović-Milenković et al. [138] can be included, given its main purpose of defining a parallel overview of the property market in the USA, China, some European nations, and the Republic of Serbia for identifying the harm to nations’ economies and to real estate market development interventions due to the emergency. Although the virus appeared at different time periods in the different countries, the analysis concluded that the same trend of behavior regarding the indicators of changes in the building market was observed, with a reduction in real estate sales by 90% compared to the same period in 2019 in the Chinese context, a 15% reduction in sales in April 2020 compared to the previous year in the US real estate market, a decline of 70% in European nations, such as Great Britain, Italy, and the Republic of Serbia. By taking into account that the real estate market constitutes a substantial component of an overall country’s economy, during the acute pandemic phases (especially in the lockdown periods), the real estate sector had to be significantly transformed, for example, by applying new technologies. In this sense, challenges and opportunities for real estate brokerage firms of Vietnam in

the post-COVID-19 period were examined by Ngoc [139], in order to propose solutions and recommendations for real estate operators to improve their professional skills and knowledge. Likewise, in the Indian territory, an examination of the national building sector before COVID-19 was performed, implications of the health emergency on specific markets were detected, and the relative opportunities and threats for builders, homebuyers, and the workforce in real estate were deciphered by drawing a targeted summarized framework for the various real estate participants [140]. The same geographical context was analyzed by Yadav and Yadav [141] with the purpose of describing the influence of the pandemic on housing, tourism, retail, and commercial buildings through secondary data: the crisis impacted foreign exchange earnings and job chances caused by a substantial drop in the arrivals of foreign tourists in 2020 to India. Consequently, the retail and hospitality buildings were more affected by COVID-19 compared to the industrial and residential segments. Through an empirical investigation, the causal differences of three main macroeconomic indicators, i.e., real estate prices, gold prices, and the USA exchange rate on stock market returns, were assessed in the Pakistan market by considering the three months pre-COVID-19 and three subsequent months, explaining the most significant variations in the mechanisms of the capital market during the health crisis [142].

The worldwide rapid spread of the pandemic, which has involved all economic and investment divisions, has caused increasing public attention to be given to likely future real estate scenarios. Among the different implications of forced measures to restrict economic activities, some of them have resulted in long-term or permanent modifications in the features of the real estate market. Thus, new behavior models for the market participants and new strategies have been defined, also within the real estate legal regulations and by promoting the use of digital technologies for transactions [143].

The possible consequences of the onset of COVID-19 on the global real estate development and management dynamics were explored by making interesting evaluations and insights into several studies and for different geographical contexts. Tanrıvermiş [144] used data on macro-economic variations and the real estate sector to provide a basis for the analysis and generalization of the prevailing situation in Turkey. The study observed that the Turkish government wants to recover the property market only through the growth of the sales of existing houses and businesses and through tourism-oriented measures (such as a hygiene certificate), but actions taken for fundamental changes in the long run are still inadequate. Jagun et al. [145] provided a review on Malaysian workers, construction sites, property development, and the national economy and found that the pandemic has significantly influenced real estate progress, the residential market, and the construction industry.

5. Conclusions

This review has identified the main aspects that have been addressed regarding the impacts of COVID-19 on the real estate market to grasp variations in its dynamics. In particular, according to the analyzed sample of 102 research papers, the following considerations can be outlined:

- The residential segment has been the most studied within the real estate sector in terms of selling and rental price variations, number of transactions, and changes in the appreciation of some property characteristics;
- The office segment has been strongly affected by the spread of remote work by rediscovering the current office environment configurations and their capacity to be adapted to meet the demands in the post-pandemic era, proposing solutions for more effective workspaces;
- The commercial segment has shown an overall drop in rental and selling prices but, nevertheless, the acceleration of digitization through the presence and diffusion of e-commerce has represented an important opportunity for the recovery of the sector;
- The examination of the global real estate market has highlighted the strong relationship that exists between the real estate implications of COVID-19 and the main trends in the financial markets. Furthermore, the debate on the best economic strategies that local

- governments should pursue to start the recovery has attributed a relevant central role to the study of the property market as it represents local socio-economic conditions;
- The most implemented methodology is the econometric one (hedonic model), aimed at identifying and quantifying variations in the market demand for some specific property characteristics. Also, the difference-in-differences method appears to be frequently used.

Regarding the variations in real estate dynamics, the main transformations have been observed in the residential segment. Specifically, property characteristics, such as the presence of green spaces, a balcony or terrace, rooms to be used for remote work, and its proximity to public transport stops, have assumed a higher importance in the mechanisms of buyers and sellers' choices. In addition, the appearance of a novel paradigm—the so-called “donut effect”—has led to spatial patterns that are based on the renewed preference for suburban and rural areas compared to cores and city centers. This may be due to the possibilities offered by remote work to reduce the importance of proximity to workplaces, thus allowing for positive migratory flows towards smaller centers and rural areas. Given the impacts of the COVID-19 on second homes and, especially, touristic ones, the COVID-19 crisis has triggered modifications in the supply of short-term rentals. In this framework, the intensification of the existing processes of the commodification of housing has started, empowering accommodation platforms, like *Airbnb*, and placing profit potential around the tourist rental market.

In conclusion, the real estate market seems to have been quite resilient with respect to the impact generated by the pandemic outbreak, as several studies, despite having found a negative impact in the short-term, found that, instead, in the medium and long terms, the real estate market has mostly reacted more to the changes imposed by the crisis by starting a general recovery [146–150]. In fact, the changed needs expressed by the communities have been transposed into real estate dynamics through the definition of “new normal” models that have redefined the way in which residential, commercial, and office properties are able to meet the new modalities of living in cities, including the suburban areas. Currently, in the post-pandemic period, the property market has absorbed some of the mechanisms introduced by the spread of COVID-19 by creating novel ways with which to live in domestic spaces and to use the office and commercial ones. This contingency has been incorporated into the selling and rental processes by the main market operators involved (buyers, sellers, real estate agents, managers, and property valuers, etc.), establishing adequate processes of choice to allow for transparent and reliable transactions.

The main contributions of the present review relate to the provision of a clear and structured classification and categorization of the existent literature on the effects of COVID-19 on the real estate market, and the specific changes that the pandemic has generated on the real estate dynamics from different point of views, such as population flows, second house utilization, the spread of smart working, ways of living in office spaces, sub-urban area appreciation, market demand variations, and so on. Although most of the retrieved papers pertain to the USA, both in terms of the geographical provenance of the authors and the geographical context of the analysis, this review provides an overview of the studies at this moment, highlighting the impacts that COVID-19 has also generated in other European and international countries.

In this sense, this research represents an attempt to go beyond a simple summary of what has been conducted in the reference literature worldwide by providing useful information on each market segment analyzed.

Author Contributions: The paper is attributed in equal parts to the authors. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data are contained within the article.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Main findings of the residential property market.

Summary of the Main Findings	Ref.	COVID-19 Effects		Notes or Other Observable Changes
		Positive	Negative	
The residential market has seen growth in housing prices and the supply. Moreover, a general reduction in mass evictions was also observable. Regarding mortgages, construction materials, and the dynamics of the hotel and tourism market, the authors reveal numerous negative impacts, such as a reduction in hospitality demand, constraints on mortgage returns, and delays in housing construction.	[81]	x	x	
During the pandemic period, U.S. housing prices grew, but the effective influence of the COVID-19 on the variations differed across certain patterned spaces. The residential hot spots were mainly located in more affordable suburbs and low-density areas.	[82]	x		The spatial differences were taken into account.
The study showed that the population migration flowed from metropolitan areas to non-core zones, especially in summer 2020. At the same time, the newly populated places showed positive and relevant increases in real estate activity, suggesting new waves of rural gentrification.	[83]	x		The focus was mainly on population flow activities.
The impact of COVID-19 in densely populated areas shows correlations with the infection cases and the number of the deaths.	[84]			Impacts on the residential market were analyzed based on their correlations with infection cases and deaths.
The authors highlighted that the pandemic in the UK could increase social inequalities and deepen the critical issues of the housing sector.	[85]		x	
The Yangtze River Delta region has seen an increase in housing prices, mainly related to the better conditions and urban governance that exist in this considered region.	[86]	x		
The suburban property prices and volatility risk increased after the spread of the pandemic. For the inner-city residential market, only asking prices have undergone a structural change. It was possible to observe the so-called “spillover effect”, which was linked to the difference between the city center and suburban housing markets. However, a lag of information in the transaction premiums for the city center occurred for these property prices.	[87]	x	x	Volatility risk and lag of information are negative impacts; property prices rise could be a positive impact.
The authors state that at the city level, negative effects on the residential market are reported in terms of significant returns of residential prices. Regarding the regional analysis, instead, a mainly positive COVID-19 effect was obtained.	[88]	x	x	According to the two models implemented at the different scales of analysis, the results are considered differently.
In Vietnam, the pandemic has had a disruptive effect on the real estate sector, due to the fact that the investors have become more hesitant to invest in the real estate market, and therefore, a sharp decrease in the housing market’s demand has occurred.	[89]		x	

Table A1. Cont.

Summary of the Main Findings	Ref.	COVID-19 Effects		Notes or Other Observable Changes
		Positive	Negative	
The authors observed that in Prague, the pandemic could enhance the already existing trend of the real estate market towards the richest segments of the population. Regarding the rent of cheap flats near public transport access, the price was the most important factor, not the quality of the property. This is especially valid for the AirBnB apartments for which shortfalls in incomes have been generated by the pandemic.	[90]		x	The focus is on the AirBnB and short-term rental dynamics.
The rental housing market stagnated or slightly increased during the spread of COVID-19, except for touristic attractions.	[91]			No significant impact of COVID-19 was observed for the property segment under analysis.
The study highlights how appreciation for property features has changed after the spread of COVID-19. The results highlight the relevance assumed by indoor acoustic and thermal comfort property factors, compared to the pre-COVID-19 conditions.	[92]			Indoor acoustics and thermal comfort have increased their relevance in residential market appreciation.
The property choices underwent a variation in the COVID-19 period, and in fact the buyers' preferences are moving towards the green buildings for having better living conditions. The residential real estate market of the future will require smart bathrooms, energy efficiency, and more open spaces.	[93]	x		COVID-19 generated a "green" change in the trend of real estate market buyers.
Regarding the achievement of the sustainable economic development goal of China, the residential real estate market is fundamental. The authors observed that the negative impacts of the spread of COVID-19 were small on the residential market. For this reason, the real estate market can be considered "resilient" and it is able to support the sustainable economic development of China during such critical periods.	[94]	x		The residential market is considered "resilient" regarding the occurrence of COVID-19.
In Turkey, the unit rent prices of the residential segment increased from March 2020 to December 2021. However, a difference between the metropolitan cities and the provinces is reported; the former has the highest unit rental prices.	[95]	x		Spatial differences in the effects of COVID-19 on the real estate market are highlighted.
The authors highlight, from their analysis of the Spanish short-term rental market, that providers have found flexible ways to accommodate their short-term rentals, which changed in 2020 due to the impacts of COVID-19.	[96]	x		The Spanish rental market is considered "resilient" to the spread of COVID-19.
The study reports that for the short-term rental market, available listings decreased by 25% once the pandemic started, income shrank by 22%, and occupancy decreased by 20%. The cleanliness of the properties, on the other hand, appears to be significant. What were perceived as clean accommodations increased their income by 17.5% and their occupation by 16.5%. However, rental prices for clean Airbnb apartments have not significantly increased since COVID-19.	[97]	x	x	A significant change in the appreciation for the short-term rental market is reported.
According to the results of the study, the shift in tourist preferences towards second homes following the pandemic could place second homes at the center of tourism activity, exacerbating the most critical aspects related to these activities.	[98]		x	Changes in tourist approval for second homes are not seen as a positive change induced by COVID-19.

Table A1. Cont.

Summary of the Main Findings	Ref.	COVID-19 Effects			Notes or Other Observable Changes
		Positive	Negative		
Except for tenant reputation and membership, there was no significant relationship between tenant health and the effect of COVID-19 on tenant failure to fulfill their tenancy. Failure to comply with lease obligations by tenants is, however, conditioned by affordability, reputation, and their ability to maintain a commitment.	[99]				No significant effects of COVID-19 were observed on tenant failure to fulfill their tenancy.
Even if prices in the real estate market were at historic highs with COVID-19, a series of regulatory and governmental factors considered by the authors allow us to say that it is unlikely that the real estate crisis of 2007–2009 will repeat itself. It is important to say that changes in legislation and the characteristics of supply and demand have helped to avoid the crisis of the great recession.	[100]				COVID-19 has not established a situation that would recreate the real estate crisis of 2007–2009.
The research determined that the outbreak led to a drop in house prices of about 3% in April and May 2020 and then to a rise in house prices of almost 4% in September. From March to May, both the demand and supply of housing decreased, and then increased in July and August, when the first openings occurred. Price volatility is closely related to demand. This suggests that recovery policies should focus more on demand, which, following the analyses conducted in the study, seems to have been more linked to the dynamics of COVID-19 than the supply.	[101]				The housing demand has suffered more than the housing supply from the effects of the spread of COVID-19.
COVID-19 significantly has influenced the relevance of subway accessibility in the dynamics of the residential real estate market. Specifically, small or inexpensive houses have been less affected than large or high-priced houses.	[102]				Different appreciation for metro accessibility was observed during the spread of COVID-19.
The externalities of the economic policies provided in Australia for first-home buyers have generated a short-term growth in the number of first-home buyers. However, the real estate market, as a result of fiscal and monetary policies, including changes in interest rates, has become disadvantageous for many potential first-home buyers, who fear they will never be able to afford home ownership.	[103]	x	x		The work highlights the need to mitigate the unintended negative consequences of economic recovery policies on potential first-home buyers.

Table A2. Main findings of the commercial property market.

Summary of the Main Findings	Ref.	COVID-19 Effects			Notes or Other Observable Changes
		Positive	Negative		
In some U.S. urban areas studied, the rent of business premises on long-term leases is inversely proportional to the distance from the city center. Evaluating the effect of COVID-19, the commercial rent gradient decreased by about 15%, and the rent premium associated with occupational density decreased dramatically following the impact of COVID-19.	[105]		x		
The analysis carried out shows that, thanks to government interventions, the commercial real estate market of the United States has not recorded any estimated decreases in value between approximately −47% and −62% and approximately −10% and −16% for returns.	[106]				The US commercial real estate market, were it not for the extreme monetary and fiscal policy pursued during the first months of the pandemic, would have experienced significant negative impacts.

Table A2. Cont.

Summary of the Main Findings	Ref.	COVID-19 Effects		Notes or Other Observable Changes
		Positive	Negative	
The pandemic's spread has significantly prompted the decline of the commercial market liquidity of eight major US markets.	[107]		x	
The applied hedonic model did not show significant COVID-19 changes in the geographic areas considered in the study.	[108]			The spatial distribution of the effect of the COVID-19 spread on the commercial segment is considered an important factor to be included in the analysis on the topic.
Urban commercial real estate prices have dropped significantly since January 2020 (−8%), but the effect differs across cities and building types. At the urban scale, the propensity to work from home and make long journeys plays a significant role. Regarding the type of buildings, the prices of older buildings have decreased significantly. However, in suburban areas, prices have tended to be stable and/or to increase over the long term. Significant increases were observed for buildings in high commuting cities, office buildings, apartment buildings, and buildings less than 20 years old.	[109]	x	x	
The gap between the observed prices and the implied fair value of the commercial real estate sector widened in the first year of COVID-19, following a sharp decline in demand and net operating income. Additionally, with declining transaction volumes and falling prices globally in 2020, retail real estate, hotels, and office buildings were heavily impacted by the pandemic.	[110]		x	
In the Asia–Pacific commercial real estate rental market, substantial rental decreases of approximately 15% were documented during the first six months of the first year of the pandemic (2020). The most important drops were recorded in the regions with the highest number of cases of infection, where there were also drops exceeding 30%, with little recovery starting during the second quarter of 2020. At the expense of the commercial sector, new capital flows appeared in the residential and industrial sectors.	[111]		x	
COVID-19 has caused a sharp decrease in non-residential investment and has triggered a change in sale prices, transaction numbers, and new financing operations. Conversely, to date there have been no significant deteriorations in credit quality associated with this market segment.	[112]		x	

Table A3. Main findings of the office market.

Summary of the Main Findings	Ref.	COVID-19 Effects		Notes or Other Observable Changes
		Positive	Negative	
The authors highlight (i) a potential drop in the number of required workspaces at the main office of between 85.2% and 62.8%, (ii) a decrease in office space compared to pre-COVID-19 of 79.6% for an average of one day of remote work and of 72.1% for an average of two days of remote work.	[117]		x	
The positive outcomes of COVID-19 in the office sector are explained: the flexibility of office spaces represents the benefit of an increase in employee protection and comfort, new technologies have allowed for the possibility of setting up online meetings, and working from home is more suitable for some employers, starting the definition of new job models for which the localization of a physical office is less important.	[118]	x		An analysis of the changes in the approaches of employers towards office space caused by COVID-19 was carried out.
The hybrid and remote work and the value of commercial office real estate in the short and medium terms are strictly connected. In the long run, with improvement in remote work technologies, the existing office assets can be used for alternative functions.	[119]			At the time of the analysis, a reduction in office supply and limited construction and adaptive reuse activities of office assets were observed.
A relevant and negative impact of COVID-19 on the Chinese office building market has been detected: a drop in the rent of more than 8% was found if a city was exposed to an increase of one unit of the COVID-19 sentiment index for an entire quarter. A high level of investors' COVID-19 sentiment index has led to a decrease in office rents.	[120]		x	The COVID-19 sentiment index has had a more substantial effect on office building rents where office vacancy is higher.
In Europe and North America, firms are likely to demand less workspace in the future in comparison to Asian, African, and the Middle Eastern companies. The authors commented that the effects of the COVID-19 pandemic may be much stronger than the quantitative aspects of office space use, depending on if the firms' perceptions have changed since the pandemic. In this sense, a health emergency may not automatically drive changes to firms' strategies, differentiating the companies that have generally reported a negative work-from-home experience from those with positive previous experiences.	[121]			The pandemic could have changed the firms' perception regarding the use of office space.
The COVID-19 pandemic forced the largest office occupiers to analyze the role of their office spaces. The flex space business model is suitable for activities needing accommodation quickly and/or with relatively short-term occupational horizons, and the coworking solutions are significantly demanded.	[122]			The office is recognized as a central hub that facilitates corporate connection and cooperation.
The research indicates a reduction both in procuring office spaces and in their unit prices.	[123]		x	After the pandemic, a continuous shift into a hybrid work mode is expected, as the employee productivity of remote workers remains relatively high despite the various home distractions.
The negative effects of post-COVID office hybrid work arrangements on employee health and safety have been analyzed: the physical distancing caused by staying at home contributes to isolation and a lack of distinction between work life and home life. Moreover, fewer opportunities for career development and promotions because of weakened ties between employees and the employer have been recognized as the main impacts on the working world.	[124]			New skills and abilities to adapt to new ways of working should be defined and tested by employees and managers.

Table A4. Main findings of the research papers on mixed uses.

Summary of the Main Findings	Ref.	COVID-19 Effects		Notes or Other Observable Changes
		Positive	Negative	
In the first month of the COVID-19 pandemic, a drop of 45% was observed in the real estate sales market, as a direct implication of the restrictions in the movement of people and businesses. The authors invite academic communities to focus on the future prospect of real estate, i.e., on monitoring the measurements of the indicators, such as prices and transaction volumes.	[126]		x	The real estate sector was heavily and immediately affected by pandemic.
The authors discuss the impact of the pandemic on different market segments. They argue that (i) the hospitality sector was the hardest hit real estate segment due to the COVID-19 emergency, (ii) the retail segment was strongly affected when the physical shops were closed and there were no online sales.	[127]		x	Relevant disruptions to property markets can be caused by a health crisis.
Among the different real estate sectors affected by COVID-19, the authors found a direct (but relatively limited) impact on the housing market, a significant influence on the mortgage market by further growing the wealth inequality between households, a non-unique effect on the commercial real estate segment, and a direct and hard consequence on the stationary and non-food retail industries.	[128]		x	
The retail and hospitality properties and, to a lesser extent, the office buildings are the most affected sectors. The residential and industrial segments have been less impacted by the pandemic.	[129]		x	
Retail sector: an immediate effect has been observed for the rental and sale markets, with an increase in the vacancy rate and a reduction in the sale volume transactions. Office sector: an instant suppression of the growth rate of rent for offices was detected in the first phase of COVID-19, even though this impact was short-lived, as the growth rate began to recover in the following quarter. Industrial sector: an immediate and negative implication on the rental market with an increase in the vacancy rate and a rapid positive market trend in the next quarter have been found.	[130]	x	x	

References

1. International Labour Organisation. ILO Monitor: COVID-19 and the World of Work. Second Edition (7 April 2020). Updated Estimates and Analysis. Available online: www.ilo.org (accessed on 2 May 2023).
2. Trias-Llimós, S.; Riffe, T.; Bilal, U. Monitoring life expectancy levels during the COVID-19 pandemic: Example of the unequal impact of the first wave on Spanish regions. *PLoS ONE* **2020**, *15*, e0241952. [CrossRef]
3. Drefahl, S.; Wallace, M.; Mussino, E.; Aradhya, S.; Kolk, M.; Brandén, M.; Malmberg, B.; Andersson, G. Socio-demographic risk factors of COVID-19 deaths in Sweden: A nationwide register study. *Stockh. Res. Rep. Demogr.* **2020**, *23*, 1–15.
4. Luppi, F.; Arpino, B.; Rosina, A. The impact of COVID-19 on fertility plans in Italy, Germany, France, Spain, and the United Kingdom. *Demogr. Res.* **2020**, *43*, 1399–1412. [CrossRef]
5. Palloni, A.; Walter, S. COVID-19: How Can We Explain Differences in Mortality. 2020. Available online: www.population-europe.eu (accessed on 25 May 2023).
6. Balbo, N.; Kashnitsky, I.; Melegaro, A.; Meslé, F.; Mills, M.C.; de Valk, H.; Vono de Vilhena, D. Mills Helga de Valk Daniela Vono de Vilhena, Demography and the Coronavirus Pandemic. *Popul. Policy Brief* **2020**, *25*.
7. European Commission. Eurostat. Available online: <https://www.oecd.org/coronavirus/en/> (accessed on 30 April 2023).
8. Marois, G.; Muttarak, R.; Scherbov, S. Assessing the potential impact of COVID-19 on life expectancy. *PLoS ONE* **2020**, *15*, e0238678. [CrossRef]
9. World Health Organization. Statement on the Fifteenth Meeting of the IHR (2005) Emergency Committee on the COVID-19 Pandemic. Available online: www.who.int (accessed on 23 April 2023).
10. Lopes, M.; Dias, A.M. Changing perspectives in times of crisis. The impact of COVID-19 on territorial accessibility. *Transp. Res. Part A Policy Pract.* **2022**, *158*, 285–301. [CrossRef] [PubMed]

11. Wang, S.; Liu, Y.; Hu, T. Examining the change of human mobility adherent to social restriction policies and its effect on COVID-19 cases in Australia. *Int. J. Environ. Res. Public Health* **2020**, *17*, 7930. [CrossRef]
12. Galindo-Pérez, M.C.; Suárez, M.; Rosales-Tapia, A.R.; Sifuentes-Osornio, J.; Angulo-Guerrero, O.; Benítez-Pérez, H.; de Anda-Jauregui, G.; Díaz-de-León-Santiago, J.L.; Hernández-Lemus, E.; Alonso Herrera, L.; et al. Territorial Strategy of Medical Units for Addressing the First Wave of the COVID-19 Pandemic in the Metropolitan Area of Mexico City: Analysis of Mobility, Accessibility and Marginalization. *Int. J. Environ. Res. Public Health* **2022**, *19*, 665. [CrossRef]
13. Di Toro, A.; Bozzani, A.; Tavazzi, G.; Urtis, M.; Giuliani, L.; Pizzoccheri, R.; Aliberti, F.; Fergnani, V.; Arbustini, E. Long COVID: Long-term effects? *Eur. Heart J. Suppl.* **2021**, *23* (Suppl. E), E1–E5. [CrossRef]
14. Sharifi, A.; Ahmadi, M.; Ala, A. The impact of artificial intelligence and digital style on industry and energy post-COVID-19 pandemic. *Environ. Sci. Pollut. Res.* **2021**, *28*, 46964–46984. [CrossRef]
15. Khiong, K. Impact and Challenges of Digital Marketing in Healthcare Industries during Digital Era and COVID-19 Pandemic. *J. Ind. Eng. Manag. Res.* **2022**, *3*, 112–118.
16. Lee, C.H.; Wang, D.; Desouza, K.C.; Evans, R. Digital transformation and the new normal in China: How can enterprises use digital technologies to respond to COVID-19? *Sustainability* **2021**, *13*, 10195. [CrossRef]
17. Jackson, J.K. *Global Economic Effects of COVID-19*; Congressional Research Service: Washington, DC, USA, 2021.
18. Deb, P.; Furceri, D.; Ostry, J.D.; Tawk, N. The economic effects of COVID-19 containment measures. *Open Econ. Rev.* **2022**, *33*, 1–32. [CrossRef]
19. Fernandes, N. *Economic Effects of Coronavirus Outbreak (COVID-19) on the World Economy*; IESE Business School: Barcelona, Spain, 2020.
20. Bakar, N.A.; Rosbi, S. Effect of Coronavirus disease (COVID-19) to tourism industry. *Int. J. Adv. Eng. Res. Sci.* **2020**, *7*, 189–193. [CrossRef]
21. Buera, F.J.; Fattal-Jaef, R.N.; Hopenhayn, H.; Neumeyer, P.A.; Shin, Y. *The Economic Ripple Effects of COVID-19* (No. w28704); National Bureau of Economic Research: Cambridge, MA, USA, 2021.
22. Deb, P.; Furceri, D.; Jimenez, D.; Kothari, S.; Ostry, J.D.; Tawk, N. The effects of COVID-19 vaccines on economic activity. *Swiss J. Econ. Stat.* **2022**, *158*, 3. [CrossRef] [PubMed]
23. Buzzi, C.; Tucci, M.; Ciprandi, R.; Brambilla, I.; Caimmi, S.; Ciprandi, G.; Marseglia, G.L. The psycho-social effects of COVID-19 on Italian adolescents' attitudes and behaviors. *Ital. J. Pediatr.* **2020**, *46*, 69. [CrossRef]
24. Abouk, R.; Heydari, B. The immediate effect of COVID-19 policies on social-distancing behavior in the United States. *Public Health Rep.* **2021**, *136*, 245–252. [CrossRef]
25. Flor, L.S.; Friedman, J.; Spencer, C.N.; Cagney, J.; Arrieta, A.; Herbert, M.E.; Stein, C.; Mullany, E.C.; Hon, J.; Patwardhan, V.; et al. Quantifying the effects of the COVID-19 pandemic on gender equality on health, social, and economic indicators: A comprehensive review of data from March, 2020, to September, 2021. *Lancet* **2022**, *399*, 2381–2397. [CrossRef]
26. Viola, T.W.; Nunes, M.L. Social and environmental effects of the COVID-19 pandemic on children. *J. Pediatr.* **2022**, *98*, 4–12. [CrossRef]
27. Malliet, P.; Reynès, F.; Landa, G.; Hamdi-Cherif, M.; Saussay, A. Assessing short-term and long-term economic and environmental effects of the COVID-19 crisis in France. *Environ. Resour. Econ.* **2020**, *76*, 867–883. [CrossRef]
28. Praveena, S.M.; Aris, A.Z. The impacts of COVID-19 on the environmental sustainability: A perspective from the Southeast Asian region. *Environ. Sci. Pollut. Res.* **2021**, *28*, 63829–63836. [CrossRef] [PubMed]
29. Kefalaki, M.; Nevradakis, M.; Li, Q. Cross-Cultural Effects of COVID-19 on Higher Education Learning and Teaching Practice: A Case Study from Greece. *J. Univ. Teach. Learn. Pract.* **2021**, *18*, 5. [CrossRef]
30. Ratten, V. Coronavirus (COVID-19) and entrepreneurship: Cultural, lifestyle and societal changes. *J. Entrep. Emerg. Econ.* **2021**, *13*, 747–761. [CrossRef]
31. Voegel, J.; Wachsmann, Y. The effect of culture in containing a pandemic: The case of COVID-19. *J. Risk Res.* **2022**, *25*, 1075–1084. [CrossRef]
32. Kantor, A.; Kubiczek, J. Polish culture in the face of the COVID-19 pandemic crisis. *J. Risk Financ. Manag.* **2021**, *14*, 181. [CrossRef]
33. Cao, C.; Li, N.; Liu, L. Do national cultures matter in the containment of COVID-19? *Int. J. Sociol. Soc. Policy* **2020**, *40*, 939–961. [CrossRef]
34. Olunkwa, C.N.; Adenuga, J.I.; Salau-deen, M.B.; Mesagan, E.P. The Demographic Effects of COVID-19: Any Hope for Working Populations? *BizEcons Q.* **2021**, *15*, 3–12.
35. Faraz, N.; Khan, Y.; Goufo, E.D.; Anjum, A.; Anjum, A. Dynamic analysis of the mathematical model of COVID-19 with demographic effects. *Z. Naturforschung C* **2020**, *75*, 389–396. [CrossRef]
36. Zajacova, A.; Jehn, A.; Stackhouse, M.; Denice, P.; Ramos, H. Changes in health behaviours during early COVID-19 and socio-demographic disparities: A cross-sectional analysis. *Can. J. Public Health* **2020**, *111*, 953–962. [CrossRef]
37. Narayanan, R.P.; Nordlund, J.; Pace, R.K.; Ratnadiwakara, D. Demographic, jurisdictional, and spatial effects on social distancing in the United States during the COVID-19 pandemic. *PLoS ONE* **2020**, *15*, e0239572. [CrossRef]
38. Ramelli, S.; Wagner, A. What the stock market tells us about the consequences of COVID-19. In *Mitigating the COVID Economic Crisis: Act Fast and Do Whatever*; CEPR Press: London, UK, 2020; Volume 63.
39. Lee, K.Y.M.; Jais, M.; Chan, C.W. Impact of COVID-19: Evidence from Malaysian stock market. *Int. J. Bus. Soc.* **2020**, *21*, 607–628.

40. Herwany, A.; Febrian, E.; Anwar, M.; Gunardi, A. The influence of the COVID-19 pandemic on stock market returns in Indonesia stock exchange. *J. Asian Financ. Econ. Bus.* **2021**, *8*, 39–47.
41. Li, W.; Chien, F.; Waqas Kamran, H.; Aldeehani, T.M.; Sadiq, M.; Nguyen, V.C.; Taghizadeh-Hesary, F. The nexus between COVID-19 fear and stock market volatility. *Econ. Res.-Ekon. Istraž.* **2022**, *35*, 1765–1785. [CrossRef]
42. Belasen, A.R.; Polachek, S.W. How disasters affect local labor markets: The effects of hurricanes in Florida. *J. Hum. Resour.* **2020**, *44*, 251–276. [CrossRef]
43. Akhmet, M.; Akhmetova, Z.; Fen, M.O. Chaos in economic models with exogenous shocks. *J. Econ. Behav. Organ.* **2014**, *106*, 95–108. [CrossRef]
44. Chen, Y.; Luo, Z. Hedonic Pricing of Houses in Megacities Pre-and Post-COVID-19: A Case Study of Shanghai, China. *Sustainability* **2022**, *14*, 11021. [CrossRef]
45. Kumar, S.A.; Goswami, H.; Kumar, A.A.; Sangeetha, R.; Jain, P. Classification of Effect on Real Estates in Mumbai During COVID-19. *SN Comput. Sci.* **2022**, *3*, 399. [CrossRef] [PubMed]
46. Yang, L.; Liang, Y.; He, B.; Lu, Y.; Gou, Z. COVID-19 effects on property markets: The pandemic decreases the implicit price of metro accessibility. *Tunn. Undergr. Space Technol.* **2022**, *125*, 104528. [CrossRef]
47. Cohen, J.P.; Friedt, F.L.; Lautier, J.P. The impact of the Coronavirus pandemic on New York City real estate: First evidence. *J. Reg. Sci.* **2022**, *62*, 858–888. [CrossRef]
48. Li, X.; Kao, C. Spatial Analysis and Modeling of the Housing Value Changes in the US during the COVID-19 Pandemic. *J. Risk Financ. Manag.* **2022**, *15*, 139. [CrossRef]
49. Grybauskas, A.; Pilinkienė, V.; Stundžienė, A. Predictive analytics using Big Data for the real estate market during the COVID-19 pandemic. *J. Big Data* **2021**, *8*, 105. [CrossRef]
50. Tian, C.; Peng, X.; Zhang, X. COVID-19 pandemic, urban resilience and real estate prices: The experience of cities in the Yangtze River Delta in China. *Land* **2021**, *10*, 960. [CrossRef]
51. De Toro, P.; Nocca, F.; Buglione, F. Real estate market responses to the COVID-19 crisis: Which prospects for the metropolitan area of Naples (Italy)? *Urban Sci.* **2021**, *5*, 23. [CrossRef]
52. Del Giudice, V.; De Paola, P.; Del Giudice, F.P. COVID-19 infects real estate markets: Short and mid-run effects on housing prices in Campania region (Italy). *Soc. Sci.* **2020**, *9*, 114. [CrossRef]
53. Ahsan, M.M.; Sadak, C. Exploring housing market and urban densification during COVID-19 in Turkey. *J. Urban Manag.* **2021**, *10*, 218–229. [CrossRef]
54. Marona, B.; Tomal, M. The COVID-19 pandemic impact upon housing brokers' workflow and their clients' attitude: Real estate market in Krakow. *Entrep. Bus. Econ. Rev.* **2020**, *8*, 221–232. [CrossRef]
55. Aksoy Khurami, E.; Özdemir Sarı, Ö.B. Trends in housing markets during the economic crisis and COVID-19 pandemic: Turkish case. *Asia-Pac. J. Reg. Sci.* **2022**, *6*, 1159–1175. [CrossRef]
56. D'Lima, W.; Lopez, L.A.; Pradhan, A. COVID-19 and housing market effects: Evidence from US shutdown orders. *Re. Est. Econ.* **2022**, *50*, 303–339. [CrossRef]
57. Fritsche, C. The expected impact of COVID-19 on the housing market. *Streichlicht VWL* **2021**, *5*, 1–10.
58. Chinthavali, S.; Tansakul, V.; Lee, S.; Whitehead, M.; Tabassum, A.; Bhandari, M.; Munk, J.; Zandi, H.; Buckberry, H.; Kuruganti, T.; et al. COVID-19 pandemic ramifications on residential Smart homes energy use load profiles. *Energy Build.* **2022**, *259*, 111847. [CrossRef] [PubMed]
59. Chareyron, S.; Régnier, C.; Sari, F. COVID 19 and Dynamics of Residential Property Markets in France: An Exploration. *Econ. Stat.* **2022**, *536–537*, 75–93. [CrossRef]
60. Breuillé, M.L.; Le Gallo, J.; Verlhac, A. Migrations résidentielles et crise de la COVID-19: Vers un exode urbain en France?/Residential Migration and the COVID-19 Crisis: Towards an Urban Exodus in France? *Econ. Stat.* **2022**, *536*, 59–76.
61. Doling, J.; Arundel, R. The home as workplace: A challenge for housing research. *Hous. Theory Soc.* **2022**, *39*, 1–20. [CrossRef]
62. Liu, S.; Su, Y. The impact of the COVID-19 pandemic on the demand for density: Evidence from the US housing market. *Econ. Lett.* **2021**, *207*, 110010. [CrossRef]
63. Belej, M. Housing price forecasting in selected Polish cities during the COVID-19 pandemic. *Geomat. Environ. Eng.* **2021**, *15*, 59–80. [CrossRef]
64. Gallent, N.; Madeddu, M. COVID-19 and London's decentralising housing market—what are the planning implications? *Plan. Pract. Res.* **2021**, *36*, 567–577. [CrossRef]
65. Allen-Coghlan, M.; McQuinn, K.M. The potential impact of COVID-19 on the Irish housing sector. *Int. J. Hous. Mark. Anal.* **2021**, *14*, 636–651. [CrossRef]
66. Anundsen, A.K.; Kivedal, B.K.; Larsen, E.R.; Thorsrud, L.A. Behavioral changes in the housing market before and after the COVID-19 lockdown. *J. Hous. Econ.* **2023**, *59*, 101907. [CrossRef] [PubMed]
67. Ngo, T.; Squires, G.; McCord, M.; Lo, D. House prices, airport location proximity, air traffic volume and the COVID-19 effect. *Reg. Stud. Reg. Sci.* **2023**, *10*, 418–438. [CrossRef]
68. Li, H.; Li, Z.; Hsiao, C. Assessing the impacts of pandemic and the increase in minimum down payment rate on Shanghai housing prices. *Empir. Econ.* **2023**, *64*, 2661–2682. [CrossRef]
69. Huang, N.; Pang, J.; Yang, Y. JUE Insight: COVID-19 and household preference for urban density in China. *J. Urban Econ.* **2023**, *133*, 103487. [CrossRef] [PubMed]

70. Liu, Y.; Tang, Y. Epidemic shocks and housing price responses: Evidence from China's urban residential communities. *Reg. Sci. Urban Econ.* **2021**, *89*, 103695. [CrossRef] [PubMed]
71. Cheung, K.S.; Yiu, C.Y.; Xiong, C. Housing market in the time of pandemic: A price gradient analysis from the COVID-19 epicentre in China. *J. Risk Financ. Manag.* **2021**, *14*, 108. [CrossRef]
72. Yörük, B.K. Early effects of COVID-19 pandemic-related state policies on housing market activity in the United States. *J. Hous. Econ.* **2022**, *57*, 101857. [CrossRef] [PubMed]
73. McCord, M.; Lo, D.; McCord, J.; Davis, P.; Haran, M.; Turley, P. The impact of COVID-19 on house prices in Northern Ireland: Price persistence, yet divergent? *J. Prop. Res.* **2022**, *39*, 237–267. [CrossRef]
74. Lee, S.; Wang, L. Intermediate Effect of the COVID-19 Pandemic on Prices of Housing near Light Rail Transit: A Case Study of the Portland Metropolitan Area. *Sustainability* **2022**, *14*, 9107. [CrossRef]
75. Li, T.; Jing, X.; Wei, O.; Yinlong, L.; Jinxuan, L.; Yongfu, L.; Li, W.; Ying, J.; Weipan, X.; Yaotian, M.; et al. Mobility restrictions and their implications on the rental housing market during the COVID-19 pandemic in China's large cities. *Cities* **2022**, *126*, 103712. [CrossRef]
76. Pilinkienė, V.; Stundziene, A.; Stankevičius, E.; Grybauskas, A. Impact of the economic stimulus measures on Lithuanian real estate market under the conditions of the COVID-19 pandemic. *Eng. Econ.* **2021**, *32*, 459–468. [CrossRef]
77. Yiu, C.Y. Why House prices increase in the COVID-19 recession: A five-country empirical study on the real interest rate hypothesis. *Urban Sci.* **2021**, *5*, 77. [CrossRef]
78. Kuk, J.; Schachter, A.; Faber, J.W.; Besbris, M. The COVID-19 pandemic and the rental market: Evidence from Craigslist. *Am. Behav. Sci.* **2021**, *65*, 1623–1648. [CrossRef]
79. Li, L.; Wan, W.X.; He, S. The heightened 'security zone' function of gated communities during the COVID-19 pandemic and the changing housing market dynamic: Evidence from Beijing, China. *Land* **2021**, *10*, 983. [CrossRef]
80. Soundararaj, B.; Pettit, C.; Lock, O. Using Real-Time Dashboards to Monitor the Impact of Disruptive Events on Real Estate Market. Case of COVID-19 Pandemic in Australia. *Comput. Urban Sci.* **2022**, *2*, 14. [CrossRef]
81. Mohammed, J.K.; Aliyu, A.A.; Dzukogi, U.A.; Olawale, A.A. The impact of covid-19 on housing market: A review of emerging literature. *Int. J. Real Estate Stud.* **2021**, *15*, 66–74. [CrossRef]
82. Li, X.; Zhang, C. Did the COVID-19 pandemic crisis affect housing prices evenly in the US? *Sustainability* **2021**, *13*, 12277. [CrossRef]
83. Nelson, P.B.; Frost, W. Migration Responses to the COVID-19 Pandemic: A Case Study of New England Showing Movements down the Urban Hierarchy and Ensuing Impacts on Real Estate Markets. *Prof. Geogr.* **2022**, *75*, 415–429. [CrossRef]
84. Desmet, K.; Wacziarg, R. JUE Insight: Understanding spatial variation in COVID-19 across the United States. *J. Urban Econ.* **2022**, *127*, 103332. [CrossRef]
85. Blakeley, G. Financialization, real estate and COVID-19 in the UK. *Community Dev. J.* **2021**, *56*, 79–99. [CrossRef]
86. Yang, M.; Zhou, J. The impact of COVID-19 on the housing market: Evidence from the Yangtze river delta region in China. *Appl. Econ. Lett.* **2022**, *29*, 409–412. [CrossRef]
87. Tsai, I.C.; Chiang, Y.H.; Lin, S.Y. Effect of COVID-19 lockdowns on city-center and suburban housing markets: Evidence from Hangzhou, China. *J. Asian Econ.* **2022**, *83*, 101544. [CrossRef]
88. Kaynak, S.; Ekin, A.; Kaya, H.F. The effect of COVID-19 pandemic on residential real estate prices: Turkish case. *Quant. Financ. Econ.* **2021**, *5*, 623–639. [CrossRef]
89. Ha, N.H.P. Factors Affecting Real Estate Prices During the COVID-19 Pandemic: An Empirical Study in Vietnam. *J. Asian Financ. Econ. Bus. (JAFEB)* **2021**, *8*, 159–164.
90. Hromada, E. Impacts of COVID-19 on the real estate market in the Czech Republic. In *SHS Web of Conferences*; EDP Sciences: Les Ulis, France, 2021; Volume 91, p. 01028.
91. Hromada, E. Development of the real estate market in the Czech Republic in connection with the COVID-19 pandemic. In *Proceedings of the Economics and Finance Conferences (No. 12713389)*, Trier, Germany, 5–7 November 2021; International Institute of Social and Economic Sciences: London, UK, 2021.
92. Tajani, F.; Liddo, F.D.; Guarini, M.R.; Ranieri, R.; Anelli, D. An assessment methodology for the evaluation of the impacts of the COVID-19 pandemic on the Italian housing market demand. *Buildings* **2021**, *11*, 592. [CrossRef]
93. Kaklauskas, A.; Lepkova, N.; Raslanas, S.; Vetloviene, I.; Milevicius, V.; Sepliakov, J. COVID-19 and green housing: A review of relevant literature. *Energies* **2021**, *14*, 2072. [CrossRef]
94. Zhang, X.; Pan, F. Asymmetric effects of monetary policy and output shocks on the real estate market in China. *Econ. Model.* **2021**, *103*, 105600. [CrossRef]
95. Subaşı, S.Ö.; Baycan, T. Impacts of the COVID-19 pandemic on private rental housing prices in Turkey. *Asia-Pac. J. Reg. Sci.* **2022**, *6*, 1177–1193. [CrossRef]
96. Sequera, J.; Nofre, J.; Díaz-Parra, I.; Gil, J.; Yrigoy, I.; Mansilla, J.; Sánchez, S. The impact of COVID-19 on the short-term rental market in Spain: Towards flexibilization? *Cities* **2022**, *130*, 103912. [CrossRef]
97. Shen, L.; Wilkoff, S. Cleanliness is next to income: The impact of COVID-19 on short-term rentals. *J. Reg. Sci.* **2022**, *62*, 799–829. [CrossRef]
98. Zoğal, V.; Domènech, A.; Emekli, G. Stay at (which) home: Second homes during and after the COVID-19 pandemic. *J. Tour. Futures* **2022**, *8*, 125–133. [CrossRef]

99. Gbadegesin, J.T. Does the COVID-19 affect tenants' adherence to lease obligations in rental market? Property managers' perspective. *J. Facil. Manag.* **2022**, *ahead-of-print*.
100. Afrentiou, D.; Harris, P.; Kutasovic, P. The COVID-19 Housing Boom: Is a 2007–2009-Type Crisis on the Horizon? *J. Risk Financ. Manag.* **2022**, *15*, 371. [CrossRef]
101. Wang, B. Housing market volatility under COVID-19: Diverging response of demand in luxury and low-end housing markets. *Land Use Policy* **2022**, *119*, 106191. [CrossRef]
102. Yang, L.; Liang, Y.; He, B.; Yang, H.; Lin, D. COVID-19 moderates the association between to-metro and by-metro accessibility and house prices. *Transp. Res. Part D Transp. Environ.* **2023**, *114*, 103571. [CrossRef]
103. Bangura, M.; Lee, C.L.; Schafer, B. The Unintended Consequences of COVID-19 Economic Responses on First Home Buyers? Evidence from New South Wales, Australia. *Buildings* **2023**, *13*, 1203. [CrossRef]
104. Ling, D.C.; Wang, C.; Zhou, T. A first look at the impact of COVID-19 on commercial real estate prices: Asset-level evidence. *Rev. Asset Pricing Stud.* **2020**, *10*, 669–704. [CrossRef]
105. Rosenthal, S.S.; Strange, W.C.; Urrego, J.A. JUE insight: Are city centers losing their appeal? Commercial real estate, urban spatial structure, and COVID-19. *J. Urban Econ.* **2022**, *127*, 103381. [CrossRef]
106. Chong, J.; Phillips, G.M. COVID-19 losses to the real estate market: An equity analysis. *Financ. Res. Lett.* **2022**, *45*, 102131. [CrossRef]
107. Van Dijk, D.; Kinsella Thompson, A.; Geltner, D. *Recent Drops in Market Liquidity May Foreshadow Major Drops in US Commercial Real Estate Markets*; MIT Center for Real Estate Research Paper; MIT Center for Real Estate: Cambridge, MA, USA, 2020.
108. Croom, B.; Kennedy, S.; Ojha, S.; Sparks, J. Analysis of the Commercial Real Estate Market in a post COVID-19 World. *SMU Data Sci. Rev.* **2020**, *3*, 5.
109. Rolheiser, L.; Van de Minne, A.; Ghosh, C.; Wang, X. The Price of Work-from-Home: Commercial Real Estate in the City and the Suburbs. 2022. Available online: <https://ssrn.com/abstract=4279019> (accessed on 6 August 2023).
110. Deghi, A.; Mok, J.; Tsuruga, T. Commercial real estate and macrofinancial stability during COVID-19. *IMF Work. Pap.* **2021**, A001.
111. Allan, R.; Liusman, E.; Lu, T.; Tsang, D. The COVID-19 pandemic and commercial property rent dynamics. *J. Risk Financ. Manag.* **2021**, *14*, 360. [CrossRef]
112. Fernández Cerezo, A.; Lamas, M.; Roibás, I.; Vegas Sánchez, R. Impact of the COVID-19 pandemic on the Spanish commercial real estate market. *Banco De Esp. Artic.* **2021**, *26*, 21.
113. Nanda, A.; Xu, Y.; Zhang, F. How would the COVID-19 pandemic reshape retail real estate and high streets through acceleration of E-commerce and digitalization? *J. Urban Manag.* **2021**, *10*, 110–124. [CrossRef]
114. Zhu, D. Research and analysis of a real estate virtual E-commerce model based on big data under the background of COVID-19. *J. Organ. End User Comput. (JOEUC)* **2021**, *33*, 1–16. [CrossRef]
115. Sulaiman, M.Z.; Aziz, M.N.A.; Bakar, M.H.A.; Halili, N.A.; Azuddin, M.A. Matterport: Virtual tour as a new marketing approach in real estate business during pandemic COVID-19. In Proceedings of the International Conference of Innovation in Media and Visual Design (IMDES 2020), Tangerang, Indonesia, 10–11 November 2020; Atlantis Press: Amsterdam, The Netherlands, 2020; pp. 221–226.
116. Koszel, M. The COVID-19 Pandemic and the Professional Situation on the Real Estate Market in Poland. *Hradec Econ. Days* **2021**, *11*, 412–425.
117. Hensher, D.A.; Wei, E.; Beck, M.J. The impact of COVID-19 and working from home on the workspace retained at the main location office space and the future use of satellite offices. *Transp. Policy* **2023**, *130*, 184–195. [CrossRef] [PubMed]
118. Barath, M.; Schmidt, D.A. Offices after the COVID-19 Pandemic and Changes in Perception of Flexible Office Space. *Sustainability* **2022**, *14*, 11158. [CrossRef]
119. Gupta, A.; Mittal, V.; Van Nieuwerburgh, S. *Work from Home and the Office Real Estate Apocalypse (No. w30526)*; National Bureau of Economic Research: Cambridge, MA, USA, 2022.
120. Wang, S.; Lee, C.L.; Song, Y. The COVID-19 Sentiment and Office Markets: Evidence from China. *Buildings* **2022**, *12*, 2100. [CrossRef]
121. Oladiran, O.; Hallam, P.; Elliot, L. The COVID-19 pandemic and office space demand dynamics. *Int. J. Strat. Prop. Manag.* **2023**, *27*, 35–49. [CrossRef]
122. Cooke, H.; Fiorentino, S.; Harris, R.; Livingstone, N.; McAllister, P. Corporate occupiers' attitude to flex space in the post-COVID environment. *J. Prop. Invest. Financ.* **2022**, *ahead-of-print*.
123. Naor, M.; Pinto, G.D.; Hakakian, A.I.; Jacobs, A. The impact of COVID-19 on office space utilization and real-estate: A case study about teleworking in Israel as new normal. *J. Facil. Manag.* **2022**, *20*, 32–58. [CrossRef]
124. Bangura, S.; Lourens, M.E. Analysis of the effect of post-COVID office hybrid work arrangement on employee health and safety: A case study of Uni4 Online Westville Durban South Africa. In Proceedings of the Global Public Health Conference 2023, Kuala Lumpur, Malaysia, 19–20 October 2023; Volume 6, pp. 80–88.
125. Hamzah, A.; Yazid, M.F.; Shamsudin, M.F. Post COVID-19: What next for real estate industrial sector in Malaysia? *J. Postgrad. Curr. Bus. Res.* **2020**, *1*, 1–4.
126. Nuredini, B. *Impact of the COVID-19 Pandemic on the Global Real Estate Market*; University for Business and Technology: Pristina, Kosovo, 2020.

127. Carson, S.; Nanda, A.; Thanos, S.; Valtonen, E.; Xu, Y. Imagining a post-COVID-19 world of real estate. *Town Plan. Rev.* **2021**, *92*, 371–376. [CrossRef]
128. Balemi, N.; Füss, R.; Weigand, A. COVID-19's impact on real estate markets: Review and outlook. *Financ. Mark. Portf. Manag.* **2021**, *35*, 495–513. [CrossRef]
129. Hoesli, M.; Malle, R. Commercial real estate prices and COVID-19. *J. Eur. Real Estate Res.* **2022**, *15*, 295–306. [CrossRef]
130. Wen, Y.; Fang, L.; Li, Q. Commercial Real Estate Market at a Crossroads: The Impact of COVID-19 and the Implications to Future Cities. *Sustainability* **2022**, *14*, 12851. [CrossRef]
131. Huang, W.; Lan, C.; Xu, Y.; Zhang, Z.; Zeng, H. Does COVID-19 matter for systemic financial risks? Evidence from China's financial and real estate sectors. *Pac.-Basin Financ. J.* **2022**, *74*, 101819. [CrossRef]
132. Nguyen, M.L.T.; Bui, T.N. The macroeconomy and the Real Estate market: Evidence from the global financial crisis and the COVID-19 pandemic crisis. *Ind. Eng. Manag. Syst.* **2021**, *20*, 373–383. [CrossRef]
133. Oyediji, J.O. The impact of COVID-19 on real estate transaction in Lagos, Nigeria. *Int. J. Real Estate Stud.* **2020**, *14*, 107–112.
134. Ramani, A.; Bloom, N. *The Donut Effect of COVID-19 on Cities* (No. w28876); National Bureau of Economic Research: Cambridge, MA, USA, 2021.
135. Sanchaniya, R.J. The effect of COVID-19 on the real estate industry in India. *Balt. J. Real Estate Econ. Constr. Manag.* **2021**, *9*, 122–129. [CrossRef]
136. Worzala, E. COVID 19, real estate and uncertainty: Examining this new “normal” through the quotes of Jim Graaskamp. *J. Prop. Invest. Financ.* **2021**, *39*, 31–37. [CrossRef]
137. Kaklauskas, A.; Zavadskas, E.K.; Lepkova, N.; Raslanas, S.; Dauksys, K.; Vetloviene, I.; Ubarte, I. Sustainable construction investment, real estate development, and COVID-19: A review of literature in the field. *Sustainability* **2021**, *13*, 7420. [CrossRef]
138. Jovanović-Milenković, M.; Đurković, A.; Vučetić, D.; Drašković, B. The impact of COVID-19 pandemic on the real estate market development projects. *Eur. Proj. Manag. J.* **2020**, *10*, 36–49. [CrossRef]
139. Ngoc, N.M.; Tien, N.H.; Anh, D.B.H. Opportunities and challenges for real estate brokers in post COVID-19 period. *J. Sci. Technol.* **2020**, *170*, 203–208.
140. Bhoj, J. Impact of COVID-19 on real estate industry with reference to India. *Int. J. Manag. Hum.* **2020**, *4*, 158–161. [CrossRef]
141. Yadav, A.S.; Yadav, D.K. Impact of COVID-19 on Real Estate Sector in India. *Pac. Bus. Rev. Int.* **2021**, *14*, 85–90.
142. Chaudhry, N.I.; Asad, H.; Abdulghaffar, M.; Amir, M. Contagion effect of COVID-19 on stock market returns: Role of gold prices, real estate prices, and US dollar exchange rate. *Pak. J. Commer. Soc. Sci. (PJCSS)* **2021**, *15*, 614–635.
143. Avakyan, K.; Pratsko, G. Impact of the coronavirus pandemic in 2020 on the real estate market in Russia: Legal aspects. In *E3S Web of Conferences*; EDP Sciences: Les Ulis, France, 2020; Volume 210, p. 13001.
144. Tanrıvermiş, H. Possible impacts of COVID-19 outbreak on real estate sector and possible changes to adopt: A situation analysis and general assessment on Turkish perspective. *J. Urban Manag.* **2020**, *9*, 263–269. [CrossRef]
145. Jagun, Z.T.; Nyakuma, B.B.; Daud, D.; Samsudin, S. Property development during the COVID-19 pandemic: Challenges and outlook in Malaysia. *Environ. Sci. Pollut. Res.* **2022**, *29*, 85717–85726. [CrossRef]
146. Murgante, B.; Balletto, G.; Borruso, G.; Saganeiti, L.; Scorza, F.; Pilogallo, A.; Dettori, M.; Castiglia, P. Health hazard scenarios in Italy after the COVID-19 outbreak: A methodological proposal. *Sci. Reg.* **2021**, *20*, 327–354.
147. Pilogallo, A.; Scorza, F. Ecosystem services multifunctionality: An analytical framework to support sustainable spatial planning in Italy. *Sustainability* **2022**, *14*, 3346. [CrossRef]
148. Scorzelli, R.; Murgante, B.; Manganelli, B.; Scorza, F. The Evolution of Natural Capital Accounting: From Origins to System of Environmental-Economic Accounting. In *Proceedings of the International Conference on Computational Science and Its Applications*, Athens, Greece, 3–6 July 2023; Springer Nature: Cham, Switzerland, 2023; pp. 632–641.
149. Locurcio, M.; Tajani, F.; Morano, P.; Anelli, D.; Manganelli, B. Credit risk management of property investments through multi-criteria indicators. *Risks* **2021**, *9*, 106. [CrossRef]
150. Morano, P.; Tajani, F.; Di Liddo, F.; Amoroso, P. The public role for the effectiveness of the territorial enhancement initiatives: A case study on the redevelopment of a building in disuse in an Italian small town. *Buildings* **2021**, *11*, 87. [CrossRef]

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Article

Improvement Strategies for Enhancing User Satisfaction with Spatial Publicness in Privately Owned Public Open Space in Post COVID-19: A Case from Italy

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Abstract: In the past five decades, privately owned public open spaces (POPOS) have become increasingly prevalent and significant in urban areas. However, the COVID-19 pandemic has led to significant changes in the performance and utilization of these spaces as the internal functions of adjacent buildings were shut down. This offers an opportunity to address the research gap in the theory of publicness—one of the most crucial attributes in these places due to their ownership and management—by assessing user satisfaction with spatial publicness in POPOS independently of adjacent commercial and corporate functions. This study aims to identify key environmental factors that significantly affect user satisfaction during a pandemic and develop adaptive strategies to enhance user satisfaction and resilience in such contexts. Based on a comprehensive literature review of previous assessment criteria for spatial publicness, the study proposes 30 vital indicators. Importance-performance analysis (IPA) is employed to analyze changes in user satisfaction regarding these vital indicators. Data from 386 users of Plaza Gae Aulenti in Milan, Italy were collected via an online questionnaire. The findings reveal that optimizing physical facilities and visual permeability are crucial environmental factors for promoting a higher degree of publicness during pandemics, as evidenced by a comparison of pre-COVID-19 and post-COVID-19 feedback. This study addresses the research gap by assessing the spatial publicness of POPOS independently of adjacent commercial and corporate functions. These findings have practical implications for the design and regulation of future projects in the post-COVID-19 era.

Keywords: publicness; public/private space; user satisfaction; assessment; COVID-19

1. Introduction

With the intensification of urbanization, many cities have undergone extensive urban construction or transformation. Throughout these processes, public-private partnership (PPP) has been a tool in urban policies to address the financial challenges faced by governments worldwide [1,2]. Consequently, the private sector has played a significant role in creating publicly accessible open spaces, commonly referred to as privately owned public open spaces (POPOS). For these types of public spaces, one of the most crucial attributes is the authenticity of their “publicness”, due to their ownership and management by the private sector [3]. There are two diametrically opposed attitudes towards these particular types of urban spaces among scholars.

On the one hand, a negative school, or a traditional school, so to speak, doubted the authenticity of the publicness in these types of public spaces [4–7], arguing that they were

essentially pseudo-public spaces [8]. Public space is widely recognized as a vital public health asset for residents. However, public space within private developments has faced criticism for being overly controlled and exclusive, raising concerns about equal access to it as a health resource [9].

On the other hand, a positive school saw optimistic ideology in the provision of publicly usable spaces by the private sector [10–15], claiming that urban scholarship should adopt a broader perspective on the concept of publicness in order to better understand the composition of public life in cities. They suggest exploring alternative frameworks beyond the conventional notions of exclusion, encroachment, and claim-making. They argue that spaces become public not solely via legal or discursive recognition but also via various embodied and often habitual practices [13]. The argument is further proved by a study indicating that different user groups have their own distinct preferences, while government-owned and operated spaces continue to dominate in terms of comparative preference, specifically identified as “full freedom to use and explore”. However, it is worth noting that the private sector also contributes to sustainable public spaces that are interactive, self-managed, and provide a strong sense of security and safety for users [15]. Carmona contends that the commonly held negative perceptions of privatization are often misguided, as processes of publicization can bring significant benefits to society. By examining historical and current data, his study reached a contrasting observation—a “public-isation of private space” [14].

The conflict intensified with the radical change in people’s lifestyles and the reorganization of the cities due to the need for social distancing and other precautions related to Corona virus disease 2019 (COVID-19). In a webinar held in the midst of the pandemic, public health experts and policymakers discussed “how to support safe public space during COVID-19”. The panelists were convinced that access to public spaces enhances physical and mental health, especially in times of stressful inactivity and isolation [16]. However, during COVID-19, POPOS witnessed significant changes in performance due to the shutdown of interior functions in adjacent buildings, such as the closure of the main attraction of such places—the commercial functions—or the closedown of the corporate function that brings the most regular visitors to the places. One can find the notable consequences of such changes on POPOS in Milan, Italy during the lockdown of the COVID-19 crisis; the number of daily visits to the spaces dropped drastically since the “Mild Restrictions” of COVID-19 (closure of restaurants and other entertainment venues) in 2020. At first glance, it seems inevitable that the pandemic restrictions on different aspects of resident activities will seriously impact the overall quality of outdoor public life. Yet, it is not clear what the form of impact and its natural consequence would be. Are residents satisfied with the physical environment of POPOS when a pandemic such as COVID-19 occurs? If not, what are the crucial spatial quality attributes for improving user satisfaction in such places after COVID-19? Developing improvement strategies for user satisfaction in POPOS with adaptability to unpredictable pandemics is a crucial task at the moment.

A number of scholars carried out various kinds of publicness evaluations/assessments/measurements and developed related index/framework/model, including both qualitative and quantitative researches. However, there is limited understanding of the interrelationships and dynamics between the publicness dimensions of how physical configuration/design and user perception/satisfaction/experience interact and influence each other in shaping public spaces. Furthermore, regarding the spatial publicness of POPOS, the previous studies have overlooked a disturbing factor: the presence of clusters of privately owned or managed functions within adjacent buildings. It remains uncertain whether the presence of these functions significantly influences user satisfaction with spatial publicness, potentially either enhancing or detracting from the overall quality of the public space. Therefore, there is a need for conducting additional assessments of the spatial publicness of POPOS independently, disentangled from the influence of adjacent commercial and corporate functions. This disturbance was completely eliminated under the implications of the pandemic, while all shops and businesses were closed, giving the relevant research

an opportunity to collect conveniently suitable data, to discover the key spatial quality attributes for the publicness of POPOS.

In view of these research gaps, our research distinguishes itself as a pioneering investigation that assesses user satisfaction with spatial publicness in POPOS, independent of the impact of adjacent interior functions. We achieve this by examining changes in user satisfaction levels with POPOS in Milan before and after the implementation of “Mild Restrictions” due to COVID-19, periodically from May 2020 [17]. Furthermore, our research aims to offer environmental improvement strategies for enhancing user satisfaction in POPOS to designers and developers after COVID-19. The data were collected from 386 users who had visited Plaza Gae Aulenti in Milan, Italy. An online survey was conducted on WeChat between 26 September and 12 October 2022. The study utilized an adjusted Importance-performance analysis (IPA), taking into account the impact of COVID-19.

For the assessment criteria, based on previous research on publicness evaluation models/frameworks worldwide [18–25], along with the endorsement of the Charter of Public Space at the second Biennial of Public Space in Rome, a set of factors were developed. These factors were also evaluated by a panel of experts affiliated with the authors’ respective institutions.

The logical framework is depicted in Figure 1. The first step of this study involves assessing the levels of user satisfaction and their correlation with spatial publicness in POPOS before and after the COVID-19 pandemic, focusing on the case study of Plaza Gae Aulenti in Milan, a prototype of POPOS in the city of Milan. There are 386 selected responses for the analysis. The study employs descriptive statistics along with an IPA to evaluate the influence of the spatial publicness of POPOS before and after COVID-19 on levels of user satisfaction in Milan. IPA is a market research method used to analyze and recommend management strategies [26]. It places emphasis on managerial recommendations that are derived from optimal allocations, aiming to enhance user satisfaction, making it a valuable tool for management decision-making [27]. Thirdly, some improvement strategies are proposed to the POPOS designers/developers to recover in a more resilient manner after the COVID-19 crisis via an IPA. Furthermore, the aim of this article is to enhance user satisfaction with the numerous POPOS during uncertain pandemics after COVID-19. Additionally, suggestions are provided for testing the framework and determining the level of impact of the associations among the analytic factors for future research.



Figure 1. The logical framework. Notes: SPEM = Spatial Publicness evaluation model; IA = Importance After COVID-19; PB = Performance Before COVID-19.

The remaining sections of the paper are organized into five sections. The following section contains a literature review that examines the phenomenon of POPOS and its implications during the COVID-19 pandemic within the context of the case study. It clarifies the discussion of publicness in academia, focusing on the theory of dimensions of publicness. Additionally, it reviews the main literature on the publicness dimensions of physical configuration/design and user satisfaction/perception/experience. Subsequently, data collection and research methods are clarified. The fifth section presents the analysis results and interprets them in six aspects. Eventually, the conclusion was found that, out of all the analytic indicators, the enhancement of a list of physical facilities and the optimization of the visual permeability of these places can greatly contribute to the environmental improvement strategies of user satisfaction in POPOS after COVID-19.

2. Literature Review

2.1. Privately Owned Public Open Spaces (POPOS) during COVID-19

Triggered by the introduction of PPP as a tool in urban policies worldwide, an increasing number of urban zones are surrendered to commercial and residential developers in exchange for a variety of spaces being open for public access and use, based on either holistic legal provisions or a single agreement between municipalities and private sectors since the middle of the nineteenth century. Thus, many privately owned public open spaces (POPOS) emerged. It is adapted from “privately owned public space (POPS)” —the term that was popularized in 2000 via the book *Privately Owned Public Space: The New York City Experience* [10]. “Public” is a word that contains many layers of significance—political significance, ideas about property, aim, use, etc. Regarding POPOS, “public” refers only to the use of the space, i.e., its availability for public use or access.

Since the 1980s (notably from 2000 to 2010), the phenomenon of privately owned public spaces and the notion of publicness have been studied in sociology and urban planning and later introduced to the spatial design discipline. In different regions, the debts were concentrated at various times in history due to development patterns. For instance, in Italy during the five years between 1990 and 1995 (especially 1993 and 1994), the issue drew a great deal of attention in academia and was intensively discussed in the *Casabella* journal by Gregotti, Secchi, Ingersoll, etc.; afterwards, the wave gradually faded.

The duration of home confinement during the COVID-19 pandemic has been unprecedentedly long [28]. During the COVID-19 pandemic, Italy, particularly the region of Lombardy in Northern Italy, experienced one of the highest death tolls in Europe, making Europe the second most affected continent [29,30]. Italy was the second country after China to be severely impacted by the COVID-19 pandemic and experienced a nationwide lockdown for two months. After the reopening of public spaces, social interactions in person, while maintaining physical distance, resumed, highlighting the significance of these places for people [31].

In response to the COVID-19 pandemic, urban planners, architects, landscape designers, and journalists have already started examining the impact of the COVID-19 pandemic on our engagement with public spaces [32–34]. Their efforts have shed light on the evolving dynamics and challenges faced by communities in navigating public environments amidst the pandemic. However, more targeted research is needed to investigate the specific effects on the realm of POPOS, which are a fragile (some scholars define them as “pseudo-public space”) yet integral part of urban landscapes during this particular period, to foster adaptive resilience.

2.2. Publicness as the Most Important Attribute of POPOS

As articulated before, publicness is the most significant attribute of POPOS due to their privately owned nature. In fact, it is a word that contains many layers of significance—political significance, ideas about property, aim, use, etc. Therefore, the previous studies and debates about publicness discussed the term from various perspectives:

- *Political/democratic.* The governmental policy-making and inspection are studied, such as how enactments and implementations affect public usage, and some probe the property rights of these spaces [11,35–39].
- *Economical.* The corporate management and property values of open space are analyzed, such as the property values of various landscape typologies or closeness to open areas in various neighborhoods, in order to guide the private sector to utilize open space to achieve maximum profitability [40–43].
- *Social.* The control in “secured spaces” is investigated, where the private developer exposes mandatory surveillance facilities on purpose, so the public feels psychologically safer and is more willing to conduct commercial activities. Moreover, there is an increasing awareness of civic organizations and advocates. It is a bottom-up approach for regenerating existing POPOS from public opinions and inspections [44–49].

- *Actor-networks*. The recurring relationship among various stakeholders and their impact on final projects are untangled since owner, manager, and users are all different identities, and their interrelationship is more complex in projects by the private sector than that in public projects [50–54].
- *Dimensional*. The dimensions of publicness are theorized, setting a framework for the evaluation of publicness in urban space [55–57].

Among the aforementioned layers, the dimension of publicness is the most closely linked to the assessment of the actual degree of publicness of POPOS, which is evaluated using various assessment models or frameworks. There is a clear continuation in the theorization of the dimension of publicness, starting from the 1980s, when publicness was first proposed as a multi-dimensional concept—access, agency, and interest [58]. After that, the dimensions were supplemented in both breadth and depth by a number of scholars, notably in sociology and urban planning, and later were also introduced to the spatial design discipline.

Ownership, accessibility, and intersubjectivity were argued as the three dimensions of publicness in urban spaces, emphasizing the encouragement of intersubjectivity in urban public spaces [59]. Through the development of this theory, function, perception, and ownership were proposed to be the three key aspects that determine whether an urban space is more public or private [60]. Uniquely, the cobweb diagram of Van Melik et al. did not measure publicness per se but focused on the models of “themed space” and “secured space” by illustrating the particular qualities of these two types of space using a cobweb diagram [61]. Furthermore, a tri-axial model for publicness—ownership, management, and uses/user—was concluded [19]. Based on a literature review of abundant previous studies about publicness, the existing dimensions of publicness were organized into five—the Star Model of Publicness—ownership, control, civility, physical configuration, and animation [18]. After that, another evaluation index called OMAI—ownership, management, accessibility, and inclusiveness—was proposed [62]. With measurable indicators to limit subjectivity, the ‘six-axial’ model was proposed, which can be applied not only to urban public spaces but also to various gathering places, including suburban areas [12]. Building upon those efforts, with particular attention to users, a publicness evaluation model (PEM) was created, structured in four dimensions: urban life, physical design, human connection, and management [24]. Examination of the case of public transport offers valuable insights into agency, power dynamics, and vulnerability, contributing to a holistic understanding of public space and prompting a reconsideration of the concept of publicness [63].

Based on the project processes, Wang and Chen restructured the dimensions of publicness into three stages: planning and design, management and control, and use [8]. They also identified three limitations in the Star Model of Publicness, namely its lack of comprehensiveness, generality, and systematic approach. To address these shortcomings, they further expanded and consolidated the three stages into eight dimensions of publicness, encompassing function, spatial design, ownership, management, control, perception, access, and use/user [8]. Similarly, based on place-making processes, publicness was subdivided into localized publicness, procedural publicness, and symbolic publicness [64]. Wu et al. proposed a tool that integrates the Star Model, a qualitative assessment tool, with Space Syntax, a quantitative assessment tool, to provide a scientific evaluation of different public spaces focusing on “measurement” [65]. In addition, there are a series of empirical studies on the publicity evaluation of actual plots based on the theory of the dimension of publicness [66,67]. The quality assessment of a public space that underwent redevelopment by the private sector in Dhaka was conducted via a comparative analysis, considering variables such as accessibility, services and facilities, environment and safety, structural design, as well as management and management systems [68].

2.3. The Key Environmental Factors of Publicness—On the Spatial and Perceptual Level

The spatial level and the perceptual level represent the two major levels of a space. At present, the main literature on the publicness dimensions of physical configuration/design and user perception/satisfaction/experience respectively is as follows:

The physical configuration dimension in the Star Model of Publicness proposed the three sub-dimensions: centrality and connectedness, visual permeability, and thresholds and gateways [18]. Considering contemporary needs for modern communities, an index for public spaces was constructed to evaluate their quality based on empirical assessments of inclusiveness, meaningfulness, safety, comfort, and pleasurability [69]. Figurative design means were suggested to control urban space—an index of encouraging and discouraging features being employed by publicly and privately owned media, respectively, is calculated, as are the features in different categories, ranging from laws signs, and surveillance equipment to access and physical facilities such as restrooms, seating types, microclimates, lighting, food vendors, art, cultural, visual enhancement, etc. [70]. Furthermore, previous models have identified specific indicators such as physical maintenance and cleaning of hard landscape areas and urban furniture, provision and maintenance of green spaces, CCTV cameras, police or private guards, control signage, active frontage, infrastructure for cycling and jogging, pedestrian walkways, cycling routes, etc. [22]. Ma et al. proposed calculations to evaluate the performance of the spatial structure of public space, which encompasses three indicators: the proximity degree to local urban blocks, the network connectivity degree, and the comprehensive connectivity degree of urban blocks interconnected by each public space [71]. Additionally, Pan et al. further examined spatial morphology at the level of “micro-renewal” or “micro-renovation” by considering indicators of spatial publicness such as the number of participants, betweenness centrality, and accessibility [21].

In the past few years, there have been an increasing number of related studies dedicated to user perception/satisfaction/experience and its influencing elements [72–75] and striving to create more inclusive public spaces for people [76,77]. The interactive relationships among publicness, quality/performance, and user satisfaction were examined in both privately owned open space (POS) and government-owned open space (GOS) in order to enhance the comprehension of utilizing both GOS and POS from the user’s perspective [25]. The perceptions of young people and the elderly were analyzed to identify environmental planning factors that contribute to enhancing the publicness of urban public spaces [78]. User perception was assessed through physical observations, online questionnaire surveys, and semi-structured interviews to identify the attributes of public spaces provided by both the government and private sector in the urban context of developing countries [15]. It is argued that publicness is generated via events by taking into account the attendees and their experiences, control practices, and spatial configuration [79]. Moreover, Smith et al. aimed to enhance the suitability of public spaces for hosting events by evaluating the level of publicness through accessibility and considering factors such as payment methods and the mobility of event audiences [80]. The situation of distance (both social and spatial dimensions) as a relational variable was constructed as an instrument to explore the lived experience of publicness, incorporating novel indicators to examine the interplay between tangible and intangible expressions of publicness with the aim of enhancing the concept of visibility through empirical analysis [81]. The legal sense and lived sense are also further related to interpreting public space, respectively [82]. A study aims to examine the various public spaces within Hail through six dimensions, including accessible and linked, activity and uses, amenity, attractiveness and appeal, safety, and maintenance, correlating quantitative and qualitative data by utilizing fieldwork observations and user perception [23].

Previous studies have proposed numerous qualitative and quantitative indices to assess the diverse dimensions of publicness in POPOS. Nevertheless, there are some limitations, which are outlined below.

- (1) There is a limited understanding of the interrelationships and dynamics between the different dimensions of publicness. Further research that examines the interplay and synergies between these dimensions is needed. Specifically, how do the publicness dimensions of physical configuration/design and user perception/satisfaction/experience interact and influence each other in shaping public spaces? There have been some attempts, such as the formulation of “informality” and publicness [20], to address this question. However, further in-depth research is required to fully understand the complex relationship between these dimensions.
- (2) Previous studies on spatial publicness assessments have been conducted in the presence of clusters of privately owned or managed functions within adjacent buildings. However, it remains uncertain whether the presence of these functions significantly influences the assessment results, potentially either enhancing or detracting from the overall quality of the public space. Therefore, there is a need for conducting additional assessments of the spatial publicness of POPOS independently, disentangled from the influence of adjacent commercial and corporate functions. The data collected during the pandemic period, when many shops and businesses were temporarily closed, are convenient and valuable.

3. Materials and Methods

The theory of publicness provides a framework that helps researchers understand and evaluate the degree of various dimensions of publicness in public space. By leveraging the theory, this study establishes evaluation indicators and uses quantitative methods for data collection and analysis to propose environmental design strategies.

Therefore, this study is a mixed-methods research method in the field of architectural and urban design. It utilizes quantitative data collection methods (a questionnaire survey) and statistical analysis methods (the IPA method) to assess user satisfaction ratings of the spatial design of a specific square in Milan. Through the statistical analysis of the evaluation indicators, the research aims to derive spatial design strategies that enhance user satisfaction. The selection of indicators is a qualitative study based on a literature analysis of the theory of publicness. The conclusion is derived from statistical analysis, providing quantifiable comparisons and inferences.

3.1. Data Collection Method

3.1.1. The Selection of Case Study

Milan has always been open to relatively heavy architecture and urban modifications compared to other Italian cities, at least since WWII. It is a historical European city that has gone through massive urban transformation projects in the last two decades. Almost all of the new Milanese interventions have been financed through private development, and the number of privately owned public open spaces (POPOS) skyrockets [4].

Plaza Gae Aulenti (PGA) in Milan is the central plaza of an urban transformation project (called “the New Gate of the City”) with the ambition of being a new center of the city, connecting several railway lines as well as the important metro lines. Owned and operated by UniCredit S.p.A., an international banking group Italy’s only systemically important bank according to the list provided by the Financial Stability Board in 2022 [83], the plaza is a prototypical exemplar of POPOS in Milan, which combines both corporate and commercial functions. Part of the success of the plaza can be attributed to Jan Gehl, the celebrated Danish social architect, who consulted in programming the area for liveliness. The place is constructed with certain environmental qualities instead of evident inferior space, and it is popular with residents of the city. However, its success is still controversial from certain critical angles, such as inclusiveness, consumerism, etc. [4]. Therefore, it is a suitable case study for this research.

3.1.2. Explanation of Questionnaire

The objective of this study was to address the research gap in assessing the spatial publicness of POPOS independently of adjacent commercial and corporate functions and propose environmental improvement strategies to enhance user satisfaction in POPOS post COVID-19. Therefore, the study employed a questionnaire survey to obtain visitors' satisfaction with the spatial publicness of Plaza Gae Aulenti before and after the mild restriction due to the COVID-19 pandemic. We designed an online survey using WJX (Changsha Ranxing IT Ltd., Changsha, China). Subsequently, we distributed the e-questionnaire to various online social groups in the Milan area, Italy, including work groups, student groups, etc. Additionally, we enlisted volunteers to share the survey on their respective social media pages. The data were collected between 26 September and 12 October 2022. We received a total of 386 survey responses from individuals who had visited Plaza Gae Aulenti in Milan before and after the COVID-19 pandemic, which were selected for analysis.

The initial section of the questionnaire includes a question: "Did you visit Plaza Gae Aulenti before the pandemic and during the period of mild restrictions following the outbreak?" Only 386 valid questionnaires that responded "yes" were selected for data analysis. In this case, it is assumed that the information provided by the participants is truthful and reliable, facilitating subsequent data analysis and research. The participants' responses serve as the basis for a scientific investigation.

The main content of the survey comprised a set of 30 elements, ranging from centrality and connectedness on an urban scale to physical facilities on an architectural scale. A Likert scale consisting of five points was employed to assess residents' satisfaction following their visit to the public open space [84]. The scale included the following categories: (1) Importance (post-COVID-19): "5 = highly important", "4 = important", "3 = moderate", "2 = unimportant", and "1 = highly unimportant". The questionnaire used for data collection can be found in Appendix A. (2) Performance (Pre-COVID-19): "5 = excellent", "4 = good", "3 = average", "2 = poor", and "1 = bad".

3.1.3. Questionnaire Questions

For the assessment of spatial publicness, the selected cases were analyzed in an inductive manner, considering public space as an external entity separate from individuals, which was opposite to emotion and perception [85]. There are plenty of analytic models, dimensions, classifications, definitions, and guidelines for the assessment of publicness. They are developed by a number of researchers from different disciplines. To address the above-mentioned research gaps, we aimed to develop a multiple-item scale to assess user perceptions of POPOS both before and after the COVID-19 pandemic.

We investigated the spatial publicness determinants of user satisfaction with POPOS and established an arrangement of these factors. Regarding the general index of the questionnaire, the study adopted the three sub-dimensions of the physical configuration dimension of the Star Model of Publicness, namely centrality and connectedness, visual permeability, and thresholds and gateways. Additionally, two additional indices were incorporated, including physical facilities and the surrounding buildings. The evaluation indices proposed by Nemeth and Schmidt [19], Mehta [20], Pan et al. [21], Sandaruwani and Hewawasam [22], Alnaim and Noaime, E. [23], Lopes et al. [24], Ho et al. [25], and others were referenced for the detailed spatial quality attributes of the physical environment in this research. Lastly, to determine the impact of adjacent commercial and corporate functions on visitors, the questionnaire also included the functional program as an indicator to compare user satisfaction in the presence and absence of these functions. Despite the temporary closure of neighboring functions, visitors still retain their perception of the space when the functions were available and can express their level of demand through scoring the questions related to this indicator. Eventually, based on previous research on publicness evaluation models/frameworks worldwide as well as the ratification of the Charter of Public Space at the second Biennial of Public Space in Rome, several factors were identified

(Table 1). A group of experts from three institutions associated with the authors evaluated all the factors for the validity of their content and appearance.

Table 1. The factors to assess user satisfaction of spatial publicness in POPOS before/after COVID-19.

Determinants of User Satisfaction to Plaza Gae Aulenti (Based on Previous Research)	30 Factors: Importance (after COVID-19)/Performance (before COVID-19)	QN
Physical Facilities [18,19,24,25,86–88]	Public seating is sufficient with free/comfortable orientation and location for people watching and engaging.	1
	Tables are sufficient with free/comfortable orientation and location for people watching and engaging.	2
	The shading performance is good.	3
	Lighting is sufficient to encourage nighttime use.	4
	The pavement is safe and comfortable.	5
	Natural elements can be found in the plaza (such as trees, fountain).	6
	Interactive and fun elements can be found in the plaza (such as artwork).	7
	Various micro-climates.	8
	Restrooms are available.	9
	Drink fountain/food stall is available.	10
	Bicycle parking is available.	11
	Litter receptacles are easy to find.	12
Centrality and Connectedness [18,69,81]	The plaza is well located within the overall movement network (public and private transportation).	13
	The connection between the plaza and the city facilitates both movement to and movement through the space.	14
	Desire lines within surrounding area continue into and through the space.	15
Visual Permeability [18,89]	Visual connection between the plaza and external public realm (surrounding streets, etc.) is strong.	16
	Visual connection between the plaza and the adjacent building interiors in the same floor level is strong.	17
Thresholds and Gateways [19,24,90]	Thresholds and entry points are not distinguished from surrounding public realm (e.g., one does not know precisely when the space is entered).	18
	Distribution of gateways is balanced and convenient from every direction.	19
	Escalators/elevators are functional and convenient.	20
	Pedestrian roads and ramps are functional and convenient.	21
	Stairs are functional and convenient.	22
The Surrounding Buildings [62,91–93]	Entrances and exits of the surrounding buildings facilitate circulation to open space freely from all directions.	23
	The surrounding architecture design is attractive (with identifiers).	24
	Enclosing facades of the plaza are habitable (e.g., comfortable to stop and stay).	25
	Enclosing facades have fine details.	26
Functional Program [24,81,94,95]	There are a variety of functions around the plaza.	27
	Proportion of active commercial frontages is high.	28
	Proportion of active corporate frontages is high.	29
	Proportion of active cultural and art frontages is high.	30

3.2. Analysis Method

The aim of the data analysis was to identify the key environmental factors that influenced user satisfaction during a pandemic by comparing the satisfaction of visitors with the spatial publicness of Plaza Gae Aulenti before and after the mild restriction due to COVID-19 pandemic, periodically from May 2020. Importance-performance analysis (IPA) was chosen as the statistical analysis method. IPA is a research method and technique that aims to assess and provide recommendations for management strategies. The core principle of IPA is to evaluate the performance and significance of various service features and offer actionable recommendations for improving management practices. Therefore, it is a suitable choice for the research method in this study as it allows for a comprehensive assessment of the importance and performance of spatial publicness elements in relation to user satisfaction during the pandemic.

However, one challenge with using IPA is the selection of the most appropriate threshold values to divide the quadrants. There are two primary methods for determining these thresholds: the data-centric (DC) method, which utilizes the critical point determined by the actual average level of the data, and the scale-centric (SC) method, which provides a simpler description. Additionally, some researchers have employed diagonal lines (DLs) or isolines (IRLs). Among these approaches, the IRL method is more suitable for assessing the disparity between pre-performance and post-importance (satisfaction forecast) levels. In this study, the DC-DL method was used to establish the threshold values (Figure 2).

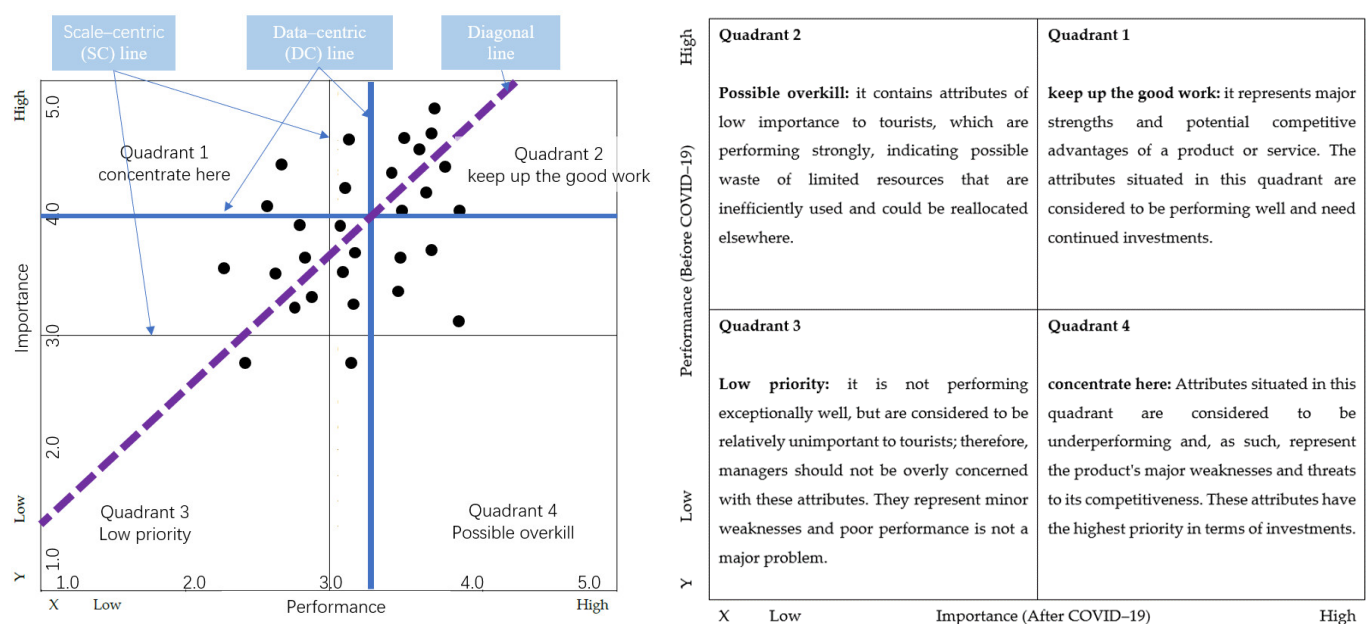


Figure 2. The line of different thresholds within the IPA plot [96–98].

4. Results

4.1. Reliability and Validity Analysis

The analysis of the questionnaire was performed using IBM’s SPSS 26 statistical software in New York, USA. The reliability of the questionnaire was assessed via the Cronbach’s alpha coefficient, with a value greater than 0.7 indicating “high reliability” and greater than 0.5 indicating “reliability”. The questionnaire’s alpha coefficient was calculated to be 0.991, which is considered comparatively high and satisfactory [94]. Furthermore, the survey instrument demonstrated satisfactory content validity, construct-related validity, and structural validity, as indicated in Tables 2 and 3.

Table 2. Validity statistics.

		Number	%
Cases	Valid	386	100
	Excluded	0	0
	Total	386	100

Table 3. Reliability statistics.

Cronbach’s Alpha	Number of Items
0.991	60

4.2. Importance-Performance Scores

The findings are presented in Table 4 and Figure 3. Initially, these components are situated in (Q4 + Q3): numbers 1, 3, 7, 8, 9, 10, and 17. As an illustration, these elements require heightened priority in the aftermath of COVID-19: Physical facilities (public seating is sufficient with free/comfortable orientation and a location for people watching and engaging; interactive and fun elements can be found in the plaza, such as artwork; the shading performance is good; there are various micro-climates; restrooms are available; a drink fountain/food stall is available); and visual permeability (the visual connection between the plaza and the adjacent building interiors in the same floor level is strong). Secondly, these items are in the priority area (Q1): numbers 12, 13, 14, 19, 29, 21, 22, and 23. Thirdly, these items fall within the medium priority area (Q3 + Q4): numbers 2, 4, 5, 6, 11,

18, and 26. Fourthly, these items are situated in the low priority area (Q2 + Q1): numbers 15, 16, 24, 25, 27, 28, 29, and 30.

Table 4. Means of importance and performance and paired sample *t* test (df =357).

No.		Paired Differences					<i>t</i>
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
					Lower	Upper	
Pair 1	I1–P1	0.14249	1.02078	0.05196	0.04033	0.24464	2.742
Pair 2	I2–P2	0.06995	0.97116	0.04943	−0.02724	0.16714	1.415
Pair 3	I3–P3	0.11399	0.93834	0.04776	0.02009	0.20789	2.387
Pair 4	I4–P4	−0.01554	0.89719	0.04567	−0.10533	0.07424	−0.340
Pair 5	I5–P5	0.05440	0.81839	0.04165	−0.02750	0.13630	1.306
Pair 6	I6–P6	−0.01813	0.91577	0.04661	−0.10978	0.07351	−0.389
Pair 7	I7–P7	0.05959	0.96917	0.04933	−0.03740	0.15657	1.208
Pair 8	I8–P8	0.12694	0.92971	0.04732	0.03390	0.21998	2.683
Pair 9	I9–P9	0.11399	1.01032	0.05142	0.01288	0.21510	2.217
Pair 10	I10–P10	0.05959	0.95839	0.04878	−0.03632	0.15550	1.221
Pair 11	I11–P11	0.03627	0.86113	0.04383	−0.04991	0.12245	0.827
Pair 12	I12–P12	0.05181	0.80091	0.04077	−0.02834	0.13196	1.271
Pair 13	I13–P13	0.05699	0.83859	0.04268	−0.02693	0.14092	1.335
Pair 14	I14–P14	0.02591	0.85241	0.04339	−0.05940	0.11121	0.597
Pair 15	I15–P15	0.01036	0.88561	0.04508	−0.07826	0.09899	0.230
Pair 16	I16–P16	0.01813	0.93263	0.04747	−0.07520	0.11147	0.382
Pair 17	I17–P17	0.05440	0.93122	0.04740	−0.03879	0.14759	1.148
Pair 18	I18–P18	−0.02073	0.93951	0.04782	−0.11475	0.07330	−0.433
Pair 19	I19–P19	0.05181	0.92717	0.04719	−0.04097	0.14460	1.098
Pair 20	I20–P20	0.07513	0.91853	0.04675	−0.01679	0.16705	1.607
Pair 21	I21–P21	0.12176	0.93319	0.04750	0.02837	0.21515	2.563
Pair 22	I22–P22	0.08290	0.94984	0.04835	−0.01215	0.17796	1.715
Pair 23	I23–P23	0.08808	1.00260	0.05103	−0.01225	0.18842	1.726
Pair 24	I24–P24	0.00259	1.07751	0.05484	−0.10524	0.11042	0.047
Pair 25	I25–P25	−0.02591	1.04663	0.05327	−0.13065	0.07883	−0.486
Pair 26	I26–P26	0.00518	1.00646	0.05123	−0.09554	0.10590	0.101
Pair 27	I27–P27	0.02332	0.96805	0.04927	−0.07356	0.12019	0.473
Pair 28	I28–P28	−0.05699	1.06995	0.05446	−0.16407	0.05008	−1.047
Pair 29	I29–P29	−0.14508	1.03180	0.05252	−0.24833	−0.04182	−2.762
Pair 30	I30–P30	−0.08549	0.98585	0.05018	−0.18415	0.01317	−1.704

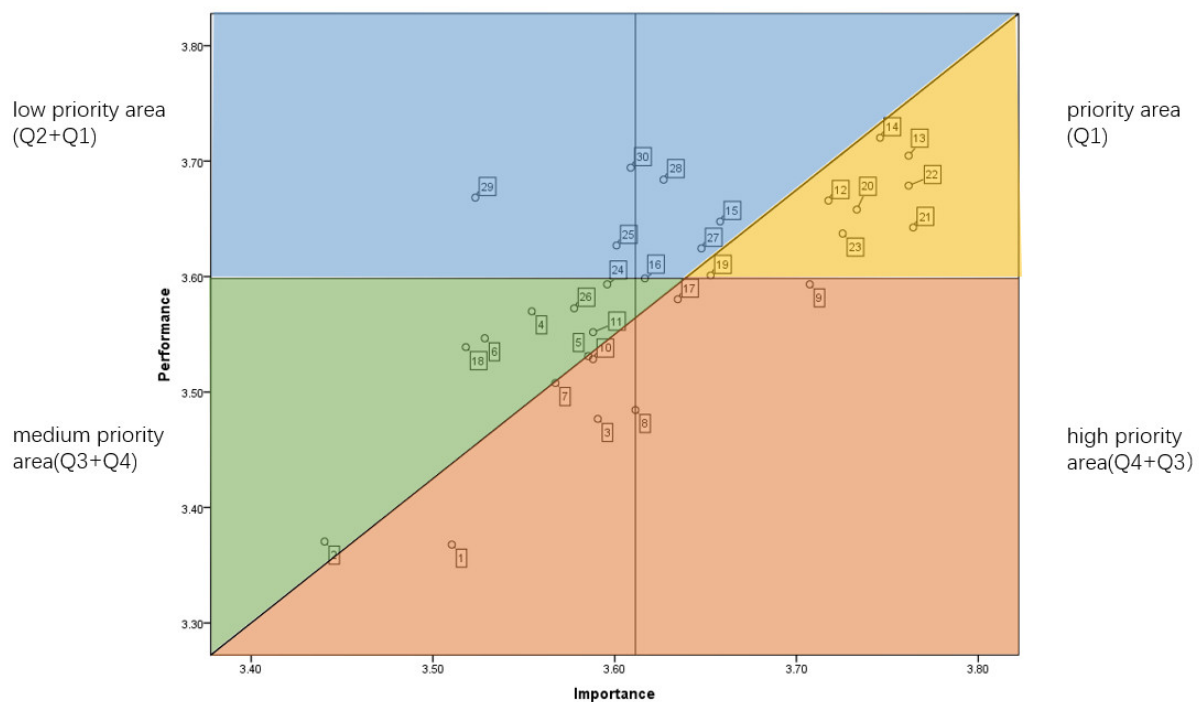


Figure 3. The Importance-Performance Analysis.

5. Discussion

5.1. Impacts

First, this research represents one of the initial attempts to unveil the effects of COVID-19 restrictions on user satisfaction with spatial publicness in privately owned public open spaces (POPOS) independently of adjacent commercial and corporate functions. Secondly, considering the research methodology aspect, the combination of DC and IRL methodologies utilizing content analysis provided a framework to disentangle and navigate the intricate relationships between variables, thus offering potential benefits for subsequent studies. Third, recommendations will be provided to the design, planning, and regulation departments of POPOS to improve the user satisfaction of public open spaces following the COVID-19 pandemic using the IPA. This study expands the scope of this field of study beyond the conventional POPOS context and contributes insights to the design and management of POPOS in the aftermath of COVID-19. In general, following the COVID-19 pandemic, visitors have shown great interest in the physical amenities and the visual permeability of POPOS, which were previously under-performed as well. However, the centrality and connectedness, as well as the ease of access related to POPOS, remain major strengths and competitive advantages of the place among visitors.

5.2. Suggestions

Feasible suggestions are also provided by this study for POPOS designers, planners, and regulators in place-making approaches for the aftermath of COVID-19. As our outcomes suggest, the contentment of visitors in the post-COVID era may be impacted directly by key spatial quality attributes of publicness in POPOS directly. The designers and developers of POPOS ought to take into account the factors identified as “High Priority” and “Priority” areas. The “Medium Priority” area represents factors that underperformed but were relatively unimportant for the users. The “Low Priority” area includes factors that performed strongly before the pandemic but were again relatively unimportant for the users, potentially leading to the inefficient use of limited resources. Consequently, the environmental improvement strategies for POPOS in the post-COVID-19 era do not encompass the factors within these two areas. The following recommendations are proposed to enhance the visitor experience.

5.3. Top-Priority Recommendations

Recommendations for the ranking based on paired differences (IA-PB): (1) “Public seating is sufficient, with free/comfortable orientation and location for people-watching and engaging”. It demonstrates that visitors like better, sufficient seating arrangements that facilitate participating in social life (not necessarily directly) after the pandemic. Sparse, fixed, and secluded seating arrangements need to be reconsidered. (2) “The shading performance is good”; (3) “Various micro-climates”. These environmental qualities were neglected to a certain extent before the outbreak. They require special awareness in the post-COVID-19 period. (4) “Restrooms are available”, and (5) “Drink fountain/food stall is available”. Restrooms and drink fountain/food stalls are mainly provided by the interior functions of the surrounding buildings with or without payment. This is obviously inconvenient for POPOS utility after the COVID-19 pandemic, and it needs to be improved. (6) “Visual connection between the plaza and the adjacent building interiors in the same floor level is strong”. Disruptions to the visual connection are mainly caused by store closures during disease outbreak prevention and management. It also needs to be focused on in POPOS.

Most of the high-priority suggestions originate from the determinants of “Physical Facilities” and “Visual Permeability”. These above-suggested spatial configurations are mainly undertaken by the indoor functions of adjacent buildings before COVID-19, either charged or free. However, the supply of these factors is largely affected by the closure of the surrounding functions under the pandemic control. In fact, the spatial layout of these physical facilities is inconvenient for users of the public open space, even in the absence of pandemic control. They are deeply hidden inside the building interiors,

with longer (compared to facilities arranged inside POPOS) and sometimes implicit paths to reach them. Therefore, the accessibility of the facilities is reduced. In addition, the disturbance of visual permeability has a great impact on user satisfaction, indicating that the adjacent interior display of the architecture (generally so-called “Starchitecture” [99]) is one of the main regular attractions of POPOS. It relies on “the architecture of public space” rather than the spatial quality of the communal area itself.

5.4. Priority Recommendations

Recommendations for the ranking based on paired differences (IA-PB): (7) “Litter receptacles are easy to find.” After the COVID-19 pandemic, litter receptacles provided by the surrounding building interiors were not available. (8) “The plaza is strategically positioned within the broader transportation network (public and private transportation);” and (9) “The connection between the plaza and the city facilitates both movement to and movement through the space”. Obstacles added by pandemic control prevented regular transportation and mobility within and through the area. POPOS should be planned within a larger network of public open spaces with ordered and controlled accessibility to citizens, even in the case of an outbreak. (10) “Distribution of gateways is balanced and convenient from every direction”, (11) “Escalators/elevators are functional and convenient”, (12) “Pedestrian roads and ramps are functional and convenient”, and (13) “Stairs are functional and convenient”. The suggestions in this part are that more attention should be paid to the balanced arrangement of thresholds and gateways in POPOS after COVID-19. People tend to reach open places via convenience and a wide choice of amenities. (14) “Entrances and exits of the surrounding buildings facilitate circulation to the open space freely from all directions”. Internal entrances and exits were used by many POPOS before the outbreak. However, during COVID-19, they are no longer open options.

Priority suggestions extend from one important amenity of “Physical Facilities” to the determinants of “Centrality and Connectedness” and “Thresholds and Gateways”. The determinant of “the Surrounding Buildings” has relatively little impact on visitors’ satisfaction.

6. Conclusions

The performance of privately owned public open spaces (POPOS) holds significant importance in many global cities due to their current large number and wide distribution, and the construction and re-development of urban spaces continuing to open up to transnational private developers in Milan. This study aims to address existing research gaps and provide an insight into the dynamics of spatial publicness and user satisfaction in POPOS. As far as we know, our research represents a pioneering investigation to probe the direct influence of the COVID-19 pandemic on user contentment with spatial publicness in POPOS in Milan, Italy, independent of adjacent interior functions. Previous related research mostly focused on exploring the correlations between public spaces and COVID-19 for some special social groups in Milan, such as the elderly, medical staff, etc. Some researchers dig into the effects of current urban planning on these correlations. However, hardly any works provide a critical account of the impact of POPOS within the framework of COVID-19 on people’s satisfaction. The reframed IPA, which compares performance before COVID-19 with importance after COVID-19, represents a novel endeavor. The study can contribute to the development of evidence-based design strategies and policies that enhance user satisfaction in POPOS, along with the establishment of standardized assessment tools to advance our understanding and practical application of Spatial Publicness Theory in architectural and urban design. It provides a series of post-COVID-19 tactics for the improvement of POPOS making.

The results depicted in Figure 3 demonstrate that the factors “Physical Facilities” and “Visual Permeability”, situated in quadrant 3 according to Figure 2, belong to the “concentrate here” category. This indicates that they exhibit low performance but hold high importance. These aspects represent a significant weakness of the place, as they were evaluated by the users as underperforming before the outbreak but are now highly valued

by them. Consequently, these determinants should be given the utmost priority in the post-COVID-19 period, demanding further consciousness. Conversely, the attributes positioned in quadrant 1, predominantly from “Centrality and Connectedness” and “Thresholds and Gateways”, fall into the “keep up the good work” category. They serve as major strengths and potential competitive advantages of POPOS, as they exhibit high performance and importance. These attributes are regarded as priority recommendations. The top-priority and priority recommendations outlined in this study have the potential to significantly contribute to the environmental quality of POPOS for their users in the post-COVID-19 era.

Furthermore, approximately half of the environmental quality attributes related to “Surrounding Buildings” fall into quadrant 3, reflecting underperformance and low importance according to the assessment results. This reveals that the physical design of surrounding buildings is not particularly exceptional in terms of performance and is relatively overlooked by users. Consequently, these attributes are significant for improving spatial publicness, but they are not considered priority areas for enhancing user satisfaction during pandemics. Lastly, the factors related to “Functional Program” occupy quadrant 2, indicating high performance but low importance. This suggests that these attributes are unimportant to users but performed strongly before the pandemic. As a result, the factors associated with “Surrounding Buildings” and “Functional Program” are not included in the environmental improvement strategies for POPOS in the post-COVID-19 era.

Nevertheless, there are certain limitations to this study, listed as follows, as well as some future research directions. Initially, the data were gathered from visitors in POPOS in Milan, Italy. Consequently, the environmental improvement strategies for user satisfaction in this type of urban space in the post-COVID-19 era could be, to some degree, hard and inappropriate to put into other regions. Furthermore, although the IPA is broadly familiar with the field of Hotel and Tourism, applying this method to privately owned public spaces is a new effort. Hence, to establish a comprehensive body of literature on the impacts of crises such as COVID-19 in POPOS, we recommend broadening the research scope to encompass related phenomena. Secondly, while we were able to establish links between the factors that influence user satisfaction and COVID-19, the degree of correlation between them remains uncertain and requires further investigation. The model can be further examined to recognize the degree of the effects of the linked relationship between the above-mentioned determinants to upgrade the POPOS making in future investigations and incorporate more nuanced research questions.

Author Contributions: Conceptualization, J.S., G.C., A.L. and B.X.; methodology, J.S. and G.C.; software, J.S. and G.C.; validation, J.S. and G.C.; formal analysis, J.S. and G.C.; investigation, J.S. and G.C.; resources, J.S. and G.C.; data curation, J.S., G.C., A.L. and B.X.; writing—original draft preparation, J.S. and G.C.; writing—review and editing, J.S. and G.C.; visualization, J.S. and G.C.; supervision, J.S. and G.C.; project administration, J.S. and G.C.; funding acquisition, J.S., G.C., A.L. and B.X. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by General Scientific Research Project of Zhejiang Provincial Department of Education (21056112-F); Start-Up Research Project of Zhejiang Sci-Tech University (21052253-Y); Project funded by China Postdoctoral Science Foundation (2023M730024); Achievements of Social Science Research of Linping District, Hangzhou (Lpsk23C13); Zhejiang Provincial Construction Research Project (2022K049); Zhejiang Provincial Construction Research Project (2021K035); Zhejiang Provincial Construction Research Project (2021K131).

Data Availability Statement: Not applicable.

Acknowledgments: The first author would like to thank her two PhD supervisors in Politecnico di Milano—Laura Montedoro and Marco Bovati—for inspiring and encouraging her during her research on public space. The first author would like to thank her two PhD supervisors in DASTU (Department of Architecture and Urban Studies), Politecnico di Milano—Laura Montedoro and Marco Bovati—for their inspiration and encouragement during her research on public space.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. The sample questionnaire.

Have you visited Plaza Gae Aulenti before COVID-19?		YES					NO				
		Importance (after COVID-19): "5 = very important", "4 = important", "3 = so-so", "2 = unimportant", and "1 = very unimportant".					Performance (Before COVID-19): "5 = very good", "4 = good", "3 = so-so", "2 = not bad", and "1 = bad".				
30 factors: performance (before COVID-19)/importance (during COVID-19) Note: the plaza = Plaza Gae Aulenti, referring to the larger area of open spaces that adjoining the Unicredit Tower, including the Park of Tree Library.		QN									
Physical Facilities	Public seating is sufficient with free/comfortable orientation and location for people watching and engaging.	1	2	3	4	5	1	2	3	4	5
	Tables are sufficient with free/comfortable orientation and location for people watching and engaging.	2									
	The shading performance is good.	3									
	Lighting is sufficient to encourage nighttime use.	4									
	The pavement is safe and comfortable.	5									
	Natural elements can be found in the plaza (such as trees, fountain).	6									
	Interactive and fun elements can be found in the plaza (such as artwork).	7									
	Various micro-climates.	8									
	Restrooms are available.	9									
	Drink fountain is available.	10									
	Bicycle parking is available.	11									
	Litter receptacles are easy to find.	12									
Centrality and Connectedness	The plaza is strategically positioned within the broader transportation network (public and private transportation).	13									
	The connection between the plaza and the city facilitates both movement to and movement through the space.	14									
	Desire lines within surrounding area continue into and through the space.	15									
Visual Permeability	Visual connection between the plaza and external public realm (surrounding streets, etc.) is strong.	16									
	Visual connection between the plaza and the adjacent building interiors in the same floor level is strong.	17									

Table A1. *Cont.*

Have you visited Plaza Gae Aulenti before COVID-19?	YES	NO
Thresholds and Gateways	Thresholds and entry points are not distinguished from surrounding public realm (e.g., one does not know precisely when the space is entered).	18
	Distribution of gateways is balanced and convenient from every direction.	19
	Escalators/elevators are functional and convenient.	20
	Pedestrian roads and ramps are functional and convenient.	21
	Stairs are functional and convenient.	22
The Surrounding Buildings	Entrances and exits of the surrounding buildings facilitate circulation to open space freely from all directions.	23
	The surrounding architecture design is attractive.	24
	Enclosing facades of the plaza are habitable (e.g., comfortable to stop and stay).	25
	Enclosing facades have fine details.	26
	There is a variety of functions around the plaza.	27
Functional Program	Proportion of active commercial frontages is high.	28
	Proportion of active corporate frontages is high.	29
	Proportion of active cultural and art frontages is high.	30

References

1. Codecasa, G.; Ponzini, D. Public-Private Partnership: A Delusion for Urban Regeneration? Evidence from Italy. *Eur. Plan. Stud.* **2011**, *19*, 648–667. [CrossRef]
2. Melik, R.; Van der Krabben, E. Co-production of public space: Policy translations from New York City to the Netherlands. *Town Plan. Rev.* **2016**, *87*, 139–158. [CrossRef]
3. Carmona, M. Principles for public space design, planning to do better. *Urban Des. Int.* **2019**, *24*, 47–59. [CrossRef]
4. Ingersoll, R. Big Milano: The privatization of the public realm. Domus 2019. Available online: <https://www.terravivaworkshop.com/single-post/2019/09/16/big-milano-the-privatization-of-the-public-realm-prof-richard-ingersoll-for-domus-1509201> (accessed on 15 April 2023).
5. Garrett, B.L. Explore Everything: Place-Hacking the City; Explore Everything: Place-Hacking the City: 2013. Available online: <https://www.amazon.com/Explore-Everything-Place-Hacking-Bradley-Garrett/dp/1781681295> (accessed on 15 April 2023).
6. Madanipour, A. Dimensions of urban public space: The case of the Metro Centre, Gateshead. *Urban Des. Stud.* **1995**, *1*, 45–56.
7. Lanning, T. Ground Control: Fear and happiness in the twenty-first-century city. Public Policy Res. 2010. Available online: https://books.google.com.hk/books/about/Ground_Control.html?id=MKYkAQAAMAAJ&redir_esc=y (accessed on 15 April 2023).
8. Wang, Y.; Chen, J. Dimensions of the publicness of urban space and defining features of “public” and “private” in western research. *Urban Plan. Int.* **2017**, *32*, 59–67. [CrossRef]
9. Jian, I.; Chan, E.; Xu, Y.; Owusu, E. Inclusive public open space for all: Spatial justice with health considerations. *Habitat Int.* **2021**, *118*, 102457. [CrossRef]
10. Kayden, J.S. *Privately Owned Public Space: The New York City Experience*; John Wiley & Sons: Hoboken, NJ, USA, 2000.
11. Dimmer, C. Public Space by Private Actors? Outlining the Issues. *Priv. Own. Public Spaces Int. Experience. Sustain. Urban Regen.* **2013**, *25*, 2–11.
12. Mantey, D. The ‘publicness’ of suburban gathering places: The example of Podkowa Leśna (Warsaw urban region, Poland). *Cities* **2017**, *60*, 1–12. [CrossRef]
13. Koch, R.; Latham, A. Inhabiting Cities, Domesticating Public Space: Observing Change in the Public Life of Contemporary London; 2021; pp. 374–383. Available online: <https://www.taylorfrancis.com/chapters/edit/10.4324/9781351202558-56/inhabiting-cities-domesticating-public-space-observing-change-public-life-contemporary-london-regan-koch-alan-latham> (accessed on 15 April 2023).
14. Carmona, M. The “public-isation” of private space—Towards a charter of public space rights and responsibilities. *J. Urban. Int. Res. Placemaking Urban Sustain.* **2021**, *15*, 133–164. [CrossRef]
15. Peiris, M.T.O.V.; Fayas, M. Assessment of User Perception on Public and Private Spaces within Urban Context. *Int. J. Built Environ. Sustain.* **2022**, *9*, 47–59. [CrossRef]
16. McCann, E. Spaces of publicness and the world after the coronavirus crisis. *Society and Space Magazine*, 1 June 2020.
17. Ministero Dello Sviluppo Economico. Modifica degli allegati 1, 2 e 3 del decreto del Presidente del Consiglio dei ministri 26 aprile 2020. Available online: <https://def.finanze.it/DocTribFrontend/getAttoNormativoDetail.do?ACTION=getArticolo&id=%7BF0BEEAC0-4F5B-4295-B2CF-8957F6E586B5%7D&codiceOrdinamento=0500000000000000&articolo=Preambolo> (accessed on 15 April 2023).
18. Varna, G.; Tiesdell, S. Assessing the publicness of public space: The star model of publicness. *J. Urban Des.* **2010**, *15*, 575–598. [CrossRef]
19. Németh, J.; Schmidt, S. The privatization of public space: Modeling and measuring publicness. *Environ. Plan. B: Plan. Des.* **2011**, *38*, 5–23. [CrossRef]
20. Mehta, V. Informality and the Production of Publicness in India. In *Informality and the City: Theories, Actions and Interventions*; Springer: Berlin/Heidelberg, Germany, 2022; pp. 407–419.
21. Pan, M.; Shen, Y.; Jiang, Q.; Zhou, Q.; Li, Y. Reshaping Publicness: Research on Correlation between Public Participation and Spatial Form in Urban Space Based on Space Syntax—A Case Study on Nanjing Xinjiekou. *Buildings* **2022**, *12*, 1492. [CrossRef]
22. Sandaruwani, T.B.; Hewawasam, C. An Evaluation on Publicness of Urban Public Spaces by Using Core Dimensions; Specific Reference to Galle Fort (Sea Bath Area), Forest (Beach) Park Area, Mahamodara Marine Walk and Ocean Pathway in Galle. *J. Serv. Sci. Manag.* **2021**, *14*, 663–679. [CrossRef]
23. Alnaim, M.M.; Noaime, E. Evaluating public spaces in Hail, Saudi Arabia: A reflection on cultural changes and user perceptions. *Alex. Eng. J.* **2023**, *71*, 51–72. [CrossRef]
24. Lopes, M.; Santos Cruz, S.; Pinho, P. Revisiting publicness in assessment of contemporary urban spaces. *J. Urban Plan. Dev.* **2019**, *145*, 04019013. [CrossRef]
25. Ho, D.C.; Lai, L.W.; Wang, A. The effects of ‘publicness’ and quality of publicly accessible open space upon user satisfaction. *Environ. Plan. B: Urban Anal. City Sci.* **2021**, *48*, 861–879. [CrossRef]
26. Martilla, J.; James, J. Importance-Performance Analysis. *J. Mark.* **1977**, *41*, 77. [CrossRef]
27. Sever, I. Importance-performance analysis: A valid management tool? *Tour. Manag.* **2015**, *48*, 43–53. [CrossRef]
28. Chouker, A.; Stahn, A.C. COVID-19-The largest isolation study in history: The value of shared learnings from spaceflight analogs. *Npj Microgravity* **2020**, *6*, 32. [CrossRef]
29. Calati, R.; Gentile, G.; Fornaro, M.; Tambuzzi, S.; Zoja, R. Preliminary suicide trends during the COVID-19 pandemic in Milan, Italy. *J. Psychiatr. Res.* **2021**, *143*, 21–22. [CrossRef] [PubMed]

30. Guida, C.; Carpentieri, G. Quality of life in the urban environment and primary health services for the elderly during the Covid-19 pandemic: An application to the city of Milan (Italy). *Cities* **2021**, *110*, 103038. [CrossRef] [PubMed]
31. Sepe, M. Covid-19 pandemic and public spaces: Improving quality and flexibility for healthier places. *Urban Des. Int.* **2021**, *26*, 159–173. [CrossRef]
32. Florida, R. We'll Need to Reopen Our Cities. But not Without Making Changes First. *CityLab*, 27 March 2020.
33. Roberts, D. How to make a city livable during lockdown. Vox 2020. Available online: <https://www.vox.com/cities-and-urbanism/2020/4/13/21218759/coronavirus-cities-lockdown-covid-19-brent-toderian> (accessed on 15 April 2023).
34. Honey-Rosés, J.; Anguelovski, I.; Chireh, V.; Daher, C.; Konijnendijk, C.; Litt, J.; Mawani, V.; McCall, M.; Orellana, A.; Oscilowicz, E.; et al. The impact of COVID-19 on public space: An early review of the emerging questions—Design, perceptions and inequities. *Cities Health* **2020**, *5*, S263–S279. [CrossRef]
35. Low, S.; Smith, N. *The Politics of Public Space*; Routledge: Abingdon-on-Thames, UK, 2013.
36. Bruyns, G.; Nel, D. Lateral-privatisation of the publics: Hong Kong's spatial struggles. *Urban Des. Int.* **2020**, *25*, 266–279. [CrossRef]
37. Stringer, S. Audit report on the city's oversight over Privately Owned Public Spaces. New York Office of the Comptroller (New York City). 2017. Available online: <https://comptroller.nyc.gov/reports/audit-report-on-the-on-the-citys-oversight-over-privately-owned-public-spaces> (accessed on 15 April 2023).
38. Jiang, M.; Nakajima, N. Chongqing People's Square after 1997: Situated publicness of municipal squares in reform-era China. In *Urban Research & Practice*; 2022; pp. 1–29. Available online: <https://www.tandfonline.com/doi/full/10.1080/17535069.2022.2028184> (accessed on 15 April 2023). [CrossRef]
39. De Backer, M.; Hopkins, P.; Liempt, I. Refugee Youth: Politics, Publicness and Visibility; 2023; pp. 231–237. Available online: <https://bristoluniversitypressdigital.com/display/book/9781529221039/ch015.xml> (accessed on 15 April 2023).
40. Jim, C.Y.; Chen, W.Y. External effects of neighbourhood parks and landscape elements on high-rise residential value. *Land Use Policy* **2010**, *27*, 662–670. [CrossRef]
41. Anderson, S.T.; West, S.E. Open space, residential property values, and spatial context. *Reg. Sci. Urban Econ.* **2006**, *36*, 773–789. [CrossRef]
42. Akkar, M. The changing 'publicness' of contemporary public spaces: A case study of the Grey's Monument Area, Newcastle upon Tyne. *Urban Des. Int.* **2005**, *10*, 95–113. [CrossRef]
43. Blomley, N. What Sort of a Legal Space is a City? 1. In *Urban Interstices: The Aesthetics and the Politics of the in-between*; Routledge: Abingdon-on-Thames, UK, 2016; pp. 1–20.
44. Milbourne, P. Growing public spaces in the city: Community gardening and the making of new urban environments of publicness. *Urban Stud.* **2021**, *58*, 2901–2919. [CrossRef]
45. Lian, Z.; Shi, P. Temporary privately owned public space in Taipei, a flexible space opens the social realm. *Sustain. Urban Regen.* **2013**, *25*, 66–69.
46. Cayli, E. Making Violence Public: Spatializing (Counter)publicness through the 1993 Sivas Arson Attack, Turkey. *Int. J. Urban Reg. Res.* **2019**, *43*, 1106–1122. [CrossRef]
47. Chitrakar, R.M.; Baker, D.C.; Guaralda, M. How accessible are neighbourhood open spaces? Control of public space and its management in contemporary cities. *Cities* **2022**, *131*, 103948. [CrossRef]
48. Das, A.; Sen, A.K.; Khan, N.M. Challenges of accessibility for marginal people in privately operated public space: Linear park, Khulna as a case. *Khulna Univ. Stud.* **2022**, *19*, 111–125. [CrossRef]
49. Zhu, J. Micro-regeneration in Shanghai and the public-isation of space. *Habitat Int.* **2023**, *132*, 102741. [CrossRef]
50. Carmona, M.; Hanssen, G.S.; Lamm, B.; Nylund, K.; Saglie, I.-L.; Tietjen, A. Public space in an age of austerity. *Urban Des. Int.* **2019**, *24*, 241–259. [CrossRef]
51. Carmona, M. The place-shaping continuum: A theory of urban design process. *J. Urban Des.* **2014**, *19*, 2–36. [CrossRef]
52. Montedoro, L. Milano, scali ferroviari e trasformazione della città. *Trasp. Cult.* **2018**, *52*, 34–43.
53. Avermaete, T.; Hooimeijer, F.; Schrijver, L. *Urban Formation and Collective Spaces*; NAI Uitgevers: Rotterdam, The Netherlands, 2006.
54. Elsheshtawy, Y. Real estate speculation and transnational development in Dubai. In *New Arab Urban: Gulf Cities Wealth Ambition Distress*; 2019; Volume 235. Available online: <https://academic.oup.com/nyu-press-scholarship-online/book/31461/chapter-abstract/264622692?redirectedFrom=fulltext&login=false> (accessed on 15 April 2023).
55. Németh, J. Defining a public: The management of privately owned public space. *Urban Stud.* **2009**, *46*, 2463–2490. [CrossRef]
56. Piyaputri, M.; Gamal, A. Private sector involvement in public space management and its varying degree of publicness. In *Proceedings of the IOP Conference Series: Earth and Environmental Science*, Surakarta, Indonesia, 24–25 August 2021; p. 012023.
57. Yaylali-Yildiz, B.; Spierings, B.; Çil, E. The spatial configuration and publicness of the university campus: Interaction, discovery, and display on De Uithof in Utrecht. *Urban Des. Int.* **2020**, *27*, 80–94. [CrossRef]
58. Benn, S.I.; Gaus, G.F. The public and the private: Concepts and action. *Public Priv. Soc. Life* **1983**, *3*, 297–325.
59. Kohn, M. *Brave New Neighborhoods: The Privatization of Public Space*; Psychology Press: London, UK, 2004.
60. Carmona, M. Contemporary public space, part two: Classification. *J. Urban Des.* **2010**, *15*, 157–173. [CrossRef]
61. Van Melik, R.; Van Aalst, I.; Van Weesep, J. Fear and fantasy in the public domain: The development of secured and themed urban space. *J. Urban Des.* **2007**, *12*, 25–42. [CrossRef]

62. Langstraat, F.; Van Melik, R. Challenging the ‘end of public space’: A comparative analysis of publicness in British and Dutch urban spaces. *J. Urban Des.* **2013**, *18*, 429–448. [CrossRef]
63. Kemmer, L.; Sgibnev, W.; Weicker, T.; Woods, M. Spaces of exposure: Re-thinking ‘publicness’ through public transport. *Cult. Geogr.* **2022**, *29*, 285–299. [CrossRef]
64. Zhu, J. Rethinking publicness: Making public space in an «excellent global city» and the rhetoric and reality of people-orientedness. *Arbor Cienc. Pensam. Cult.* **2022**, *198*, 647.
65. Wu, Y.; Wang, J.; Lau, S.S.-Y.; Lau, S.S.Y.; Miao, Y. An Improved Publicness Assessment Tool Based on a Combined Spatial Model: Case Study of Guangzhou, China. *Sustainability* **2022**, *14*, 14711. [CrossRef]
66. Getachew, A.; Asnake, K.; Desta, H. Increasing the publicness of riversides as public space development on Kebena River, Addis Ababa, Ethiopia. *Environ. Syst. Res.* **2022**, *11*, 12. [CrossRef]
67. Eissa, M. *The Quest of Publicness: How Public Are Public Spaces? The Particularity of Damascus’ Old City*; Universidade do Minho: Braga, Portugal, 2022.
68. Sultana, S.; Khan, A.M.; Rahman, A. Publicness of Newly Redeveloped Public Spaces of Dhaka South City Corporation Area. *J. Res. Infrastruct. Des.* **2022**, *5*.
69. Mehta, V. Evaluating public space. *J. Urban Des.* **2014**, *19*, 53–88. [CrossRef]
70. Németh, J.; Schmidt, S. Toward a methodology for measuring the security of publicly accessible spaces. *J. Am. Plan. Assoc.* **2007**, *73*, 283–297. [CrossRef]
71. Ma, C.-X.; Peng, F.-L.; Qiao, Y.-K.; Li, H. Evaluation of spatial performance of metro-led urban underground public space: A case study in Shanghai. *Tunn. Undergr. Space Technol.* **2022**, *124*, 104484. [CrossRef]
72. Ryu, C.; Kwon, Y. Elements that affect foreign tourists’ satisfaction: A case study in Seoul, Korea. *Urban Des. Int.* **2021**, *26*, 197–207. [CrossRef]
73. Rahm, J.; Sternudd, C.; Johansson, M. “In the evening, I don’t walk in the park”: The interplay between street lighting and greenery in perceived safety. *Urban Des. Int.* **2021**, *26*, 42–52. [CrossRef]
74. Mitrašinović, M.; Mehta, V. Experiential Dimensions and Evaluation of Public Space. In *Public Space Reader*; Routledge: Abingdon-Thames, UK, 2021; pp. 363–367.
75. Sträuli, L.; Kębłowski, W. ‘The gates of paradise are open’: Contesting and producing publicness in the Brussels metro through fare evasion. *Urban Stud.* **2022**, 00420980221125671. [CrossRef]
76. Landman, K. Inclusive public space: Rethinking practices of mitigation, adaptation and transformation. *Urban Des. Int.* **2020**, *25*, 211–214. [CrossRef]
77. Huang, T.-S.; Franck, K.A. Let’s meet at Citicorp: Can privately owned public spaces be inclusive? *J. Urban Des.* **2018**, *23*, 499–517. [CrossRef]
78. Lee, G.; Ha, M.; Byun, G. Environmental Planning for Publicness Improvement of Urban Public Space-Focusing on an Intergenerational Perceptions Survey. *J. Archit. Inst. Korea* **2022**, *38*, 61–72.
79. Klein, M.; Cox, B.; Tuck, K.; Baker, T.; Jones, R.; Schloffel-Armstrong, S. Pop-up publics: Temporary publicness at the Auckland Night Markets. *New Zealand Geogr.* **2021**, *77*, 114–122. [CrossRef]
80. Smith, A.; Vodicka, G.; Colombo, A.; Lindstrom, K.N.; McGillivray, D.; Quinn, B. Staging city events in public spaces: An urban design perspective. *Int. J. Event Festiv. Manag.* **2021**, *12*, 224–239. [CrossRef]
81. Saleh, M.; Roo, G.d.; Shim, D. The Fuzzy Side of Publicness: Visualizing Street Politics of Everyday life through the Lens of Distance. *Space Cult.* **2020**, 1206331220976725. [CrossRef]
82. Li, J.; Dang, A.; Song, Y. Defining the ideal public space: A perspective from the publicness. *J. Urban Manag.* **2022**, *11*, 479–487. [CrossRef]
83. Ali, Z. The world’s 100 largest banks, 2020. SP Glob. Mark. Intell. 2020, 7. Available online: <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/the-world-s-100-largest-banks-2020-57854079> (accessed on 15 April 2023).
84. Wang, G.-L.; Liu, C.-C.; Tseng, S.-R. An evaluation of Taiwanese B&B service quality using the IPA model. *İşletme Araştırmaları Derg.* **2012**, *4*, 20–27.
85. Bryman, A.E.; Bell, E. *Business Research Methods*, 6th ed.; Oxford University Press: Oxford, UK, 2004.
86. Leung, I.P. Artificial Landscape: In search of publicness through urban spectacle in Hong Kong. *Archit. MPS* **2021**. [CrossRef]
87. Kim, J. Eating outdoors: An inscription–prescription analysis of user behaviour in public spaces. *Urban Des. Int.* **2019**, *24*, 280–295. [CrossRef]
88. Patorniti, N.P.; Stevens, N.J.; Salmon, P.M. Decoding Cities to Model, Assess and Redesign them as Complex Urban Systems. In Proceedings of the 24th International Conference on Urban Planning and Regional Development in the Information Society, Karlsruhe, Germany, 2–4 April 2019; pp. 2–4.
89. Yeganeh, M.; Kamalizadeh, M. Territorial behaviors and integration between buildings and city in urban public spaces of Iran’s metropolises. *Front. Archit. Res.* **2018**, *7*, 588–599. [CrossRef]
90. Tani, S. Loosening/tightening spaces in the geographies of hanging out. *Soc. Cult. Geogr.* **2015**, *16*, 125–145. [CrossRef]
91. Gehl, J. Life between buildings. 2011. Available online: https://kupdf.net/download/jan-gehl-life-between-buildingspdf_59d293dd08bbc53f7868720b_pdf (accessed on 15 April 2023).

92. Ewing, R.; Handy, S. Measuring the unmeasurable: Urban design qualities related to walkability. *J. Urban Des.* **2009**, *14*, 65–84. [CrossRef]
93. Gehl, J.; Svarre, B. *How to study public life*, 2nd ed.; Island Press: Washington, DC, USA, 2013.
94. Gehl, J. *Cities for people*; Island Press: Washington, DC, USA, 2013.
95. Carmona, M. Re-theorising contemporary public space: A new narrative and a new normative. *J. Urban. Int. Res. Placemaking Urban Sustain.* **2015**, *8*, 373–405. [CrossRef]
96. Cai, G.; Hong, Y.; Xu, L.; Gao, W.; Wang, K.; Chi, X. An Evaluation of Green Ryokans through a Tourism Accommodation Survey and Customer-Satisfaction-Related CASBEE-IPA after COVID-19 Pandemic. *Sustainability* **2021**, *13*, 145. [CrossRef]
97. Hong, Y.; Cai, G.; Mo, Z.; Gao, W.; Xu, L.; Jiang, Y.; Jiang, J. The Impact of COVID-19 on Tourist Satisfaction with B&B in Zhejiang, China: An Importance-Performance Analysis. *Int. J. Environ. Res. Public Health* **2020**, *17*, 3747. [CrossRef] [PubMed]
98. Cai, G.; Xu, L.; Gao, W. The green B&B promotion strategies for tourist loyalty: Surveying the restart of Chinese national holiday travel after COVID-19. *Int. J. Hosp. Manag.* **2021**, *94*, 102704. [CrossRef]
99. Ponzini, D.; Nastasi, M. *Starchitecture: Scenes, Actors and Spectacles in Contemporary Cities*. 2016. Available online: <https://www.amazon.com/Starchitecture-Scenes-Actors-Spectacles-Contemporary/dp/1580934684> (accessed on 15 April 2023).

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Article

Hedonic Approach to Vertical Residential Rentals in the Brazilian Amazon: The Case of Belém, Pará

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Abstract: This study set out to identify and analyze the factors that influence the formation of rental prices for residential apartments in the city of Belém. The approach adopted was based on the hedonic price theory, which considers that the rental price of an apartment reflects the implicit prices of its attributes—structural, locational, and neighborhood quality. The sample used consisted of 259 observations, corresponding to the rental advertisements of the representative apartments in each building. The ordinary least squares (OLS), spatial lag model (SLM), and geographically weighted regression (GWR) techniques were used in the statistical analysis in this study. The results of the OLS model showed statistical significance between the attributes analyzed and the rental price of the apartments. In turn, the SLM indicated that the structural attributes have an impact on the rental prices of neighboring apartments, configuring a contagion effect in the real estate market. The GWR model showed that there was no spatial heterogeneity in the effects of the determinants on apartment rental prices throughout the sample.

Keywords: hedonic modeling; structural attributes; locational attributes; neighborhood qualities; OLS regression; spatial regression; real estate

1. Introduction

The residential rental market plays a key role in the real estate market, as it is responsible for offering properties available for rent and determining rental prices. With approximately 1.2 billion people living in rented accommodation worldwide [1], the rental market has become a very profitable industry in many countries, depending on the region and the type of property.

In the United States, the rental market represents about one third of all occupied housing units [2]. In Europe, the rental market varies greatly between different countries and cities, with some having a stronger culture of home ownership than others: in Germany 50.1% of properties are rented; in Switzerland the percentage is close to 58%. By contrast, in Croatia, Hungary, and Romania the percentage is less than 10% [3]. In Brazil, around 20% of the population live in rented accommodation [4].

The real estate market is distinct from ordinary consumer goods markets because properties have unique characteristics that set them apart, such as heterogeneity, durability, and spatial fixity [5]. These characteristics allow each property to meet multiple desires and needs, which makes the real estate market complex and unique. Therefore, understanding the dynamics of residential rental prices is important for the economy, since these studies allow us to estimate demand in the real estate market sector [6]. Thus, the use of the hedonic pricing model makes it possible to establish a relationship between the rent prices and their characteristics [7] and can be a tool for determining the dynamics of these prices [8].

The hedonic pricing model establishes a functional relationship where the property sale or rental price can be estimated through several potential determinants, which can be divided into three main categories: structural attributes, locational attributes, and neighborhood qualities [9–11]. Recent studies have pointed out, through the analysis of real estate market data, the determinants that influence the sale [12–14] and rental price of properties [15–17]. Moreover, the hedonic pricing model has been widely used in many cities around the world, including Bari [18], Krakow [8], Dimapur [5], Hangzhou [13], Hong Kong [19], Khulna [20], London [21], and San José [22], among others.

However, traditional hedonic modeling often imposes a consistent pricing structure on housing characteristics across an entire market area [23], treating metropolitan areas as a singular unified market. Although hedonic models consider structural, locational, and neighborhood quality features, the oversight of spatial characteristics can compromise the accurate assessment of housing submarkets and, by extension, the determination of house prices. Nevertheless, the traditional models are deemed restrictive, as the observations in this type of model may be spatially dependent, which, when corresponding to the dependent variable omitted in the hedonic function, will generate biased and inconsistent parameters [24].

Regarding the Brazilian context, the following researchers stand out: Paixão and Luporini [25], who applied hedonic price modeling based on tax data in Belo Horizonte; Campos [26], who contributed to the national literature by explaining the behavior of the real estate market for launches by pointing out the attributes with the greatest representativeness in the set of choices; Maciel and Biderman [27], who, by analyzing the implementation of the western stretch of the São Paulo Metropolitan Ring Road, estimated its effect on land prices; and Fávero [28], who contributed to the discussion on how prices in the São Paulo real estate market are formed and how they are influenced by the characteristics of the properties and the surrounding locality.

The concentration of Brazilian studies in the country's southeastern region is clear. In a vast territory characterized by different cultural and socioeconomic issues, the ways in which urban land is occupied can vary significantly between regions. As such, it is important to disseminate this approach to other parts of Brazil. Additionally, the neglect of spatial characteristics, such as spatial dependence or heterogeneity, in hedonic approaches underscores the need for a more nuanced and regionally inclusive perspective.

Therefore, the scarcity of similar studies in the Amazon region, particularly in Belém, aligned with the unique cultural and socioeconomic dynamics of the area, encourages the implementation of hedonic approaches—both traditional and spatial—in its real estate sector. According to data available from the National Continuous Annual Household Sample Survey (Pesquisa Nacional por Amostra de Domicílios Contínua Anual) [4], approximately 17% of the existing households in Belém are rented. Research in which the determinants of rental prices are identified in emerging markets is important for policymakers, as it provides information about the real estate market, which translates into better formulation of housing policies [8].

In light of this, the aim of this research is to identify and analyze the potential attributes, be they structural, locational, or neighborhood quality, which have an impact on the formation of rental prices in the city of Belém. To this end, aspects of the property's physical structure and its proximity to amenities were assessed using data obtained from the Viva Real and Google Maps websites. This research was based on the application of both traditional hedonic regression models—through the usage of OLS—and spatial approaches—SLM and GWR.

These methodologies were crucial in uncovering essential dynamics related to the operation of Belém's rental market, introducing a new dimension to our analyses. The inclusion of spatial approaches is particularly valuable as they offer a superior understanding of the spatial dependencies and heterogeneities inherent in the housing market compared with traditional analyses. The impact of the attributes on the rental price of the focal property was analyzed, as well as the influence of this property on neighboring prop-

erties. Finally, we analyzed the existence of geographical heterogeneity in the relationships between housing rental prices and their determinants.

In this way, it is expected that this study will make a theoretical contribution to hedonic theory, expanding its approach to less investigated Brazilian regions, as well as making an empirical contribution through the statistical methods and techniques applied here. Another type of contribution is aimed at the construction industry, with the incorporation of strategic information that identifies the factors that add highest value to properties, guiding investments towards projects with return potential. In addition, these findings are important for public authorities, who can incorporate this information into urban planning policies aligned with the demands of the local market. The effective integration of these results not only strengthens decision making in the private sector, but also plays a crucial role in sustainable urban development, promoting synergies between the public and private sectors for the harmonious advancement of communities.

The rest of this study unfolds in four key sections, beginning with “Theory and Hypotheses” in Section 2, where the hedonic theory is presented and testable hypotheses are formulated. Section 3 outlines the research methods in which the study area, database, and statistical models employed are presented, providing transparency in relation to the chosen methodology. In Section 4, “Results and Discussion”, the findings, supported by statistical evidence, are presented and discussed. The study culminates in Section 5, “Conclusions”, which summarizes the contributions, revisits the hypotheses, and outlines future research directions.

2. Theory and Hypotheses

The hedonic pricing model has been discussed in the literature to analyze aspects of the real estate market, with the aim of identifying the determinants that influence both sale and rental price of properties. This model assumes that hedonic prices are defined based on the implicit prices of attributes and are revealed to economic agents based on the observed prices of differentiated products and the specific quantities of characteristics associated with them [9].

These determinants can be classified according to their scale: macro or micro [7,11]. Macro determinants are those that affect the market in a general context, such as income [22], inflation [29], social and territorial vulnerability indicators [30], and immigration crises [31], among others. Micro determinants are those related to the specific characteristics of real estate. According to the literature, these determinants are classified into three categories, namely structural attributes, locational attributes, and neighborhood qualities [5,7,8,11,17,32,33].

The structural attributes correspond to the physical characteristics that compose the property: the area of the property [34], the number of bedrooms and bathrooms [35], the age of the property [12], the presence of a garage [20], and the state of repair of the property [34]. The locational attributes are made up of characteristics relating to the proximity of the property to amenities. Among the locational attributes most often studied in the literature are distance to public transport services [36], schools [11,13], hospitals [33], and green areas [22,37,38]. Finally, the qualities of the neighborhood refer to the characteristics of the neighborhood or surrounding area that can affect the price of the property. These include the quality of public transport facilities [19], the quality of schools [13,39], the presence of green amenities [22], the presence of landscape amenities [35,40], and the presence of sports facilities [41], among others.

Some authors, seeking to emphasize other analyzed characteristics, establish other categorizations: transport attributes [15,36], traffic conditions [17], landscape amenities [40], green areas [22], environmental characteristics [20], educational characteristics [13], and socioeconomic factors [42].

In order to objectively analyze the determining factors in the rental prices of vertical residences in Belém, this study chose to adopt a generalist categorizing approach, avoiding the creation of a new taxonomy of attributes. This choice is based on classifications

previously established by previous research [8,43,44], which subdivided the determinants into categories such as structural, locational, and related to neighborhood quality. These categories are detailed in the following subsections.

2.1. Structural Attributes

Structural attributes are important in modeling hedonic prices because they describe the physical characteristics of a property that are relevant to buyers and renters. In the literature, studies aimed at analyzing the impact of internal factors on real estate prices have found a significant effect on housing prices [12,45]. Among these factors, the area of the property, the number of bedrooms, the number of bathrooms, and the presence of a garage are used to compose the structural attributes of properties.

Studies such as those by Qiao et al. [16] and Efthymiou and Antoniou [36] show a positive association between area and house price. Leung and Yiu [19], when studying subdivided units in Hong Kong, noted a 0.2% increase in the rental price when adding one square foot to the area. When it comes to residential properties, Shen et al. [14] studied the area of the lot and the built-up area. They concluded that the customer's willingness to pay for a built square meter is greater than an extra square meter on the home's lot. In the approach presented by Li et al. [32], which used real estate sales and rental prices for both internal and external districts, the area of the property had a positive influence.

Another factor that contributes to hedonic modeling, when it comes to structural attributes, is the number of bedrooms and bathrooms in the home. Li et al. [32] and Qiao et al. [16] attest to the positive effect of the number of bedrooms on the sale and rental price of properties. Using a quantile analysis, Cui et al. [7] showed that consumers of properties with higher purchase and rental prices are more inclined to live in a home with more bedrooms.

Shen et al. [14] and Mathur [45] indicated a negative relationship between the number of bedrooms and the sale price of homes. They argue that the negative sign in the number of bedrooms indicator variable is due to the increase in the number of bedrooms, thus reducing their size. When it comes to the number of bathrooms, Liu et al. [15], Shen et al. [14], and Mathur [45] indicate that the number of bathrooms has a positive influence, which is the strongest among the internal amenities. For Kryvobokov et al. [46], the presence of two or more bathrooms contributes 22% to the increase in rental prices.

In addition, the presence of a garage is a factor that can significantly influence the price of a property. It is considered an important convenience for many consumers, especially in densely populated urban areas, as it can affect the perception of the property's safety and convenience. Kryvobokov et al. [46] and Trojanek [38] highlight the positive aspect of the presence of a garage in rental and sale properties, respectively. Islam et al. [20] found that, in general, the presence of a garage increases the rental price of a home by 15% and, analyzing by planned and unplanned areas, they found that the presence of garages in planned areas has a greater impact than in unplanned areas. The study conducted by Hill et al. [47], using hedonic modeling, found a positive impact of structural attributes, such as area and the presence of a garage, for both new and existing apartments in the cities of Warsaw and Poznań.

In this context, there is a strong influence of structural attributes on the formation of property prices, both for sale and for rent. Based on the considerations in the literature mentioned above, the first hypothesis of this study is presented:

Hypothesis 1. *The structural characteristics of the property (the area of the property, the number of suites, the number of bathrooms, and the number of parking spaces) have a positive influence on rental prices.*

2.2. Locational Attributes

Locational attributes are important since the location of a property is one of the main determinants of its market price. Williams [48] argues that the three most important aspects of a property are location, location, and location. The reason for this is that location directly influences the quality of life of residents, accessibility to services and facilities, and security, among other characteristics. In this way, the literature has analyzed locational attributes to assess the impact of location on the sale or rental price of properties, as well as identifying which characteristics most influence their valuation, such as proximity to hospitals, schools, green amenities, work, shopping centers, and highways.

Hospitals are important in hedonic modeling because their presence can increase the community's perception of quality of life. The availability of quality health services can be a deciding factor for many people when choosing a place to live. Liu et al. [15] and Cui et al. [7] indicated a negative relationship between the rental price of a property and the distance from the nearest hospital.

Islam et al. [20] pointed out that a 1 km increase in the distance from home to hospitals significantly reduces the rent by 17%. Tomal [8] adds that the shorter the distance to schools and universities, the higher the rental price in the analyzed market. Zhang et al. [33] indicate that the presence of hospital amenities close to the home has a positive impact on the purchase and rental price of the property. In contrast, Qiao et al. [16], when working with the number of hospitals within a radius of 1000 m and 1500 m, found a negative relationship, i.e., the more hospitals within this radius, the lower the rental price of the property. He argues that the presence of hospitals provides negative externalities, such as noise pollution, congestion during peak hours, unhealthy conditions, and health risks.

De and Vupru [5] and Tomal [8] analyzed the effect of the proximity of supermarkets to residences on sales prices and rents, respectively. De and Vupru [5] indicated a negative relationship, i.e., the shorter the distance to the supermarket, the higher the property price. On the other hand, Tomal [8] found a positive relationship, contrary to common sense that the relationship should be negative. He argues that supermarkets can generate negative externalities, such as noise pollution, which can negatively influence the price of rent.

Given this situation, Trojanek [38] points out that the presence of environmental noise pollution plays a significant role in the deterioration of quality of life in urban environments. In his research, in which he investigated the proximity effects of noise from various sources, it was observed that all noise-related variables had a negative impact on property prices in Poznań. However, the author points out that the magnitude of this impact varies according to the specific nature of each noise source. Thus, based on the literature, we expect the results to be in line with the second hypothesis of this study:

Hypothesis 2a. *Locational attributes, namely the number of hospitals and bus stops, positively influence rental prices.*

Hypothesis 2b. *Locational attributes, namely distance to supermarkets and shopping centers, have a negative influence on rental prices.*

2.3. Neighborhood Quality

In hedonic modeling, the quality of the neighborhood can be assessed through various approaches, such as urban infrastructure and socioeconomic aspects [49]. This is important because residents take into account not only the characteristics of the property, but also the environment in which it is located [50]. Thus, a neighborhood offering good quality attributes tends to increase the price of the property and therefore the demand for it, which in turn can increase its market price. In addition, the quality of the neighborhood can be a differentiating factor between similar properties, as two properties with similar characteristics but different neighborhoods tend to have different prices [51].

The impact of flooding on neighborhood quality can be significant since the presence of flooding can be perceived as a potential risk for consumers. Bin et al. [52], when analyzing

houses in coastal areas, indicated that the price of a property located in a flood area was significantly lower than that of a similar property in another region. They found a 7.3% reduction in the sales price of the home. During an investigation into passive flooding induced by sea level rise in coastal communities, Tarui et al. [53] discovered a 9–14% price discount associated with housing property transactions.

Daniel et al. [54] analyzed 19 studies available in the United States, using a multivariate meta-analysis, and showed that the marginal effect of an increase in the probability of flood risk of 0.01% in one year is equivalent to a reduction in the transaction price of a house of 0.6%. Beltran et al. [55] considered the effect of flooding on properties with a return time of 100 and 500 years. Houses located in flood areas with a return time of 100 years have a reduction in price of 2.9% and soon after the flooding occurs it increases to 6.9%. In regions where the return time is 500 years, home prices increase by 0.3%, but when flooding occurs this price tends to be reduced by 5.2%. The authors argue that recent floods cause homeowners to change their perceptions of flood risk.

Atreya and Ferreira [56] add that when the impacts of flooding are visualized, the subjective probabilities of risk are high, but as the effects of flooding disappear over time, the subjective probabilities decrease and eventually disappear. In line with these studies, Livy [57] points out that devaluation tends to dissipate over time. The author adds that this financial devaluation occurs soon after nondestructive flooding events, pointing out that residents do not take flood risks into account when river levels are within normal limits. In the study conducted by Häse and Hirte [58], it is highlighted that devaluation does not occur due to the prior disclosure of the risk, but rather immediately after the actual event occurs.

Zhang [59] used quantile regression to investigate how flood areas influence purchase price through the conditional distribution of house prices. The author found a negative impact on houses located in flooded areas and this impact is stronger in lower-priced houses. Based on the context discussed in this section, as well as the reality of the study area addressed in this research, the third hypothesis of this paper is presented:

Hypothesis 3. *The presence of a property in an area highly susceptible to flooding negatively influences the price of rent.*

3. Research Methods

3.1. Study Area

This study was conducted in the city of Belém, specifically within its expansive continental area, encompassing 35% of its total territory. As the capital of the state of Pará, Belém holds the distinction of being the most populous municipality in the state, the second most populous in the North region, and the eleventh most populous in Brazil. Within the Amazon region, its metropolitan area ranks as the second most populous.

Several factors have a significant impact on the dynamics of the real estate market in Belém, especially with regard to land use restrictions. The geographical, geotechnical, historical, and urban aspects of the city play distinct roles in shaping land use, often restricting its availability and resulting in substantial price increases.

The unique geographical configuration of Belém, resembling a peninsula, exacerbates the scarcity of land in the area. The local construction market is currently undergoing substantial growth, intensifying the demand for land. This scarcity, in turn, directly contributes to the appreciation of land prices.

The other relevant aspect to consider is the altitude of the continental portion of Belém, which is found in areas with elevations of less than or equal to 4 m, characterized as “baixadas” (lowlands). These areas, influenced by the watersheds present in the city, face the condition of occupying permanently flooded land or being subject to periodic flooding [60].

Another important characteristic of Belém is the presence of soils with a sedimentary lithological profile, where there is a dominance of clay and silty soils in the region [61].

These soil characteristics impose significant restrictions on construction activity, requiring the implementation of special stabilization measures or the use of more complex foundations. This scenario, in turn, leads to an increase in the costs of the construction process, making the affected areas less attractive for real estate development.

Belém also stands out for having a significant concentration of historical heritage buildings. These structures are generally the subject of various international and national documents, including heritage charters and urban planning legislation aimed at preserving architectural, artistic, and cultural heritage [62]. In this context, Belém is no exception, and has been the target of various interventions by the government. However, it is worth mentioning that the policies implemented do not prioritize the housing use of these areas [63], but rather the requalification of the historic center for cultural entertainment and leisure in general [64]. This approach has a certain impact on limiting the availability of land and real estate for the residential rental market, resulting in shortages and, consequently, higher prices [65].

Finally, the specific designation of Belém's coastal areas for harbor activities intensifies the restrictions on the availability of land for the construction of residential buildings. Over the centuries, the city's growth has been directed along the banks of the Guamá River and Guajará Bay. This development favored the intense occupation of the riverfront, predominantly for harbor activities, in order to facilitate the efficient flow of goods and people [66]. This destination not only limits the territorial extension available, but also generates direct competition for space, resulting in a restricted supply for residential development.

In addition to the points mentioned earlier, the rationale for examining the city of Belém is further underscored by its future prospects in the rental market. Despite the current rental property rate standing at only 17%, as highlighted in this article's introduction, the city holds potential for growth. This potential is closely tied to the increasing environmental and political importance of the Amazon region on a global scale. The city is set to host the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 30) in 2025, an event that expects to attract approximately 50 thousand attendees [67]. Given the growing environmental concern and, consequently, the region's rising political importance, it is anticipated that such environmental events will become more recurrent in the future.

Thus, considering the insufficient hotel infrastructure to accommodate this demand, it becomes pertinent for scientific studies to explore the potential of available rental properties, considering both their structural and locational attributes, even for short-term stays. These characteristics exert a notable influence on the land dynamics in Belém, leading to increased construction costs. In response to this scenario, the real estate sector is driven to devise projects that align with the intricacies of the local market, aiming to optimize potential returns. Within this framework, the application of the hedonic pricing model in the city of Belém emerges as a valuable tool for accurately identifying additional determinants that impact real estate rental prices.

3.2. Database

The present study analyzed the rental prices of apartments in residential buildings in the continental region of Belém, based on structural, locational, and neighborhood quality variables. The initial database was assembled using data collected from the Viva Real website (<https://www.vivareal.com.br>) accessed on 17 February 2023, using the web scraping technique. As a result, the initial database had 1043 observations, corresponding to rental ads, consisting of the variables "rent" (rent in BRL), "area" (total area in square meters), "suite" (number of suites), "bathroom" (number of bathrooms), "parking" (number of parking spaces), and "address" (full location information).

In order to adjust the database to the scope of the research, observations with missing data or discrepant records, as well as those referring to ads located outside the mainland region of the municipality, were excluded. The application of both of these filters resulted in a database with 424 rental ads. In addition, using the address variable, a georeferencing ser-

vice was used to compute the geographical coordinates of each apartment and incorporate the “latitude” and “longitude” variables into the database.

To avoid specification problems in the spatial modeling, apartments with the same geographical coordinates—i.e., located in the same building—were identified. For these apartments, the median of the variables related to their structural characteristics, as well as the rental price, was taken as the representative value. This process resulted in the final database for this study, made up of 259 observations corresponding to the rental advertisements for the representative apartments in each building.

Furthermore, some variables related to the location of the apartments were incorporated into the database, with the aim of analyzing the influence of locational characteristics on the variation in rental prices. To carry out this analysis, service and recreational amenities in the mainland region of Belém were mapped using the Google Maps website. The geographical coordinates of 1625 bus stops, 160 hospitals, 79 supermarkets, and 5 shopping centers were obtained.

Using the Haversine formula, which measures the angular distance between two points on Earth (i.e., along a great circle), the distances between the apartments and these amenities were calculated. For bus stops and hospitals, the “bus_500” and “hospital_500” variables were computed, which represent the quantities of each of these elements within a 500 m radius of the apartments (equivalent to a 20 min walk). For supermarkets and shopping malls, the distances to the nearest facility for each apartment were recorded: “closest_supermarket” and “closest_shopping”.

Each apartment was also associated with its own human development unit (HDU) in order to compute the variables related to the quality of the neighborhood in which they live. The HDUs, according to the United Nations Development Program, are divisions of the municipality’s urban fabric that have similar socioeconomic and infrastructure conditions [68]. Therefore, the boundaries of the HDUs do not necessarily coincide with the divisions of the neighborhoods, and may cover multiple neighborhoods, or a single neighborhood may contain more than one HDU.

Thus, the socioeconomic influence was incorporated by including the variables “pci” (per capita income in BRL/inhabitant) and “activ_pop” (number of people in formal employment). In addition, the influence of infrastructure was quantified by the “infra” variable, which is defined as the arithmetic mean of four indicators: (1) the percentage of households served by a public water supply; (2) the percentage of households served by an electricity supply; (3) the percentage of households served by an adequate sewage distribution system; and (4) the percentage of households served by waste collection and disposal services.

Finally, using data provided by the Geological Survey of Brazil (Serviço Geológico do Brasil), the susceptibility to flooding of the location of each apartment was considered. These data were computed using the categorical variable “flood”, which has four classes: (0) no susceptibility; (1) low susceptibility; (2) medium susceptibility; and (3) high susceptibility. Table 1 shows all the variables used in this study.

Table 1. Definition of variables.

Variable	Description	Category
rent	Rent price, in BRL	---
area	Area of the apartment unit, in square meters	Structural
suite	Number of suites in the apartment unit	Structural
bathroom	Number of bathrooms in the apartment unit	Structural
parking	Number of parking spots	Structural
bus_500	Number of bus stops within a 500 m radius from the apartment	Locational
hospital_500	Number of hospitals within a 500 m radius from the apartment	Locational
closest_supermarket	Distance to the nearest supermarket, in meters	Locational

Table 1. Cont.

Variable	Description	Category
closest_shopping	Distance to the nearest shopping mall, in meters	Locational
ipc	Income per capita in the HDU where the apartment is situated	Neighborhood quality
activ_pop	Number of people with formal employment in the HDU where the apartment is situated	Neighborhood quality
infra	Infrastructure coverage in the HDU where the apartment is situated	Neighborhood quality
flood	Flooding susceptibility in the area where the apartment is situated (levels: 0, 1, 2, and 3)	Neighborhood quality

3.3. Statistical Models

Most of the studies related to evaluating the characteristics responsible for variations in housing prices are based on hedonic regression [69]. This method is defined using one of the most fundamental approaches in statistics, the OLS linear regression model [70], shown in the following equation:

$$y = X\beta + \varepsilon, \quad (1)$$

where y represents the vector of the dependent variable, X represents the matrix of independent variables, β is the vector containing the regression coefficients belonging to each independent variable, and ε is the vector of error terms.

Using this technique, this study was able to assess the influence of various characteristics—structural, locational, and neighborhood quality—on the variation in rental prices of residential apartments in Belém do Pará. To this end, the natural logarithmic specification of these prices (LN_RENT) was used as the dependent variable in this study. As for the independent variables, natural logarithmic transformations were carried out for the continuous variables—apartment area and distances to urban amenities—in order to improve the distribution of the data [71].

It should be noted that this procedure resulted in more significant associations between the dependent variable and the transformed independent variables when compared with the original relationship presented by Pearson’s correlation. In addition, in order to address the heteroscedasticity present in the OLS model, the robust standard errors technique was applied [72].

To evaluate the presence of spatial autocorrelation in the data, Moran’s index was used [73]. The value of Moran’s index ranges from -1 to 1 , where a positive/negative value suggests positive/negative spatial autocorrelation or the presence of clusters in an observed area. Thus, analysis of the Moran index determines whether the rental price of an apartment in the sample is influenced by the proximity of neighboring apartments, with this having a positive or negative impact on its variation. The neighborhood matrix associated with the Moran index was computed using the k -nearest-neighbors approach [74].

The optimum value of k was determined using the Lagrange multipliers (LM) test applied to the dependent variable LN_RENT, as well as to the residuals of the OLS model. In both cases the initial value of k was set to 2 and increased by 1 during each subsequent step. The selection process ended when the value of the LM test became insignificant, with $k = 4$ being the optimal number of neighbors—i.e., the maximum point of the Moran’s index for the model’s dependent variable after its stabilization ($\ln_rent$ Moran’s $I = 0.379$; p -value < 0.001 | OLS residual Moran’s $I = 0.0937$; p -value < 0.001). Thus, the presence of spatial autocorrelation was investigated by determining four neighbors for each focal apartment, as shown in Figure 1a,b.

In the context of the real estate market, spatial autocorrelation can occur due to various factors: diffusion effects of market prices for apartments in nearby areas (spatial dependence), the omission in the hedonic function of relevant variables with a spatial character, or the existence of distinct real estate markets (spatial heterogeneity). In order to take these effects into account, it is necessary to use spatial econometric models [75].

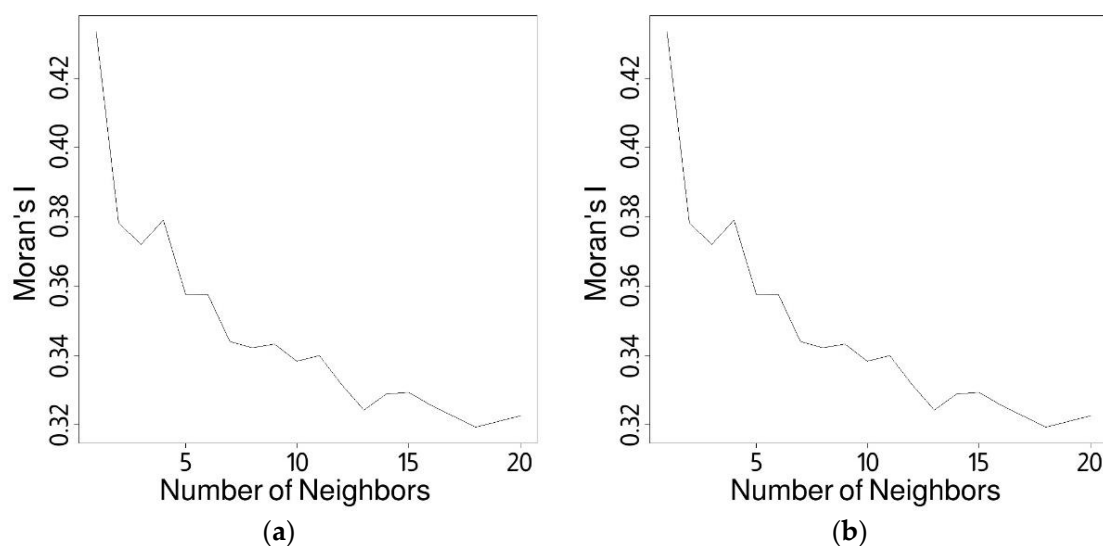


Figure 1. (a) LM test for dependent variable (ln_rent); (b) LM test for OLS residuals.

Among the spatial models used in this study are the classic spatial autoregression (SAR) model and the GWR model. The SAR model takes two general forms: the SLM and the spatial error model (SEM) [76]. The SLM assumes that the dependent variable is affected not only by the independent variables, but also by the values of the dependent variable in nearby observations.

Therefore, this approach recognizes that the context of the real estate environment plays a significant role in determining the rental price of a specific property. To this end, in SLM a spatially lagged component—representing the spatial weighted average around the dependent variable—is added to the regression [77]. The specification of the SLM is given by the following equation:

$$y = \rho W y + X\beta + \varepsilon, \quad (2)$$

where ρ is the spatial lag parameter and W is the spatial weight matrix that defines the neighborhood of each observation.

In contrast, SEM assumes that spatial autocorrelation is due to unmodeled effects, unmeasured factors, or other specification errors. Thus, spatial dependence, as well as its interaction, is treated as disturbances in the error term, rather than being incorporated as a spatially lagged component in the equation [77]. Equation (3) demonstrates the specification of the SEM:

$$y = X\beta + \mu, \quad (3)$$

where $\mu = \lambda W\mu + \varepsilon$ is the vector of spatially correlated error terms, λ is the spatial error parameter, and ε is the vector of independent error terms.

Determining the most suitable specification for spatial modeling was also guided by the LM test, as well as reinforced by the robust Lagrange multipliers (RLM) method. The choice of the best specification was based on the strength of the rejection of the null hypothesis of the test, which postulates that the regression coefficient of the specified model is statistically equal to zero [78]. Thus, the spatial model chosen for use in this study was the SLM (p -value < 0.05), as it was the only one to reject the null hypothesis of the LM test.

It is worth noting that the estimators of the SLM, unlike those found in the OLS, are not directly interpretable. The presence of feedback effects from lags in the dependent variable, present in the SLM, causes changes in neighboring observations. Therefore, the parameters estimated by the SLM should be seen as representations of an equilibrium state in the modeling process, incorporating the effects of spatial diffusion [79].

In this scenario, the effects of each variable take the form of a matrix. This means that in order to fully understand the impact of each variable, we need to consider not only its direct effects, but also how these effects spread and interact in surrounding areas [80]. To

this end, LeSage and Pace [81] recommend using scaling indicators to interpret the SLM's estimators. These indicators include the following:

- Average direct effect, representing the effects caused by observations of an independent variable;
- Average indirect effect, which quantifies the diffusion effect between observations due to changes in an independent variable;
- Average total effect, which includes the total direct and indirect effect received by the dependent variable.

Lastly, GWR was used to deal with the spatial heterogeneity present in the data. Equation (4) shows the general specification of this model:

$$y_i = \beta_0(u_i, v_i) + \sum_j \beta_j(u_i, v_i)x_{ij} + \varepsilon_i, \quad (4)$$

where (u_i, v_i) indicates that the regression parameters belong to a specific spatial location. This type of model is estimated in a similar way to linear regression, using weighted least squares, with the peculiarity that the weights are established as a function of the distance between the local regression point and the neighboring data points [69].

The weights assigned in the GWR analysis were established using the Gaussian model with an adaptive kernel (tri-cube), and the bandwidth of the kernel was determined by minimizing the AIC [82]. The adaptive kernel is used to ensure that each observation contains an equal number of data points.

4. Results and Discussion

4.1. Sample Characterization

Table 2 shows the description of the data relating to the variables present in the statistical model (OLS) proposed in this article. In the following paragraphs, some variables have been chosen as highlights among our results.

Table 2. Descriptive analysis of the model's variables.

Variable	Mean	SD	Min	Max
rent	3990.467	2386.135	1000	16,500
area	118.602	83.301	38.0	810.0
suite	1.606	1.201	0	7
bathroom	1.224	0.453	1	3
parking	1.440	0.736	0	4
closest_supermarket	489.503	522.086	30.5	3997.6
closest_shopping	1667.522	1224.655	57.0	9382.6
hospital_500	5.355	5.031	0	20
bus_500	15.741	4.844	1	28
active_pop	7824.645	5971.802	300	25,572
infra	98.128	1.912	86.2	99.6
ipc	2582.248	1241.543	370.6	4342.0
flood	0.749	1.061	0	3

In Belém, the rents for the apartments on offer range from BRL 1000 (USD 205) to BRL 16,500 (USD 3360), with an estimated average of BRL 3990 (USD 812.28). In addition, the average total area of the apartments is 119 m², with units ranging from 38 m² to spacious apartments measuring up to 810 m². Figure 2 provides a visual representation of the geographical distribution of the sampled apartments in relation to rental costs and their corresponding areas. Predominantly situated in the south/southwest region of Belém, 62% of these properties are concentrated in the neighborhoods of Umarizal, Marco, Batista Campos, and Nazaré. Notably, the key characteristic of this variable lies in its inherent heterogeneity, with a diverse array of rental prices and varying total areas among the available apartments.

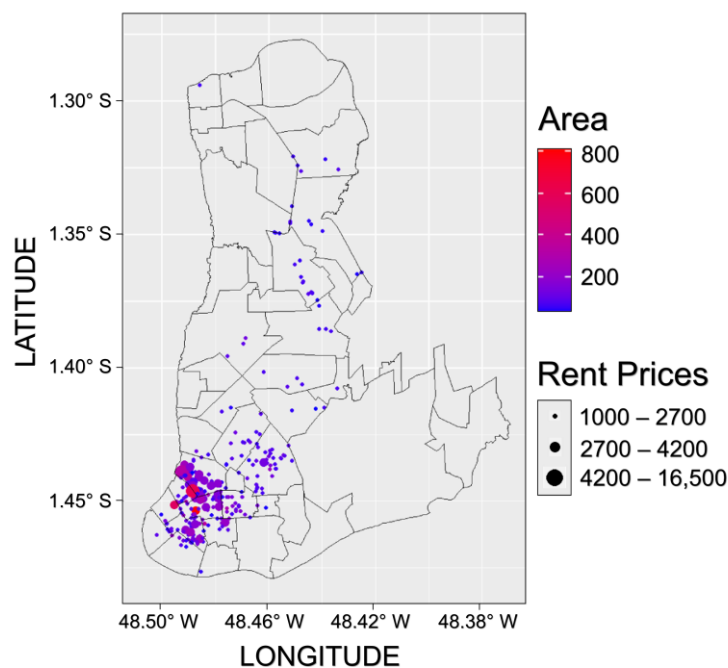


Figure 2. Distribution of apartments on offer according to area (AREA) and rent (RENT).

In terms of parking spaces, there is a tendency towards uniformity. Approximately 62.5% of the apartments have at least one parking space, while around 91.9% of the sample tends to have either one or two parking spaces (Table 3). This condition determined the average of our sample at 1.4 parking spaces.

Table 3. Parking availability: partial and accumulated frequency.

Parking	Frequency	% of Total	% Accumulated
0	5	1.9%	1.9%
1	162	62.5%	64.5%
2	71	27.4%	91.9%
3	15	5.8%	97.7%
4	6	2.3%	100.0%

Regarding the mobility aspect, each apartment has an average of just over 15 bus stops within a radius of 500 m. Figure 3 shows the robust urban mobility infrastructure in the south/southwest region of Belém. Most apartments in this area exceed the average number of bus stops. As the apartments move away from this region, towards the more peripheral areas of the city, the number of bus stops tends to decrease.

Figure 4a–c illustrate the distribution of apartments, in which each housing unit received specific assignments for the infrastructure coverage index, per capita income, and economically active population, respectively, based on its HDU. The apartments are located in areas with infrastructure coverage indices between 86.2% and 99.6%, as highlighted in Figure 4a, predominantly in regions with significant percentage coverage.

The population's per capita income per HDU ranges from 370.20 BRL/inhabitant to 4342.00 BRL/inhabitant. This wide variation is a reflection of the substantial economic disparities present in the city of Belém. Figure 4b shows that the apartments available in the south/southwest region have the highest per capita income, without showing significant variations, while as we move away from this region, income tends to decrease.

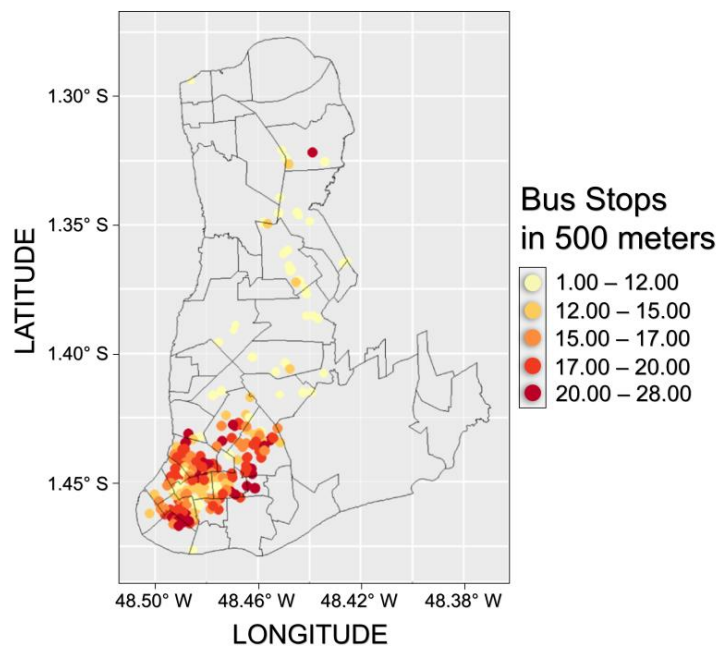


Figure 3. Distribution of the apartments on offer, according to the number of bus stops within a 500 m radius.

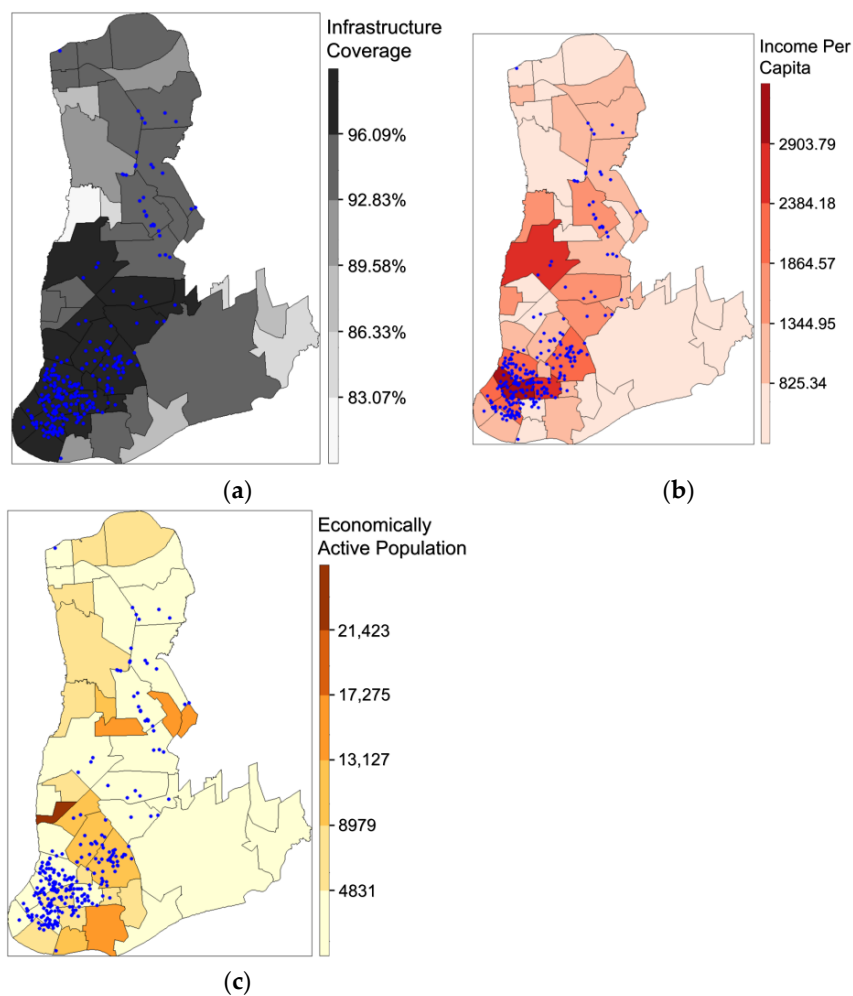


Figure 4. Distribution of apartments offered, according to the (a) infrastructure coverage index, (b) per capita income, and (c) economically active population.

In terms of the economically active population, the apartments on offer are located in HDUs that house between 300 and 25,572 formally working inhabitants. Figure 4c shows that a significant proportion of the apartments are concentrated in areas with a high concentration of economically active people.

With regard to flooded areas, Figure 5 illustrates the geographical distribution of the apartments available in this sample in relation to the cost of rent and the category of flooding. It can be seen that there are apartments available with high rents in areas susceptible to flooding and that a significant portion of the sample, made up of 158 units, is in areas not prone to flooding. Conversely, apartments offered in areas susceptible to flooding have the highest average rents, reaching close to BRL 5000 and up to BRL 16,500, as detailed in Table 4.

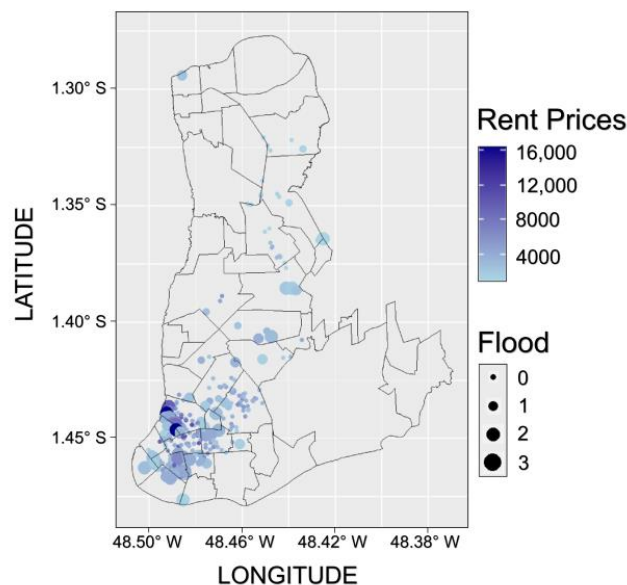


Figure 5. Distribution of apartments on offer, according to flood susceptibility index (FLOOD) and rental price (RENT).

Table 4. Descriptive analysis of the RENT variable as a function of the FLOOD variable.

	Flood	N	Mean	SD	Min	Max
Rent	0	158	4118	2355	1000	12,000
	1	36	3362	1301	1300	6500
	2	37	3341	1509	1100	8500
	3	28	4937	3848	1300	16,500

It is worth noting that in Belém there is a tendency for high-end buildings to be located in areas prone to flooding, a characteristic captured by this sample. This trend highlights the complexity of the local real estate market, where the appreciation of certain properties seems to transcend conventional risk considerations, suggesting that exclusivity and prestige often outweigh geographical limitations.

When analyzing the correlation matrix, the results highlight different correlation patterns between the structural, locational, and neighborhood quality attributes and the logarithm of the rental price ($\ln_rent$) (see Figure 6). On the other hand, the correlations between the independent variables mostly indicate weak associative patterns, suggesting that multicollinearity is not a problem in the statistical models in this article.

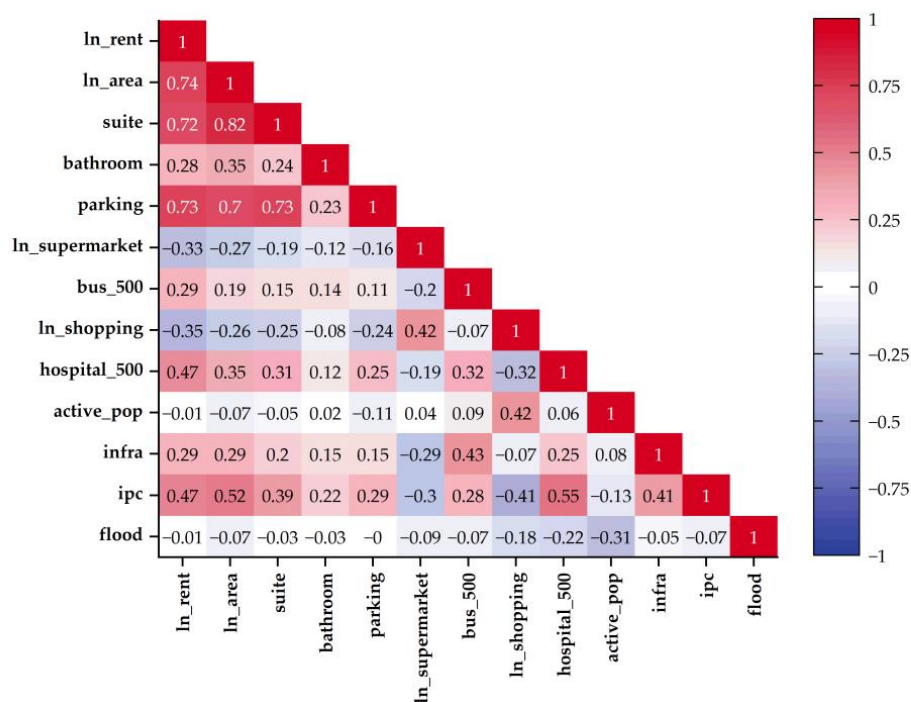


Figure 6. Results of Spearman correlation analysis.

4.2. OLS

Table 5 shows the results of the OLS regression, which are interpreted and discussed in subsequent subsections. The results of the analysis of the hedonic regression coefficients indicate that most of the variables are statistically significant, showing important relationships between the structural, locational, and neighborhood quality attributes of the apartments and the rent price. The number of bathrooms, infrastructure, per capita income, and two of the three levels of the flooding variable were not statistically significant.

Table 5. OLS regression model—ln_rent (dependent).

Variable	Coefficient	Standard Error
(Intercept)	6.30951 ***	1.12594
ln_area	0.20255 **	0.07127
suite	0.07990 **	0.02874
bathroom	0.03343	0.04244
parking	0.26220 ***	0.03752
ln_supermarket	−0.04732 #	0.02678
ln_shopping	−0.06663 *	0.03035
hospital_500	0.01683 ***	0.00472
bus_500	0.01050 *	0.00426
active_pop	8.01×10^{-6} *	3.58×10^{-6}
infra	0.00765	0.01145
ipc	9.31×10^{-6}	2.09×10^{-5}
flood:		
1–0	−0.02143	0.05705
2–0	0.00404	0.05619
3–0	0.14517 *	0.06248

Adjusted R-squared: 0.7124; Max. VIF: 4.2184; AIC: 105.2613 Breusch–Pagan test: 25.583 *; White test: 8.02 *

p-value < 0.10; ** p-value < 0.05; *** p-value < 0.01; **** p-value < 0.001.

The adjusted determination coefficient (adjusted R^2) shows a value of 71.2%, indicating that approximately 71.2% of the variability in rent is explained by the variables

included in the model. The signs of the observed coefficients are consistent with theoretical expectations, except for the flooding variable, pointing to a general coherence in the estimated relationships.

4.2.1. Structural Attributes

By analyzing the structural attributes, the significant influence of the area of the property on the rental price stands out. According to the study by De and Vupru [5], residences with larger areas generally have higher rental prices, corroborating the findings of this study. This specific model supports the authors' observation, showing that a 1% increase in the area of the property results in a 0.20% increase in the rental price. Other scholars, such as Shen et al. [14], Leung and Yiu [19], and AbdelHalim et al. [83], have also obtained similar results, highlighting the positive effect of area in determining rental prices.

The regression analysis revealed that the presence of suites, comprising bedrooms combined with bathrooms, was statistically significant in the context analyzed, as opposed to the bathroom alone. This finding is in line with previous research, notably the study conducted by Sirmans et al. [84]. In this comprehensive analysis of 37 studies, in which the researchers examined the twenty characteristics most frequently used in studies of hedonic pricing models, they found that the "bathroom" variable had a negative coefficient in only one study. In contrast, 31 of these studies showed positive coefficients for this variable. Statistical significance was not reached in only five cases.

Sirmans et al. [84] found that internal features, such as bathrooms, often show positive coefficients, even if they occasionally fail to reach statistical significance. Thus, the presence of suites in apartments in Belém emerges as a relevant convenience in contrast to the isolated presence of bathrooms, showing its statistically significant influence on the appreciation of rental prices.

Among the structural variables examined, the presence of a parking space emerged as the factor with the greatest impact on the pricing model. The addition of parking space has a positive influence, resulting in a significant 26.2% increase in rental prices. This result contrasts with the trend observed in the literature. Although it is common to find positive and significant coefficients for this variable, as highlighted by Sohn et al. [35], the magnitude of the impact identified in this study is a particular aspect of Belém.

In Belém, the valorization of parking spaces is apparently the result of a complex interaction between urban and climatic factors. The high rainfall in the region, combined with the scarcity of public parking lots, creates a challenging scenario for parking on public roads. The long blocks, punctuated by several houses with garages, make on-street parking impossible, intensifying the demand for private parking spaces. As a result, parking spaces have emerged as an essential attribute in the valuation of real estate. Its scarcity, coupled with adverse weather conditions and the limited supply of public parking, contributes to an increase in rental prices.

Thus, with regard to structural attributes, Hypothesis 1 presented in this research, which postulates a positive influence of structural attributes on rental prices, was partially confirmed. The results indicate that "ln_area" ($t = 2.8421$; $p < 0.01$), "suite" ($t = 2.7798$; $p < 0.01$), and "parking" ($t = 6.9887$; $p < 0.001$) exert a positive and significant influence on rental prices. On the other hand, "bathroom" ($t = 0.7878$; $p = 0.432$) was not significant in the model.

4.2.2. Locational Attributes

While analyzing the locational attributes, it becomes evident that the distance from amenities, such as supermarkets and shopping centers, plays a role in influencing the appreciation of rental prices. The proximity to these amenities is directly linked to an upsurge in rental prices, underscoring the value placed on convenience due to their close proximity.

In the case of supermarkets, a 1% increase in distance is associated with a 0.04% reduction in the rental price, while for shopping malls the decrease is 0.06%. Previous studies, such as that of De and Vupru [5], have observed the negative impact of increasing the

distance between the supermarket and the focal apartment. In relation to shopping centers, the results of this research corroborate the findings of Kam et al. [12], who indicate that properties in close proximity to shopping centers tend to have higher prices, demonstrating that convenience leads to the appreciation of surrounding properties.

The model analyzed also takes health services into consideration. In hedonic regression, the inclusion of a hospital within 500 m of the apartment shows a positive impact, albeit moderate, reflecting an increase of 1.6% in the rental price. Cui et al. [7] and Zhang et al. [33] showed the positive impact of hospitals on rental prices, in line with the results found in this research.

Another relevant factor that affects rent and is incorporated into the model is the number of bus stops within a 500 m radius. The addition of a bus stop, according to the regression results, is associated with a 1% increase in the rental price. This finding is in line with the studies by Shen et al. [14] and Liu et al. [15]. When investigating the density of bus stops within a 900 m radius, Liu et al. [15] also found an increase in rental prices as the number of bus stops increased. In addition, the conclusions of Tomal [8] point out that tenants are willing to pay higher rents in exchange for the convenience of being close to public transport.

This study considers two aspects that are prevalent in Brazilian capitals, especially those located in the North, such as Belém do Pará. In this context, it is necessary to consider some reflections when analyzing the variable that encompasses bus stops. Firstly, there is the low quality of public transport, historically used by those with lower purchasing power. Secondly, it is important to note the profile of the sample in this article, which includes high-end properties. It therefore seems unlikely that the residents of the apartments included in this sample are users of this mode of urban transportation.

However, when examining Figure 2, which shows the rents, and Figure 3, which shows the concentration of bus stops, it becomes clear that the locations of the properties with the highest rents coincide with a high concentration of bus stops. Thus, given the premise that the residents of these apartments are not the main users of urban buses, the question arises as to why our result identified this variable with statistical significance and a positive sign. Some plausible explanations can be considered.

The first concerns the presence of low and medium-low standard properties in the sample, which may have influenced the model's algorithm when determining the correlation between these variables. Other more tangible explanations include (a) the geographical configuration of the city, which resembles a peninsula and is surrounded by bodies of water, imposing significant restrictions on urban public transport corridors and resulting in a considerable concentration of these corridors in specific areas of the city, including those housing high-end properties; (b) the concentration of urban corridors due to the unfeasibility of bus traffic in much of the peripheral regions, especially those prone to flooding; and (c) the concentration of urban corridors due to the presence of environmental preservation areas.

Thus, in relation to locational attributes, two hypotheses were formulated: Hypothesis 2a, which proposes a positive influence of the number of hospitals and banks on rental prices, and Hypothesis 2b, which suggests a negative influence of distance to supermarkets and shopping centers on rental prices. Both hypotheses were confirmed by the results obtained. The data show that "ln_supermarket" ($t = -1.7667$; $p < 0.10$) and "ln_shopping" ($t = -2.1955$; $p < 0.05$) have a positive and significant influence on rental prices. On the other hand, "hospital_500" ($t = 3.5703$; $p < 0.001$) and "bus_500" ($t = 2.4666$; $p < 0.05$) have a negative and significant influence on rental prices.

4.2.3. Neighborhood Quality

In examining attributes linked to neighborhood quality, a positive correlation emerges between the number of formally employed individuals in the HDU where the apartment is situated and rental prices. In simpler terms, an increase in the number of residents in formal employment is directly associated with a corresponding upswing in rental prices.

This phenomenon may be related to the demand generated in nearby regions with high employment. Therefore, proximity to the workplace emerges as an influential need in pricing patterns in the rental market. This behavioral pattern is in line with the findings of authors such as Shen et al. [14], Zhang et al. [33], and Qiao et al. [16], who highlighted people's willingness to pay more to live near their workplace.

The variables related to infrastructure and per capita income were not statistically significant. In the case of infrastructure, this lack of significance can be attributed to the homogeneity of the availability of infrastructure in the HDUs in which the apartments are located, as shown in Figure 4a. This finding is in line with previous findings, such as those elucidated by Lima et al. [85].

In terms of the per capita income variable, the lack of significance may be associated with a trend in the city, where medium and high-end developments are not launched in HDUs with low per capita income. This phenomenon, already identified by Mendes [86], reflects a dynamic of gradual transformation in previously peripheral neighborhoods, previously dominated by stilts and wetlands. The author argues that these areas have been the target of intense action by real estate capital, which uses marketing strategies to reconfigure the image of these locations, removing the stigma of poor areas marked by spontaneous occupation and violence.

This peculiar dynamic is also reflected in the flooding variable. Contrary to the expectations of conventional hedonic literature, it can be seen that when moving from an area with no susceptibility (0) to an area with high susceptibility (3), the price of rent increases considerably, reaching around 14.5%. This may be a reflection of the fact that high-end homes are located close to the city's characteristic "canals", which are areas that flood frequently. This singularity reveals that even in areas with a high susceptibility to flooding, as exemplified by Avenida Visconde de Sousa Franco, the locality is considered noble. This situation highlights the complexity of real estate dynamics in Belém, where factors such as infrastructure, income, and geographical peculiarities intertwine, challenging the traditional conventions of real estate valuation.

Thus, with regard to neighborhood quality attributes, Hypothesis 3 was formulated, proposing a negative influence of the location of the property in an area susceptible to flooding on the price of rents. However, the results obtained did not confirm this hypothesis. The data indicate that "flood 1–0" ($t = -0.3756$; $p = 0.708$) and "flood 2–0" ($t = 0.0720$; $p = 0.943$) were not statistically significant. On the other hand, "flood 3–0" ($t = 2.3233$; $p < 0.05$) has a positive and significant influence on rental prices.

4.3. SLM

Table 6 shows the estimation of the average direct, indirect, and total effects of the explanatory variables on apartment rents in Belém. It should be noted that the direct impacts quantify the relationship between the rental price of apartment i and variations in its own attributes (structural, locational, and neighborhood). This is equivalent to interpreting the coefficients estimated by the OLS. The indirect impacts, in turn, measure the effect on the rental price of the same apartment i resulting from the variation in the attributes of apartment j .

In the analysis of the direct effects, there is a similarity in the results of the coefficients in relation to the OLS regression, with the exception of the distance to the supermarket, which did not show statistical significance. In the indirect effects, only five attributes show statistical significance, three of which are related to structural attributes, one to the locational attribute, and one to the quality of the neighborhood.

The coefficients of the structural variables have a positive and significant impact on determining rental prices, both in the hedonic regression and in the direct effects presented in this study. In the analysis of the indirect effects of the structural attributes, it is noteworthy that the area, number of suites, and number of parking slots have significant and positive coefficients. This suggests that an increase in these variables in an apartment available for rent will result in an increase in the rental prices of neighboring apartments.

Table 6. SLM—ln_rent (dependent).

Category	Variables	Direct Effects	Indirect Effects	Total Effects
Structural	ln_area	0.21527 **	0.04512 #	0.26038 **
Structural	Suite	0.07833 **	0.01642 #	0.09475 **
Structural	Bathroom	0.03888	0.00815	0.04703
Structural	Parking	0.25564 ***	0.05358 *	0.30922
Locational	ln_supermarket	−0.03806	−0.00798	−0.04603
Locational	ln_shopping	−0.04808 #	−0.01008	−0.05816
Locational	hospital_500	0.01202 *	0.00252 *	0.01454 #
Locational	bus_500	0.00936 *	0.00196	0.01133
Neighborhood quality	active_pop	5.976×10^{-6} #	1.252×10^{-6}	7.228×10^{-6}
Neighborhood quality	infra	−0.00061	−0.00013	−0.00074
Neighborhood quality	ipc	6.243×10^{-8}	1.308×10^{-8}	7.552×10^{-8}
Neighborhood quality	flood:			
	1–0	−0.03297	−0.00691	−0.03988
	2–0	−0.00898	−0.00188	−0.01087
	3–0	0.12802 *	0.02683 *	0.15486 *

#” p -value < 0.10; “*” p -value < 0.05; “***” p -value < 0.01; “****” p -value < 0.001.

This trend can be attributed to the effects of real estate appreciation on the part of owners who put their apartments up for rent in Belém. There is a tendency for properties to rise in price, which suggests that, as the supply of more expensive properties for rent increases, there is a tendency for the prices of other properties in the region to rise as well, characterizing a contagion effect in the real estate market.

In this context, Hyun and Heinig [87] identify a recurring practice in the real estate market, in which prices converge towards a reference price in a given location. Complementing this perspective, Hyun and Milcheva [88] emphasize the considerable dependence on information on the transaction prices of nearby properties, characterized by comparable attributes, as a determining factor in reaching consensus on transaction prices.

4.4. GWR Model

In order to investigate the effects of spatial heterogeneity on the determinants of apartment rental prices in Belém, the GWR technique was used. Table 7 provides descriptions of the GWR coefficients. The estimates of these coefficients, varying at each observation point, are identified by their minimum, median, and maximum values, along with their interquartile range. A priori, by examining the minimum and maximum coefficients, it is possible to identify a low amplitude in the coefficients, indicating, preliminarily, a lack of spatial heterogeneity in the sample.

Table 7. GWR model—ln_rent (dependent).

Category	Variable	Min	Median	Max
----	Intercept	6.24650	6.36070	6.59960
Structural	ln_area	0.17403	0.17954	0.22318
Structural	Suite	0.06915	0.07084	0.08432
Structural	bathroom	0.02798	0.03278	0.03434
Structural	parking	0.25417	0.27592	0.27694
Locational	ln_supermarket	−0.05395	−0.02221	−0.01754
Locational	ln_shopping	−0.09046	−0.08177	−0.06300
Locational	hospital_500	0.01538	0.01602	0.01699
Locational	bus_500	0.00611	0.00818	0.01110

Table 7. Cont.

Category	Variable	Min	Median	Max
Neighborhood quality	active_pop	6.91×10^{-6}	7.69×10^{-6}	8.09×10^{-6}
Neighborhood quality	Infra	0.00409	0.00925	0.01063
Neighborhood quality	Ipc	-1.88×10^{-5}	-9.93×10^{-6}	1.35×10^{-5}
Neighborhood quality	flood:			
	1–0	−0.04099	−0.03901	−0.00409
	2–0	−0.08256	−0.06005	0.02210
	3–0	0.12938	0.13264	0.14549
Adjusted R-squared: 0.7402; AIC: 79.5293; AICc: 102.8923				

The adjusted R^2 of 74%, resulting from the application of GWR, reveals a clear similarity with the value obtained by the OLS approach, which reached 71.2%. The similarity observed suggests the possibility of performance equivalence between GWR and the OLS method.

Figure 7 shows the graphs of the coefficients resulting from the GWR analysis. There is no spatial heterogeneity in the effects of the determinants on apartment rental prices throughout the sample. It is possible to see a uniformity in the coefficients, suggesting a homogeneity in the influences of the factors studied, indicating that the patterns of determinants remain consistent throughout the area analyzed.

This finding differs from previous studies, notably those of Liu et al. [17], Tomal [8], and Liu et al. [15], which were successful in examining the spatial heterogeneity of the determining factors in rental prices. This homogeneity may be a reflection of the lack of transparency in the real estate market, as argued by Hyun and Heinig [87], posing a significant challenge by making property valuation complex for participants with less transaction experience. This opacity makes it difficult to analyze homes with nonidentical sets of attributes, impacting the ability of those involved to make informed decisions in real estate transactions. Although this study did not explicitly focus on identifying homogeneous areas, its findings also suggest that, in the city of Belém, PA, apartments tend to be grouped together based on properties related to both physical characteristics and geolocation attractiveness, as highlighted by Renigier-Bilozor et al. [89].

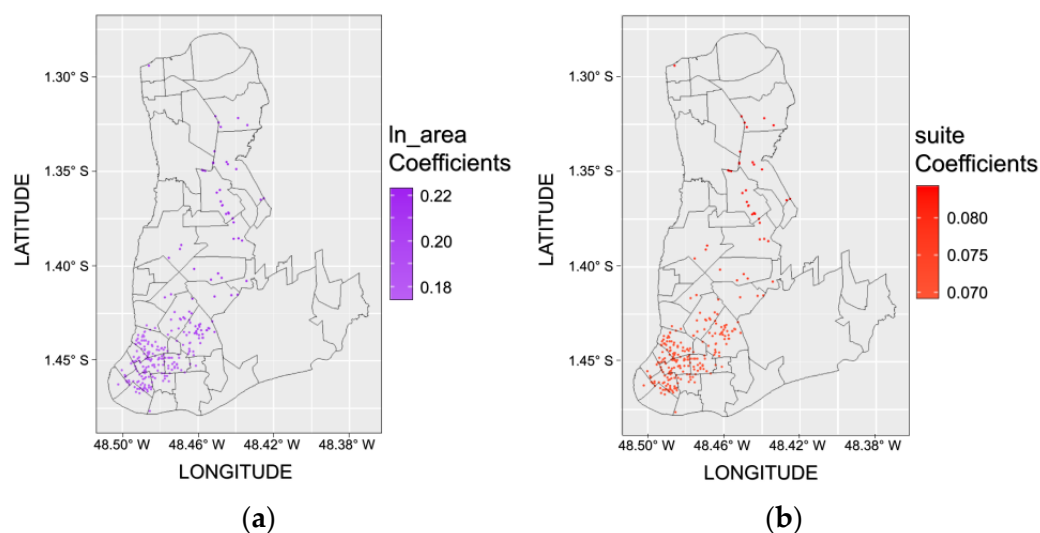


Figure 7. Cont.

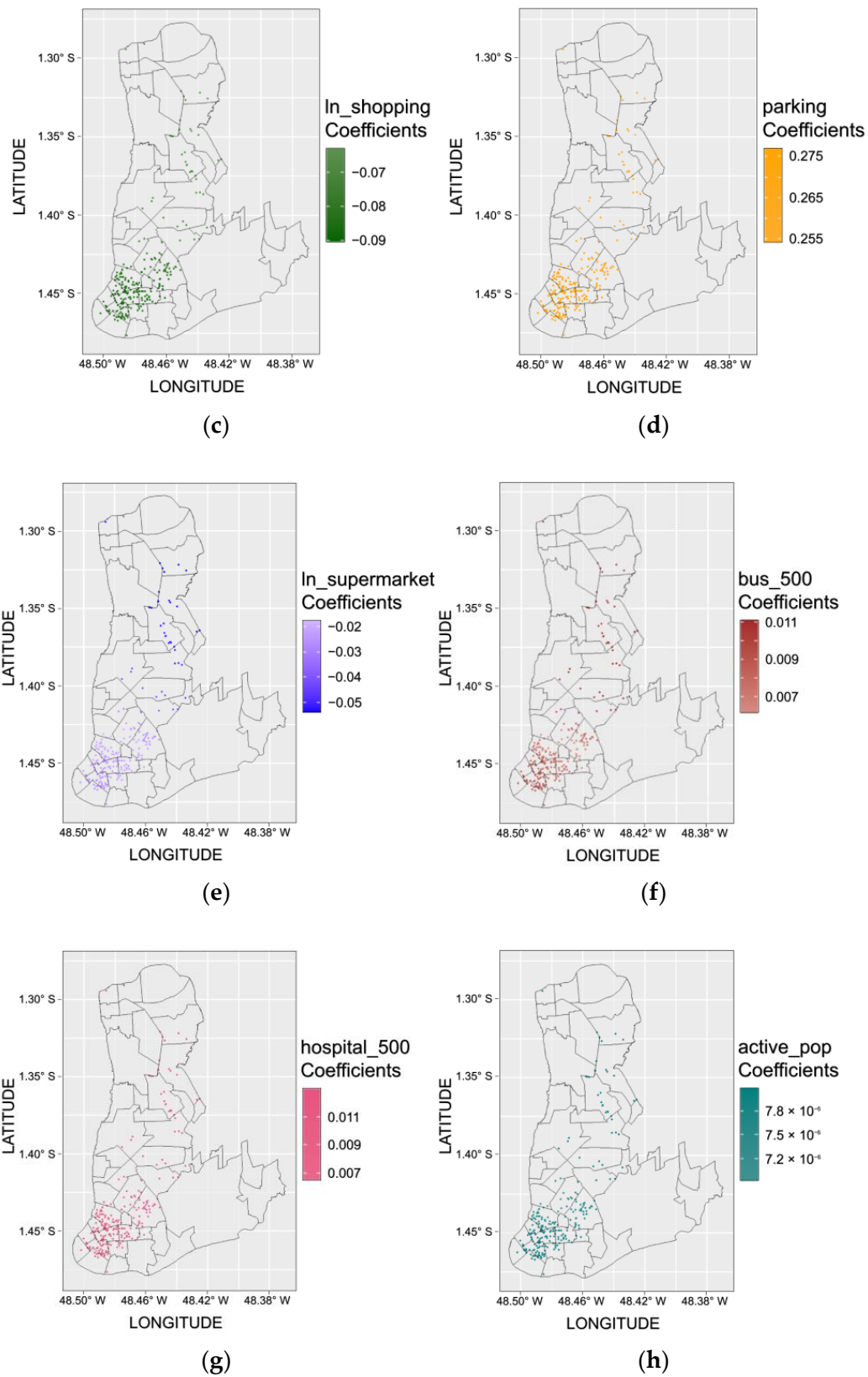


Figure 7. GWR coefficients for (a) $\ln_area$, (b) $suite$, (c) $\ln_shopping$, (d) $parking$, (e) $\ln_supermarket$, (f) bus_500 , (g) $hospital_500$, and (h) $active_pop$.

5. Conclusions

This study aimed to comprehensively examine the rental real estate market in Belém, Pará, utilizing the hedonic modeling methodology. The primary objective was to identify and analyze various factors contributing to rent pricing in this region, with a specific focus on socioeconomic characteristics associated with the real estate market, particularly within the construction industry. Emphasizing the substantial importance and relevance of the study, the real estate market represents the culmination of a production chain that not only generates employment, income, investments, and taxes but also produces products contributing to overall social welfare.

To delve into the intricacies of the rental market in Belém, this study aimed to analyze the influence of structural characteristics of apartments on their average rental prices. Additionally, it sought to investigate locational factors within the framework of hedonic price theory. The literature review provided support for the hypothesis, anticipating a positive correlation between features such as property area, the number of suites, and parking spaces with the average rental price of apartments. Moreover, the study anticipated that factors related to location, such as the availability of nearby hospitals and banks, would exert a substantial influence on determining the average rental value. The formulated hypothesis posited that, considering the minimum distance to a locational attribute, the greater the distance to the nearest supermarkets and shopping centers, the lower the expected average rental price for a given apartment.

Methodologically, we employed an established technique in hedonic price theory, namely OLS regression. Additionally, spatial techniques, including SLM and GWR, were incorporated to deepen our understanding and analysis of the complex interplay between structural, locational, and neighborhood quality characteristics and the rental prices in Belém, Pará. Regarding the findings, the hypothesis related to structural characteristics was partially supported: OLS analysis indicated a positive relationship between apartment area, the number of suites, and the number of parking spaces available with the average rental price of properties. However, the number of bathrooms did not prove statistically significant in this relationship. When applying SLM, considering total effects, there was consistency with the OLS results.

In regard to the hypothesis associated with locational factors, the results remained in line with the existing literature. Moreover, OLS analysis revealed a significantly negative correlation in the distance from the apartment to the nearest supermarket. However, in the case of SLM, considering total effects, the null hypothesis of non-significance was not rejected at a level of at least 10%. Regarding the distance to the nearest shopping center, OLS results confirmed the study's proposed hypothesis; in the SLM, the relationship was significantly negative when considering only direct effects.

Concerning the hypothesis related to the quantity of locational attributes available within a fixed distance of each apartment, both the quantity of buses and that of hospitals showed a positive relationship, both in OLS and SLM (with direct effects as reference). In addition, the results of GWR were consistent with those obtained in OLS, indicating low variability in regression estimates. This suggests that the influence of structural and locational factors is homogeneous in the delineated study area.

It is worth noting that the statistical significance—presence or absence—in certain variables can be attributed to various factors. Aspects such as the nature of the variables and their measurement format were defined directly from the study's data sources, which led to a loss of control over the results. Moreover, within the context of our study, the characteristics of certain variables may be particularly influenced by the locality aspect. The variations in cultural, political, legal, and environmental factors that Belém presents in comparison with other global metropolises could impact the relevance and significance of specific variables in different geographical settings, contributing to the observed variations in statistical outcomes.

The managerial contribution lies in the identification and correlation of structural and locational attributes as drivers of civil construction, influencing residential product devel-

opment strategies and territorial distribution. This aligns with specific market demands. Analyzing locational and neighborhood attributes becomes crucial for formulating public policies that guide urban land occupation, fostering real estate appreciation, and enhancing the quality of life and social well-being in Belém, Pará.

However, limitations are present, notably the restricted sample size due to spatial regression model constraints, preventing the analysis of more than one apartment in the same building. This limitation might impact the generalizability of results to situations with multiple units in a single building.

For subsequent investigations, an exploration into spatial–temporal analysis of determinants can assess the persistence of findings over time. Utilizing quantile regression to analyze determinants would unveil potential heterogeneities between rental price quartiles. Furthermore, incorporating machine learning models could enrich the analysis, offering new perspectives and enhancing predictive capabilities in the rental market. Considering the evidence presented by this study about the possible clustering of apartments in Belém, PA, based on physical characteristics and geographic attractiveness, it is recommended that further inquiries delve into the specific dynamics of these clusters. This exploration would involve investigating additional factors that may influence the formation of homogeneous patterns in the region’s real estate market.

It is essential to note that this article focuses solely on the market tool perspective, excluding the opinions of the two main actors in the real estate scenario: landlords (supply side) and tenants (demand side). This quantitative analysis underscores the need for future qualitative research, integrating interviews with both involved parties.

Author Contributions: Conceptualization, Y.G.P.M.d.F. and F.G.P.M.; methodology, A.H.F.d.S. and V.I.M.d.S.; software, A.H.F.d.S. and V.I.M.d.S.; validation, A.H.F.d.S., V.I.M.d.S. and F.G.P.M.; formal analysis, A.H.F.d.S., V.I.M.d.S. and F.G.P.M.; investigation, Y.G.P.M.d.F., A.H.F.d.S. and V.I.M.d.S.; resources, A.H.F.d.S., V.I.M.d.S. and F.G.P.M.; data curation, Y.G.P.M.d.F. and F.G.P.M.; writing—original draft preparation, Y.G.P.M.d.F.; writing—review and editing, Y.G.P.M.d.F. and F.G.P.M.; visualization, Y.G.P.M.d.F. and F.G.P.M.; supervision, F.G.P.M.; project administration, Y.G.P.M.d.F. and F.G.P.M.; funding acquisition, F.G.P.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research received financial support for the publication of this article from Qualified Publication Support Program of the Department of Research and Postgraduate Studies at the Federal University of Pará (PROPESP/PAPQ/UFGA). Moreover, as the first author (Y.G.P.M.d.F.) received a master’s scholarship (From October 2022 to February 2024), this study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível (CAPES) (Coordination for the Improvement of Higher Education Personnel)—Brazil—Finance Code 001.

Data Availability Statement: The data presented in this study are available upon request from the corresponding author. The data are not publicly available due to the need to protect the privacy of the research respondents.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Gilbert, A. Rental housing: The international experience. *Habitat Int.* **2016**, *54*, 173–181. [CrossRef]
2. NMHC. American Community Survey. Available online: <https://www.nmhc.org/research-insight/quick-facts-figures/quick-facts-resident-demographics/renters-and-owners/> (accessed on 7 December 2023).
3. EUROSTAT. Distribution of Population by Tenure Status, Type of Household and Income Group—EU-SILC Survey. Available online: https://ec.europa.eu/eurostat/databrowser/view/ILC_LVHO02_custom_3553007/bookmark/table?lang=en&bookmarkId=2457e44e-df35-4995-aacc-e79684402691 (accessed on 7 December 2023).
4. IBGE. PNAD Contínua—Pesquisa Nacional por Amostra de Domicílios Contínua. Available online: <https://www.ibge.gov.br/estatisticas/sociais/trabalho/17270-pnad-continua.html?edicao=27258&t=resultados> (accessed on 7 December 2023).
5. De, U.K.; Vupru, V. Housing Demand and Its Determinant in a Small Town in India. *J. Urban Plan. Dev.* **2021**, *147*, 05020036. [CrossRef]
6. Medeiros, R.d.V.V.; Carvalho, S.T. Modelagem econométrica do preço de alugueis de apartamentos na cidade de Petrópolis-RJ utilizando regressão linear múltipla. *Rev. Econ. Da UEG* **2017**, *13*, 157–174. [CrossRef]

7. Cui, N.N.; Gu, H.Y.; Shen, T.Y.; Feng, C.C. The Impact of Micro-Level Influencing Factors on Home Value: A Housing Price-Rent Comparison. *Sustainability* **2018**, *10*, 4343. [CrossRef]
8. Tomal, M. Modelling Housing Rents Using Spatial Autoregressive Geographically Weighted Regression: A Case Study in Cracow, Poland. *Isprs Int. J. Geo-Inf.* **2020**, *9*, 346. [CrossRef]
9. Rosen, S. Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. *J. Political Econ.* **1974**, *82*, 34–55. [CrossRef]
10. Lancaster, K.J. A New Approach to Consumer Theory. *J. Political Econ.* **1966**, *74*, 132–157. [CrossRef]
11. Hu, L.R.; He, S.J.; Han, Z.X.; Xiao, H.; Su, S.L.; Weng, M.; Cai, Z.L. Monitoring housing rental prices based on social media: An integrated approach of machine-learning algorithms and hedonic modeling to inform equitable housing policies. *Land Use Policy* **2019**, *82*, 657–673. [CrossRef]
12. Kam, K.J.; Chuah, S.Y.; Lim, T.S.; Lin Ang, F. Modelling of property market: The structural and locational attributes towards Malaysian properties. *Pac. Rim Prop. Res. J.* **2016**, *22*, 203–216. [CrossRef]
13. Wen, H.; Zhang, Y.; Zhang, L. Do educational facilities affect housing price? An empirical study in Hangzhou, China. *Habitat Int.* **2014**, *42*, 155–163. [CrossRef]
14. Shen, Q.; Xu, S.M.; Lin, J. Effects of bus transit-oriented development (BTOD) on single-family property value in Seattle metropolitan area. *Urban Stud.* **2018**, *55*, 2960–2979. [CrossRef]
15. Liu, Q.C.; Zhao, P.X.; Xiao, Y.; Zhou, X.; Yang, J. Walking Accessibility to the Bus Stop: Does It Affect Residential Rents? The Case of Jinan, China. *Land* **2022**, *11*, 860. [CrossRef]
16. Qiao, S.; Yeh, A.G.O.; Zhang, M.Z. Capitalisation of accessibility to dockless bike sharing in housing rentals: Evidence from Beijing. *Transp. Res. Part D Transp. Environ.* **2021**, *90*, 102640. [CrossRef]
17. Liu, G.; Zhao, J.; Wu, H.; Zhuang, T. Spatial Pattern of the Determinants for the Private Housing Rental Prices in Highly Dense Populated Chinese Cities-Case of Chongqing. *Land* **2022**, *11*, 2299. [CrossRef]
18. Morano, P.; Tajani, F.; Di Liddo, F.; Daro, M. Economic Evaluation of the Indoor Environmental Quality of Buildings: The Noise Pollution Effects on Housing Prices in the City of Bari (Italy). *Buildings* **2021**, *11*, 213. [CrossRef]
19. Leung, K.M.; Yiu, C.Y. Rent determinants of sub-divided units in Hong Kong. *J. Hous. Built Environ.* **2019**, *34*, 133–151. [CrossRef]
20. Islam, M.S.; Hossain, R.; Morshed, M.M.; Afrin, S. The value of environmental (dis)amenities in the urban housing market: Evidence from Khulna, Bangladesh. *J. Urban Manag.* **2020**, *9*, 180–190. [CrossRef]
21. Bracke, P. House Prices and Rents: Microevidence from a Matched Data Set in Central London. *Real Estate Econ.* **2015**, *43*, 403–431. [CrossRef]
22. Piaggio, M. The value of public urban green spaces: Measuring the effects of proximity to and size of urban green spaces on housing market values in San Jose, Costa Rica. *Land Use Policy* **2021**, *109*, 105656. [CrossRef]
23. McCord, M.; Davis, P.T.; Haran, M.; McGreal, S.; McIlhatton, D. Spatial variation as a determinant of house price. *J. Financ. Manag. Prop. Constr.* **2012**, *17*, 49–72. [CrossRef]
24. Anselin, L.; Rey, S.J. *Modern Spatial Econometrics in Practice: A guide to GeoDa, GeoDaSpace and PySAL*; GeoDa Press LLC: Urbana, IL, USA, 2014.
25. Paixão, L.A.R.; Luporini, V. Índice de preços hedônicos para apartamentos: Uma aplicação a dados fiscais de Belo Horizonte, 1995–2012. *Econ. Soc.* **2020**, *29*, 967–993. [CrossRef]
26. Campos, R.B.A. O mercado imobiliário residencial no município de São Paulo: Uma abordagem de preços hedônicos espacial. *Nova Econ.* **2017**, *27*, 303–337. [CrossRef]
27. Maciel, V.F.; Biderman, C. Assessing the effects of the São Paulo's metropolitan beltway on residential land prices. *J. Transp. Lit.* **2013**, *7*, 373–402. [CrossRef]
28. Fávero, L.P.L. Preços hedônicos no mercado imobiliário comercial de São Paulo: A abordagem da modelagem multinível com classificação cruzada. *Estud. Econômicos* **2011**, *41*, 777–810. [CrossRef]
29. Duan, J.; Tian, G.; Yang, L.; Zhou, T. Addressing the macroeconomic and hedonic determinants of housing prices in Beijing Metropolitan Area, China. *Habitat Int.* **2021**, *113*, 102374. [CrossRef]
30. Barreca, A.; Curto, R.; Rolando, D. Assessing Social and Territorial Vulnerability on Real Estate Submarkets. *Buildings* **2017**, *7*, 94. [CrossRef]
31. Trojanek, R.; Gluszek, M. Short-run impact of the Ukrainian refugee crisis on the housing market in Poland. *Finance Res. Lett.* **2022**, *50*, 6. [CrossRef]
32. Li, Y.L.; Lin, Y.L.; Wang, J.E.; Geertman, S.; Hooimeijer, P. The effects of jobs, amenities, and locations on housing submarkets in Xiamen City, China. *J. Hous. Built Environ.* **2022**, *38*, 1221–1239. [CrossRef]
33. Zhang, T.Z.; Zeng, Y.X.; Zhang, Y.J.; Song, Y.; Li, H.X. The Heterogenous Demand for Urban Parks between Home Buyers and Renters: Evidence from Beijing. *Sustainability* **2020**, *12*, 9058. [CrossRef]
34. Helbich, M.; Brunauer, W.; Vaz, E.; Nijkamp, P. Spatial Heterogeneity in Hedonic House Price Models: The Case of Austria. *Urban Stud.* **2014**, *51*, 390–411. [CrossRef]
35. Sohn, W.; Kim, H.W.; Kim, J.-H.; Li, M.-H. The capitalized amenity of green infrastructure in single-family housing values: An application of the spatial hedonic pricing method. *Urban For. Urban Green.* **2020**, *49*, 126643. [CrossRef]
36. Efthymiou, D.; Antoniou, C. How do transport infrastructure and policies affect house prices and rents? Evidence from Athens, Greece. *Transp. Res. Part A Policy Pract.* **2013**, *52*, 1–22. [CrossRef]

37. Trojanek, R.; Gluszek, M.; Tanas, J. The Effect of Urban Green Spaces On House Prices in Warsaw. *Int. J. Strateg. Prop. Manag.* **2018**, *22*, 358–371. [CrossRef]
38. Trojanek, R. How do different noise pollution sources affect apartment prices? *Int. J. Strateg. Prop. Manag.* **2023**, *27*, 351–361. [CrossRef]
39. Jin, S.; Zhao, Y.; Liu, C. Reconstructing Social Segregation in Danwei: An Examination of High-Quality Education Resources' Impact on Housing Prices in Nanjing, China. *Buildings* **2023**, *13*, 2427. [CrossRef]
40. Schläpfer, F.; Waltert, F.; Segura, L.; Kienast, F. Valuation of landscape amenities: A hedonic pricing analysis of housing rents in urban, suburban and periurban Switzerland. *Landsc. Urban Plan.* **2015**, *141*, 24–40. [CrossRef]
41. Wen, H.; Tao, Y. Polycentric urban structure and housing price in the transitional China: Evidence from Hangzhou. *Habitat Int.* **2015**, *46*, 138–146. [CrossRef]
42. Vale, S.; de Mello-Sampayo, F. Effect of Hierarchical Parish System on Portuguese Housing Rents. *Sustainability* **2021**, *13*, 455. [CrossRef]
43. Tan, T.-H. The impact of neighborhood types on the prices of residential properties. *Sunway Acad. J.* **2010**, *7*, 77–88.
44. Dou, M.; Gu, Y.; Fan, H. Incorporating neighborhoods with explainable artificial intelligence for modeling fine-scale housing prices. *Appl. Geogr.* **2023**, *158*, 103032. [CrossRef]
45. Mathur, S. House price impacts of construction quality and level of maintenance on a regional housing market: Evidence from King County, Washington. *Hous. Soc.* **2019**, *46*, 57–80. [CrossRef]
46. Kryvobokov, M.; Pradella, S.; Des Rosiers, F. Urban and Peri-Urban Residential Rental Markets in Wallonia: Similar or Different? *Appl. Spat. Anal. Policy* **2020**, *13*, 461–487. [CrossRef]
47. Hill, R.J.; Pfeifer, N.; Steurer, M.; Trojanek, R. Warning: Some transaction prices can be detrimental to your house price index. *Rev. Income Wealth* **2023**, *n/a*, 1–25. [CrossRef]
48. Williams, G. The effects of Mass Rapid Transit (MRT) systems on land values. *J. Valuat.* **1990**, *8*, 7–23. [CrossRef]
49. Gocer, O.; Wei, Y.; Ozbil Torun, A.; Alvanides, S.; Candido, C. Multidimensional attributes of neighbourhood quality: A systematic review. *Heliyon* **2023**, *9*, e22636. [CrossRef]
50. Li, B.; Jin, C.; Jansen, S.J.T.; van der Heijden, H.; Boelhouwer, P. Understanding the relationship between residential environment, social exclusion, and life satisfaction of private renters in Shenzhen. *J. Hous. Built Environ.* **2023**, *38*, 2449–2472. [CrossRef]
51. Heyman, A.V.; Sommervoll, D.E. House prices and relative location. *Cities* **2019**, *95*, 102373. [CrossRef]
52. Bin, O.; Kruse, J.B.; Landry, C.E. Flood hazards, insurance rates, and amenities: Evidence from the coastal housing market. *J. Risk Insur.* **2008**, *75*, 63–82. [CrossRef]
53. Tarui, N.; Urbanski, S.; Lam, Q.L.; Coffman, M.; Newfield, C. Sea level rise risk interactions with coastal property values: A case study of O'ahu, Hawai'i. *Clim. Change* **2023**, *176*, 130. [CrossRef]
54. Daniel, V.E.; Florax, R.; Rietveld, P. Flooding risk and housing values: An economic assessment of environmental hazard. *Ecol. Econ.* **2009**, *69*, 355–365. [CrossRef]
55. Beltran, A.; Maddison, D.; Elliott, R.J.R. Is Flood Risk Capitalised Into Property Values? *Ecol. Econ.* **2018**, *146*, 668–685. [CrossRef]
56. Atreya, A.; Ferreira, S. Seeing is Believing? Evidence from Property Prices in Inundated Areas. *Risk Anal.* **2015**, *35*, 828–848. [CrossRef] [PubMed]
57. Livy, M.R. Assessing the housing price capitalization of non-destructive flooding events. *Res. Econ.* **2023**, *77*, 265–274. [CrossRef]
58. Häse, S.; Hirte, G. The impact of unexpected flood events and adaption measures on lot prices. *Rev. Reg. Res.* **2023**, *43*, 29–68. [CrossRef]
59. Zhang, L. Flood hazards impact on neighborhood house prices: A spatial quantile regression analysis. *Reg. Sci. Urban Econ.* **2016**, *60*, 12–19. [CrossRef]
60. Santos, F.A.A.d.; Rocha, E.J.P.d. Alagamento e inundação em áreas urbanas. Estudo de caso: Cidade de Belém. *Rev. GeoAmazônia* **2014**, *1*, 33–55. [CrossRef]
61. Vieira, M.N.A.; Alves, C.N.; Ferreira, V.d.S.; Barbosa, C.N.L. *Modeling of Geological-Geotechnical Properties in Soils of Belém do Pará*; Universidade Federal de Itajubá (UNIFEL): Itajubá, Brazil, 2021. [CrossRef]
62. Tourinho, H.L.Z.; Lima, D.B.O. Planos urbanos e centro histórico de Belém. *Cad. Arquitetura Urban.* **2015**, *22*, 44. [CrossRef]
63. Albuquerque, M.C.B.; Ramos, M.C. Regularizacao fundiaria urbana como instrumento de direito a moradia e direito a cidade em bens imoveis tombados localizados em centros historicos: O caso do bairro da Cidade Velha, em Belem (PA). *Direito Cid.* **2021**, *13*, 921–954. [CrossRef]
64. Trindade Júnior, S.-C.C.d. Um “skyline” em mutação: O velho centro e as transformações urbanas em Belém. *Novos Cad. NAEA* **2018**, *21*, 57–78. [CrossRef]
65. Jun, M.-J.; Kim, H.-J. Measuring the effect of greenbelt proximity on apartment rents in Seoul. *Cities* **2017**, *62*, 10–22. [CrossRef]
66. Santos, E.R.C. Historia da cidade de Belém: Intervenções urbanísticas e produção do espaço da orla fluvial. In Proceedings of the Anais do XVIII Encontro Nacional de Geógrafos, São Luís, Brazil, 24–30 June 2016.
67. EBC. Belém Deve Receber Cerca de 50 mil Visitantes Para a COP30. Available online: <https://agenciabrasil.ebc.com.br/geral/noticia/2023-06/belem-deve-receber-cerca-de-50-mil-visitantes-para-cop30> (accessed on 21 January 2023).
68. Costa, M.A.; dos Santos, M.P.G.; Marguti, B.; Pirani, N.; Pinto, C.V.d.S.; Curi, R.L.C.; Ribeiro, C.C.; de Albuquerque, C.G. *Vulnerabilidade Social no Brasil: Conceitos, Métodos e Primeiros Resultados Para Municípios e Regiões Metropolitanas Brasileiras*; Texto para Discussão; IPEA: Rio de Janeiro, RJ, Brazil, 2018.

69. Cordera, R.; Coppola, P.; dell'Olio, L.; Ibeas, Á. The impact of accessibility by public transport on real estate values: A comparison between the cities of Rome and Santander. *Transp. Res. Part A Policy Pract.* **2019**, *125*, 308–319. [CrossRef]
70. Greene, W.H. *Econometric Analysis*; Prentice Hall: Upper Saddle River, NJ, USA, 1999; Volume 4.
71. Lu, M.; Zhao, Q.Y.; Zhang, J.Q.; Pohl, K.M.; Li, F.F.; Niebles, J.C.; Adeli, E.; Ieee Comp, S.O.C. Metadata Normalization. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), Nashville, TN, USA, 19–25 June 2021; pp. 10912–10922.
72. White, H. A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity. *Econometrica* **1980**, *48*, 817–838. [CrossRef]
73. Moran, P.A.P. The Interpretation of Statistical Maps. *J. R. Stat. Soc. Ser. B Methodol.* **1948**, *10*, 243–251. [CrossRef]
74. Bivand, R.S.; Pebesma, E.; Gómez-Rubio, V. *Applied Spatial Data Analysis with R*; Springer: New York, NY, USA, 2013; Volume 10.
75. Qu, S.; Hu, S.; Li, W.; Zhang, C.; Li, Q.; Wang, H. Temporal variation in the effects of impact factors on residential land prices. *Appl. Geogr.* **2020**, *114*, 102124. [CrossRef]
76. Yang, L.; Chu, X.; Gou, Z.; Yang, H.; Lu, Y.; Huang, W. Accessibility and proximity effects of bus rapid transit on housing prices: Heterogeneity across price quantiles and space. *J. Transp. Geogr.* **2020**, *88*, 102850. [CrossRef]
77. Anselin, L. Under the hood Issues in the specification and interpretation of spatial regression models. *Agric. Econ.* **2002**, *27*, 247–267. [CrossRef]
78. Anselin, L. *Spatial Econometrics: Methods and Models*; Springer: Dordrecht, The Netherlands, 1988; Volume 1.
79. Ward, M.; Gleditsch, K. *Spatial Regression Models*; Sage Publications: Thousand Oaks, CA, USA, 2008. [CrossRef]
80. Hui, E.C.M.; Liang, C. Spatial spillover effect of urban landscape views on property price. *Appl. Geogr.* **2016**, *72*, 26–35. [CrossRef]
81. LeSage, J.; Pace, R.K. *Introduction to Spatial Econometrics*; Chapman and Hall/CRC: New York, NY, USA, 2009.
82. Bowman, A.W. An alternative method of cross-validation for the smoothing of density estimates. *Biometrika* **1984**, *71*, 353–360. [CrossRef]
83. AbdelHalim, M.; Dube, J.; Devaux, N. The Spatial and Temporal Decomposition of the Effect of Floods on Single-Family House Prices: A Laval, Canada Case Study. *Sustainability* **2021**, *13*, 5088. [CrossRef]
84. Sirmans, G.S.; Macpherson, D.A.; Zietz, E.N. The Composition of Hedonic Pricing Models. *J. Real Estate Lit.* **2005**, *13*, 3–43. [CrossRef]
85. Lima, G.V.B.d.A.; Carvalho, A.C.G.d.; Moreira, F.G.P.; Bassalo, G.H.M. Real Estate Tendencies in High-Rise Residential Buildings: Case Study in Belém, Amazonia, Brazil. *J. Urban Plan. Dev.* **2021**, *147*, 05021033. [CrossRef]
86. Mendes, L.A.S. A produção do urbano e do imobiliário na região metropolitana de Belém. *Confins. Rev. Fr. Brésilienne Géographie/Rev. Fr. Bras. Geogr.* **2020**, *44*, 1–23. [CrossRef]
87. Hyun, D.; Heinig, S. Different preferences, but the same approach: The practice of the sales comparison in the Berlin housing rental and sale market. *J. Hous. Built Environ.* **2023**, *38*, 811–835. [CrossRef]
88. Hyun, D.; Milcheva, S. Spatial dependence in apartment transaction prices during boom and bust. *Reg. Sci. Urban Econ.* **2018**, *68*, 36–45. [CrossRef]
89. Renigier-Bilozor, M.; Janowski, A.; Walacik, M. Geoscience Methods in Real Estate Market Analyses Subjectivity Decrease. *Geosciences* **2019**, *9*, 130. [CrossRef]

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Article

Increase Government Support for Build-to-Rent: Should We Expect Affordable Housing?

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Abstract: Build-to-rent (BTR) is an important pathway for rental housing supply across the cities of Australia. The discourse has become more prevalent as stakeholders seek government support to expand the sector to provide, amongst other reform measures, affordable rental accommodation. This paper examines the effectiveness of BTR as a pathway to affordable housing supply in Australia and identifies the additional reforms needed to increase that supply further. Interviews with key stakeholders were used to assess the success of the asset class to date and how it is likely to perform in increasing affordable rental housing supply, as well as what additional reforms may be required to expedite supply. The paper found that while BTR aims to scale up rental housing supply, its limitations in its present form demonstrate the need for additional reforms. At present, unfavorable taxes, inner-city locational attributes, and ultramodern services make the asset class a high-end housing model. Experts posit that BTR rental prices are justified given the quality amenities and the 24/7 onsite professional management. While it is a premium product, several BTR projects in Australia have included portions of those projects for affordable housing. The study concluded that BTR can generate affordable housing outcomes in Australia. As more developments take place across the private sector, several regulatory reforms in land release and taxes are needed to produce a sizable portfolio of affordable BTR. Without government support and regulation through additional supply-side incentives, development and recurrent holding costs will remain high, making BTR unaffordable to many urban residents.

Keywords: build-to-rent; institutional investors; affordable rental housing; land tax; private rental market

1. Introduction

The literature on prioritizing rental housing supply in housing policy continues to be published worldwide [1–3]. The argument is that more rental units are needed to serve mid-to-low-income households. In Australia, build-to-rent (BTR) has become an essential tenure due to rapid demographic changes, overpriced homeownership, and affordable rental housing supply gaps [4–7]. The BTR industry is attracting significant foreign institutional capital as investors continue to explore alternative investment avenues [8–15]. With Australia's rising house prices and rental stress, this asset class has found a unique place in the residential property market. Dozens of BTR projects are already in operation, while many developments are under construction [16,17]. This asset class is expected to fill the gap in the rental stock and provide affordable rental housing.

The marriage between institutional investors and the private rental market is often described as a perfect match due to the increased demand for purpose-built rental apartments in Australia's most-cosmopolitan cities. BTR, a highly desired asset class for institutional investors, offers a long-term investment strategy, tenure security, and value for money

to renters through its world-class amenities and property management services [15]. Its performance has proven relatively rewarding in the U.S. and U.K., providing a platform for increased economic development, employment, revenue generation, and foreign direct investment. As Australia's housing markets continue to face affordable housing supply challenges, there is a need to advance this sector to resolve these challenges.

For this asset class to gain recognition and wider coverage in Australia, the government's facilitative role must be expanded in several ways. First, the sector must harness the political support needed to make it successful, and second, the right platforms must be created to attract more institutional capital. In recent years, stakeholders have shown much optimism about the ability of BTR to provide affordable housing supply outcomes in Australia [18]. Although showing massive progress, BTR is operated as a hybrid, an intermediate between residential and commercial [19], and in its present form, it commands relatively higher rents than other rental units in typical Australian suburbs. From the institutional investor's perspective, BTR is a financial asset and a good avenue to generate steady incomes and diversification benefits. Conversely, policymakers are looking at how this asset class can provide affordable housing. Australia's National Rental Affordability Scheme (NRAS), which was established to provide affordable housing, was ended in 2013 due to the many challenges. No new scheme has been set up since then to provide 20% below-market affordable housing in the private rental market. BTR, which began to pick up in 2016, is providing decent rental accommodation. Interest rates continue to rise post-COVID-19, causing serious financial stress for mortgage-assisted homeowners and first-home buyers [20]. A BTR housing model with an affordable housing mandate is expected to complement affordable housing supply, especially considering the generous support the industry enjoys from the government. At the moment, most BTR housing focuses on market-rate rents, not just in Australia but in other countries; an example was given by [21] concerning residential REITs in Japan.

There is a gap in the literature regarding the conceptualization of Australia's BTR housing model, especially whether it is a private or social investment. While the literature broadly focuses on several aspects of the asset class, such as financial viability, critical success factors, different modalities, and systematic risks or barriers [4,22–27], within Australia's housing policy, little is known about what BTR entails and whether it can provide an effective pathway towards increasing affordable rental housing supply. Using two operational BTR platforms in Australia and stakeholder engagements through interviews, this paper assesses BTR in light of affordable housing. It examines the government incentives offered to BTR investors and the expectations for social investment.

2. Literature Review

2.1. Overview of Build-to-Rent

This literature review provides an overview of the thriving BTR sectors worldwide and then describes the uniqueness of the asset class in Australia. It reviews the ideological and philosophical viewpoints on Australia's novel BTR asset class. It reviews the schools of thought on the conceptual BTR through the lens of financialization, including the dissenting views on the understanding and classification of BTR, a rental asset that commands above-market-rate rent. It then presents arguments on the theorization of BTR as a pathway towards affordable housing in Australia. All over the world, initiatives are being proposed at various levels of government to attract institutional investors into the private rent sector. Pilot schemes are being used to understand the asset and as an avenue for creating the necessary structures and systems. Holistically, there are specific variations in the rental tenure types in Australia. While individual landlordism existed for many years before proper conceptualization, BTR is being pushed into the fabric of the private rental market through a top-down trajectory. This review clarifies why BTR is considered a new asset class amid the ongoing commentary.

Several typologies characterize the rental sector. One of the initial types of units was small scale in nature, for example, rooms within a house, units built on backyard spaces,

and extensions to one-story shops, amongst others [28,29]. There are also low-to-medium-rise rental apartments owned by individual investors, some of which are called build-to-sell (BTS) apartments. In some countries, these units are owned by housing associations and organizations [30,31]. The conversations about scaling up rental housing supply started in the early 2000s, with several scholars comparing individual investors to institutional investors [32–34]. This birthed the entry of corporate or institutional landlordism into the private rental market. Several scholars have been precise in their assertions by limiting their expositions to pension funds and insurance companies [19,35], while others have focused their discussions on the rental asset [1,3,36]. Recent literature, however, has shifted the focus to attracting institutional investors into housing markets [22,37,38]. There are, therefore, various views on who institutional investors are and their role in housing markets, and BTR is central to the theoretical and policy debates. In this regard, there are multiple examples of housing types broadly badged as BTR.

There is a significant number of literature sources on BTR worldwide [9,33–35], and these are gaining ground in housing policy debates. BTR projects constitute large, high-rise rental apartments built mostly within inner-city areas to serve certain categories of renters. They are financed by institutional investors who show interest in the asset as an alternative investment avenue for the purposes of obtaining diversification benefits. The U.K., U.S., Europe, Australia, Asia, and other parts of the world have established BTR sectors or have planned to develop one.

2.2. *Build-to-Rent and Multifamily Housing in the U.S.*

The U.S. has a thriving BTR sector, also described as multifamily housing (MFH) [37–41]. MFH makes up 43% of the total rental stock in the U.S. and is worth USD 2.1 trillion, representing 25% of all institutional investment in property [42]. Although BTR is rarely used, the type of investors undertaking these housing investments and the nature of apartments being put on the market point to the BTR asset class. References [37,43] discuss how institutional investors such as real estate investment trusts (REITs), insurance companies, and pension funds in the U.S. invest in MFH to boost rental housing supply. Pinnacle, one of the largest managers of multifamily housing in the U.S., works with large-scale institutional investors. The contribution of MFH must be considered in the debates about expanding rental accommodation, as it adds hundreds of thousands of units to the U.S. market annually. Judging by the length of time: dating back to the 1960s, the U.S. has an established track record of MFH yet continues to develop purpose-built rental apartments annually.

The U.S. is also leading Australia in the private rental market. The gap between the two countries has been largely based on organizational-level comparisons, particularly the Low-Income Housing Tax Credit program (LIHTC) and the MFH [44–46]. Each of these programs is designed for a specific purpose and target group. The LIHTC is a government scheme that supports the production of affordable rental housing for low-to-mid-income households. It is comparable to Australia's recently discontinued National Rental Affordability Scheme (NRAS) [47,48], which was implemented in 2008 to play virtually the same role as the LIHTC, but with different arrangements. Unfortunately, due to some challenges, it was halted in Australia. The next point of call is the BTR sector, which is a hot topic in conferences, policy seminars, and reports. By identifying the similarities between the LIHTC and the NRAS, policy experts could make judgements on the target group for which these programs were designed and the conditions required for investors who wanted to benefit from the incentives. During the formulation of the NRAS, many comparisons were made against the U.S. LIHTC program. The two had similar holistic goals of providing affordable housing for low-to-mid-income households. It is fair to say that the LIHTC and the NRAS were condition-based in that the government had much more control over these programs in terms of supporting structures and housing outcomes. From an ideological perspective, the LIHTC and NRAS could be viewed as having social value.

Australia's emerging BTR sector behaves more like the U.S.'s MFH. This assertion is based on the type of rental apartment produced in both cases and the type of investors

undertaking these projects. The dynamics are similar, with the MFH and BTR largely focused on market-driven private rental housing investment. These differ from the LIHTC and NRAS, which were implemented specifically to increase affordable rental housing supply [49,50]. The amalgamated media attention given to BTR in print and electronic media is like that of the NRAS, except that it is an emerging asset class and not much is known about it. The difference between both countries' approaches to the private rental market is seen in the gap between them in terms of maturity and advancement, with the U.S. having the upper hand. According to the various reports and proposals for BTR in Australia, the MFH trajectory is being followed, meaning that most industry players look at BTR from a *laissez-faire* perspective. This presupposes that BTR is, in practice, not affordable housing, despite the longstanding contention in the housing literature about the definition of affordable housing. Many have posited that there is no commonly accepted definition, and it is broadly defined across income/expenditure ratio dynamics and functional mechanisms ranging from free-market housing to controlled housing [51].

2.3. Build-to-Rent in the U.K.

In 2015, the U.K. government established a GBP 1 billion BTR fund to advance the cause of building long-term purpose-built rental units [52]. This fund not only accelerated the growth process, but, most importantly, it facilitated the recognition and acceptance of the asset in the U.K. Subsequently, a joint venture between Delancey, a U.K.-based institutional investor, and the Qatari Investment Authority added more than 2000 apartments to the London housing market. Other institutional investors such as Grainger Plc, Legal and General, Greystar, Quintain, and Get Living have operational and pipeline BTR projects within their portfolios. Experts constantly attempt to understand BTR to find the right niche to integrate it into the planning system [53]. U.K.'s BTR is often viewed as a solution to their housing crisis and an escape from the challenges of private landlordism [54]. Research shows that the average age of first-time homebuyers is rising rapidly. According to the 2020 cross-country First Home Buyers' Index, the average age of first home buyers across various countries lists Australia as 36 years against 33 years for the U.S. and 34 years for the U.K. [55]. This gives BTR a positive position, as there is a ready market of young renters. Due to the growing demand for rental accommodation among young people, developers such as John Lewis and others have included affordable housing in their BTR developments. The British Property Federation, in its residential analysis, shows that BTR has affordability levels comparable to the private rental sector in the U.K. [56] and, therefore, contributes to the U.K. supply of affordable housing. To obtain planning permission, developers are required to commit at least 20% affordable housing in their development in most of England, 35% in London, and generally 50% if the building is situated on government-owned or other designated land. Sustainable finance is a major challenge for affordable BTR, something that policymakers are looking to resolve.

BTR is often distinguished geographically and not just within countries. Rather than associating it with the entire U.K., scholars refer to specific cities such as London, Birmingham, Leeds, etc. [33]. This is important because of the nature of the asset class and its target renters and is largely driven by the population being primarily based in more-urbanized locations. The U.K. has undergone various housing tenure phases, from creating homeownership societies to increasing private landlordism [57,58]. The country has a decent track record and a well-defined set of systems for BTR. The European context [19,59,60] provides interesting insights into how institutional investors are constantly exploring rental housing in a financialized manner. Other countries, such as Russia, are also experiencing an increase in institutional investors [61]. This shows the proliferation of major institutional investors in residential property markets, specifically the private rental markets, in many countries.

Theoretically, this area of housing research is broadly underpinned by neoclassical economics theories [62–64]. It allows the study of housing economics and housing markets and enables the conceptualization of housing supply shortfalls. The dynamics with BTR are that it is an addition to rental tenure, providing a distinct trajectory to the housing supply

paradigm [27,28,30,65,66]. Even with the foundations of economic theories, scholars are inclined to theories on financialization. This is where housing is viewed as a commodity or an investment vehicle, not a home [43]. Innovative vehicles are continuously being introduced on various platforms, but the extent to which these platforms influence policy intervention is yet to be understood. Nonetheless, the blend of neoclassical economics and financialization theories provides a basis for understanding BTR.

The introduction of institutional investors into private rental markets has raised questions about harnessing the financial prowess of these investors to increase affordable housing supply. Different modalities of BTR are being operated in Australia, all of which fall into two schools of thought. The first represents financialization, a phenomenon where the asset is offered at and above market rate (mBTR), while the second represents a socialistic ideology, where the asset class is preconceived as a social investment for affordable housing (aBTR). These two, mBTR and aBTR, represent the pathways embedded within the framework of the policy discourse. The contention is whether policy experts seek more government support for mBTR or aBTR (or both). This paper clarifies using BTR for affordable housing and contributes to the conceptualization of the asset class. Interviews were conducted to solicit stakeholder views on using BTR as an affordable housing product. It provides the foundation to study housing equality from the perspective of the government, which is the main facilitator of affordable housing supply.

3. Methodology

This paper used the constructivist grounded theory methodology (CGT) to investigate Australia's BTR housing model and its closeness to affordable housing. The Australian Government supports the BTR industry, yet this asset class is priced as a premium product; rents are slightly higher than those for BTS apartments. This has opened conversations about the cost of the incentives to the government, specifically if there are any social benefits in the form of affordable rental housing. CGT helps us to understand expert views through inductive reasoning and analysis of these views. The CGT is applied in the housing literature to understand and develop theories on various phenomena [67–69] and is also used in other fields [70–72]. It is appropriate for this research because of the evolving nature of BTR in Australia, where there are a limited number of operational BTR projects and many planned, proposed, and pipeline projects.

In understanding the workings of Australia's emerging BTR industry, exploratory qualitative methods were used to collect the data. A set of leading questions was developed for discussions in semi-structured interviews based on the gaps found in the literature. The interviewees included policy experts, fund managers, property developers, and property companies. The interviewees are stakeholders in Australia's BTR industry through their involvement in BTR development, policy research, or consulting. The policy experts are people in government, academia, and private consultants involved in policymaking, especially in the BTR industry. Experts in academia are academics who have written articles and policy insights on Australia's BTR industry.

The method used for selecting the interviewees was snowball sampling. This method allowed the indexed interviewee to recommend and introduce colleagues and experts within their network connected to the BTR industry in different capacities across the sectors in Australia. The total sample size for the interviews was 20, of which 15 responded and agreed to participate in the study (i.e., $n = 15$), representing a 75% response rate. The interviews were conducted via Microsoft Teams and Zoom apps for an average of 40 min and recorded, transcribed, and exported into NVivo 12 for data analysis. To resolve potential biases with the response rate, two BTR projects were selected by purposive sampling from two Australian states, New South Wales and Victoria, to examine property characteristics that provide an understanding of BTR housing. This helped to compare BTR with affordable housing in the Australian context.

BTR housing is a new form of rental accommodation owned and managed by an institutional investor, with long-term security and extra amenities, while affordable housing

commands no more than 30% of renters' income [14,51]. The study looked at location, services, amenities, infrastructure, the investors behind the projects, lease duration, etc. Only two were chosen for this research because most BTR projects across Australia are proposed, planned, or under construction. BTR projects under construction were excluded because the development may be altered based on the client's change of mind. Nonetheless, the case study projects summarize the product as it operates in Australia. Important information was also sourced from the Australian Property Council, the Australian Property Institute, the *Australian Financial Review* newspaper, the *Urban Developer*, CoreLogic®, and Australian Property Data.

The interview findings were analyzed qualitatively. Following studies by [15,36], the study examined Australia's BTR housing model in light of existing government support. Thematic analysis was adopted in accordance with [73]. The process included familiarization of transcripts, identifying relevant codes, generating initial themes, reviewing the themes, and naming and defining the themes. The themes identified from the NVivo results are discussed to represent the factors that make the BTR asset class affordable or unaffordable in its present form. Two mechanisms were adopted to control for biases and minimize subjectivity. First, the findings were reviewed with peers to ensure they were consistent and coherent with the research question. Second, the interview findings were verified from different data sources for authenticity.

4. Findings and Discussion

Build-to-rent housing is largely perceived as a financial asset rather than an avenue to increase affordable housing. As housing investments evolve from simple buy-sell arrangements to advanced investment vehicles, they are traded on various platforms to generate good returns. The innovative investment vehicles trade housing for profit rather than seeing it as a home. More broadly, this approach depletes the social value of housing, discarding potential avenues to use it as a social investment. This is more common with recent housing models, and a prominent example is BTR. The conversations surrounding BTR are good for knowledge advancement and policymaking. The fact that BTR is seen as a financialized commodity and a potential avenue for social investment is good for every party involved. The former commands more support among stakeholders than the latter. However, financialized BTR is attracting criticism from independent experts and policymakers in terms of the cost of handing out incentives without expecting social investment. Similar sentiments were raised in Australia concerning the government's first-home-buyer grants and the peculiarities of negative gearing, among others. This study used stakeholder views and two BTR projects, A and B, to assess whether they could generate affordable housing outcomes. For this discussion, affordable housing, as defined by the Australian Government, is housing that is appropriate for the needs of moderate-to-low-income households that are priced so that these households can meet living costs, including food, clothing, transport, medical care, etc. The Government mostly provides subsidies to reduce the rents to levels the target group can pay for. Does BTR qualify for affordable housing, given the support the industry is enjoying from the Government?

The findings from this study showed broadly that, although most BTR investors are profit-driven, and the asset itself is set out as a premium product, it has the potential to generate affordable housing outcomes in Australia. Three themes explain BTR as predominantly premium housing, that is housing designed for mid-to-high-income households. The first theme relates to the irony of scaling up affordable housing through BTR. The second explains the role of the inner-city locational attribute of the asset class, and the third theme is the extra facilities and property management services. On the flip side, BTR is not always premium housing, at least not in the Australian sense. Several BTR projects have been developed to offer affordable housing, either in their entirety or as an inclusion, just that the market BTR dominates more than affordable BTR. The differences and similarities between the two pathways are explicated to validate the interview findings.

4.1. The Conundrum of Scalability

It is suggested that BTR cannot meet the affordable housing requirements of mid-to-low-income households in Australia. However, the findings of previous studies by [74] show that the private rental market can play a crucial role in this pursuit. The level of participation depends on the nature of the scheme in question and the Government's policy direction. The arguments about BTR providing the necessary scale for affordable housing are quite paradoxical given the current state of the pipeline and operational projects across the country. By comparing the affordable housing supply gaps in Australia to the BTR apartments coming up, BTR may not be the answer to the supply problem. To assess whether the BTR industry could fill affordable housing supply shortfalls in Australia, Interviewee 9, a policy expert from the industry, stated:

BTR is not affordable housing. Politicians think of BTR as a panacea for affordable housing. It's not that. It's only 175,000 apartments; we are talking about 10.3 million properties in Australia. It's a drop in the ocean to what is needed, and you can't expect institutional investors to prop up the government's inaction on affordable housing. It is an asset class that is no different to commercial and core retail investing. It's like investing in a bridge or a toll road and is not driven to investing in housing. And so, will it provide a solution to Australian affordable housing? No, it won't. It'll go some way to provide another institutional asset class. It's not the panacea for social or affordable housing. It won't even provide the solution to market housing.

(Interviewee 9, policy expert)

The main justification for bringing more institutional investors onto the scene is to foster large-scale rental housing investment. This statement corroborates the findings of [30,31,60,63], which reveal that an institutionalized private rental market is needed to increase the rental stock and promote economies of scale. Comparatively, the scale at which BTS and mum-and-dad landlords will add to the rental stock is far from the capacity of BTR investors. This is largely due to financial constraints and the lack of capacity to develop and manage huge rental projects. BTR is perceived as a better avenue to meet the numbers for affordable rental housing. The challenge is the unfavorable regulatory and fiscal environment. Apart from the recent reforms to reduce land taxes by several states, BTR investors in Australia battle with high land taxes, GST and stamp duty fees, and foreign investor restrictions to get their projects running.

There is a narrative that the BTR industry is a potential substitute for the discontinued National Rental Affordability Scheme (NRAS). However, the asset class in its present form is another institutional asset comparable to commercial and retail assets. This view was expounded by Interviewees 5 and 6, who said that BTR was in a class of its own and could not be compared to any other existing residential asset in Australia. The envisaged benefits of scaling affordable housing supply through BTR do not appear realistic in Australia, at least not in the short term. This notwithstanding, this ideology must not be downgraded as it has proven effective in the U.S. and the U.K., according to the findings of a previous study by [38]. It is a fact that market-rate BTR is increasing the rental stock in Australia, but what of the affordability side of it? Interviewee 6, a policy expert from the industry, stated:

I think there can be a lot more flexibility to allow for larger-scale build-to-rent with the inclusion of affordable housing. And I don't think that's necessarily a government issue. I think it's more the developers who are not picking up on it. For example, a developer can provide one affordable housing dwelling in a 400-unit development. The flexibility on the design may be the cause of the setbacks.

(Interviewee 6, policy expert).

The issue of developers making room for inclusionary housing is an important one. Interviewee 6 believed that developers play a vital role in producing affordable housing.

The challenge is how flexible they are with designing BTR. For instance, how would the outlook of the affordable housing apartments differ from that of the market rate ones? In any case, if all BTR developers adjust their designs and include affordable housing, how many units will be added to the market? This is an important consideration for including affordable housing in BTR developments. Scalability is one of the main reasons why BTR cannot be relied on as affordable housing. What the asset class is churning out in Australia is market-rate rental housing designed for mid-to-high-income households. With the few BTR investors offering affordable housing by inclusion, the numbers may not catch up with market demand. The Queensland Government's pilot BTR scheme, which is designed to offer affordable housing, provides a more-expansive one-go pathway to speed up supply. It could be the most-effective channel for playing the numbers game in this discourse.

4.2. Inner-City Locational Attributes

Conventional knowledge in property valuation teaches that the closer a property is to the central business district (CBD), the more likely it is for that property to generate higher rents. The intense competition for BTR in inner-city areas and its convenience to renters contribute massively to the high rents charged on the asset. Predominantly institutional investors own it, so any arguments against the locational similarities with inner-city social housing projects may not hold. The BTR product, which is currently operating in Australia, thrives on its locational advantage; that is, it is a rental tenure designed and situated in inner-city areas and middle suburbs. It provides proximity to city centers, reduces commuting costs, and lessens the search costs for prospective renters since most of the projects are found within a reasonable radius of the CBD. Interviewees 3, 6, 7, 8, and 10 stated that BTR rents were high because the asset was in prime areas, providing easy access to infrastructure and social amenities. Without government support, reducing the rent could reduce the financial viability of BTR. Interviewee 1, a BTR developer, stated:

So, our project is close to the city, and the rents are set by how we define the market. If we are comparing to the private landlord rental market, which is all we must compare to in Australia at this stage, the rents set above market. And when you look at the UK in the US, they typically sit around 20% above market. There are multiple factors for that. One is that they are brand new buildings, so when we compare them to private landlord rental dwellings in a postcode, you might have 30- to 40-year-old dwellings that you're comparing to. It is not a fair comparison in that sense.

(Interviewee 1, BTR developer)

This same interviewee acknowledged that the intense competition for land in inner-city areas contributes to high land costs, thereby underscoring the need to charge higher rents. The space in inner-city areas is highly limited and competed for by commercial and retail investors. This makes the land acquisition process a daunting one for BTR developers. However, the demand for housing in inner-city areas is generally correspondingly high, especially compared to peripheral areas. This automatically raises the rents charged on BTR in these inner-city areas. The research revealed that the BTR project selected for the study commanded higher rents than other rental units. One of the interesting findings is that investors participated in the project to provide a different "style" of private renting characterized by superior amenities and services. This shift in housing delivery contributes to the high rent charged on the asset class. Interviewees 11 and 5, a policy expert and property manager, stated, respectively:

We've done analysis and found that the rents of initial BTR developments coming up in Sydney is, say, 20% premium to the wider market. One of them, which recently opened last month, is clearly aimed at a premium or an upper end of the market, which is because of the inclusions and where the price points are.

(Interviewee 11, policy expert)

...there's still a lot of confusion about the affordability side of BTR. So, I've spoken to a lot of people who assume BTR is an affordable residential model, but in fact, it's quite a high-end model.

(Interviewee 5, property manager)

This asset class improves the quality of Australia's rental stock massively and promises investors good returns. The views solicited from the interviews show that BTR rents are generally too high to qualify as affordable housing. Figure 1 compares the rents of two BTR projects, A and B, in New South Wales and Victoria from January to August 2023 against the median rents for residential dwellings in the suburbs where these projects are situated. Projects A and B are currently being operated in the market, and the rents presented here are the minimum rents charged for 1-, 2-, and 3-bedroom apartments, respectively.

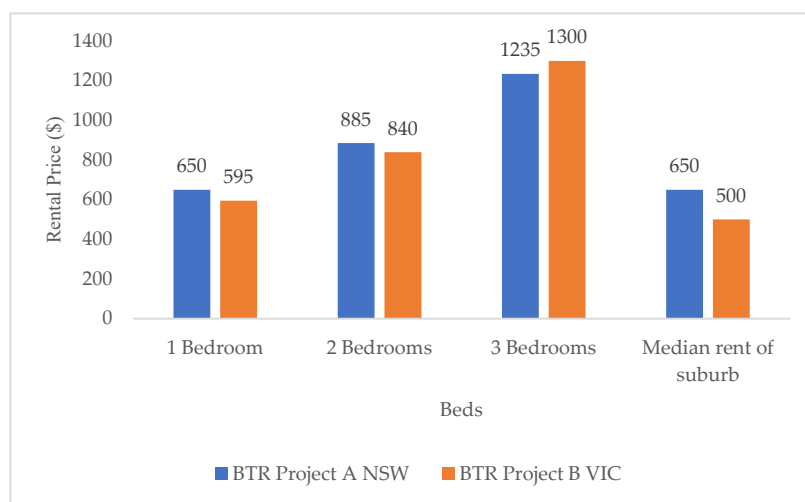


Figure 1. BTR Rents versus Median Rents of Suburbs (Source: CoreLogic 2023).

Figure 1 shows that rents for 1-, 2-, and 3-bedroom apartments were generally higher than the rents charged on other rental properties in the same suburbs, as stated by the interviewees. Except for 1-bedroom apartments, the rent of the 2- and 3-bedroom BTR apartment types were higher than the median rent, to the extent that BTR rents were almost twice that for the 3-bedroom apartment. The BTR buildings were brand new, being relatively new developments compared to most build-to-sell apartments on the market. Although not proven, the rents charged on the current BTR projects in Australia may also be influenced by the happenings in other countries. BTR investors are fond of comparing their projects with those in the U.S. and the U.K. The interviewees acknowledged that the asset class had been successful in those countries and that investors were looking to replicate this success in Australia. In summary, the high rents charged on BTR developments in Australia can be attributed to the inner-city locational attributes. There is increased housing demand in the city, and BTR buildings, apart from being brand-new, are accessible to essential amenities in the CBD. Unless this model is modified, BTR, in its present form, may not accurately qualify as affordable housing.

4.3. Extra Facilities and Property Management Services

BTR provides renters with a wide range of property and facility management services. In property valuation, buildings with more services and finishes are priced higher than those without because they cost more to build and manage. They also address the limitations associated with build-to-sell apartments and mum-and-dad-financed units. The quality services provided offer a certain lifestyle for its target renters. Interviewee 6, a policy expert from the industry, stated:

I understand how they get to look after their residents, and I know that with that rent comes a fully equipped gym, community events planned for the year, multiple people on site, and security on site.

(Interviewee 6, policy expert)

Apart from a gym facility, 24/7 on-site staff, and security personnel, BTR tenants get access to in-built shops and recreational centers, such as a children's playground and a swimming pool. Interviewees also revealed that BTR projects offer easy access to centrally positioned amenities that may not be present within the BTR building itself, for example, schools, hospitals, trains, trams, etc., confirming the conception of BTR as a premium product due to these extra services and facilities. The cost of these services is part of the rent and not paid for separately. Interviewee 1, a BTR developer, stated:

Within build-to-rent, you get a lot of additional things that you don't get in a private rental, especially from us. What we are providing so you get all your appliances included, so your fridge, washing machine, microwave, dryer, and all those things are included, which aren't included in a typical rental. We also pay the water bill and the gas bill for the dwelling. We have zero bonds, so you can move into our apartment without paying a bond.

(Interviewee 1, BTR developer)

Our research also revealed that BTR offers more-secure, long-term leases than others, sometimes between 3 and 5 years, ensuring good security for tenants. Interviewee 1, a BTR developer, stated that BTR tenants enjoy more benefits than tenants in other units, such that the trade-off for the higher rents was justifiably reasonable. The views of industry experts inclined towards the fact that BTR is a novel asset class and must be treated as such, reiterating that the rent charged was a good value for the money for those who could afford it. This presupposes that the target group for BTR may not necessarily belong to the low-income group. The policy experts interviewed raised serious concerns about the high rents of BTR apartments, arguing that the government supported BTR developers through the treasurer's 50% land tax concession. Market surveys revealed that BTR projects in Sydney, Melbourne, and some parts of Brisbane command rents 20% above the market rate, making them more expensive than build-to-sell (BTS) apartments and mum-and-dad units. This is worrying, as the lower end of the market cannot afford to rent in BTR, raising questions about its place in Australia's housing policy.

To steer Australia's housing policy in the right direction, the interviewees revealed some interesting opinions about the evolving asset class. Some perceived BTR from a liberalistic market-driven point of view, while others saw it as a viable option for social investment. From the institutional investor's perspective, this asset class could be remodeled into a financial asset to obtain the benefits of diversification, a thinking that was common among return-oriented investors who wanted to expand their portfolios with fewer correlated assets. In contrast, the housing policy experts viewed BTR as a potential avenue for institutional investors to make social investments such that, while one party was looking at making steady returns, the other was looking at how the asset could be used for social advantage. Interviewee 7, a policy expert from academia, stated:

In the current context, the way BTR is a luxury product, it doesn't make sense to subsidize it. It makes sense to subsidize it only if it's a social affordable product, not when it's a private market luxury product. At what cost will the subsidies for a luxury product affect the cost of subsidies for social and public housing? Even for that matter, subsidies for ownership housing like the First Homeowner Grant and negative gearing are being criticized because it comes at the cost of social housing and public housing. So, we need to be very careful about what we are proposing to make. What kind of BTR, how viable is it, and for whom?

(Interviewee 7, policy expert)

Some level of clarity is required in the discourse on government support to guide the efforts of the Federal and State Governments to boost the BTR industry in Australia. Otherwise, the unconditional support given to the sector could generate perverse incentives detrimental to the well-being of most mid-to-low-income households that rent in Australia. This finding confirms the finding of [32] that government support could have a negative effect, causing further housing inequality in cities. If we suppose that the support given to BTR is left open, albeit without any eligibility conditions, then institutional investors may eventually enrich themselves by developing more high-end apartments for the market, likely exacerbating the already severe housing unaffordability. It is, therefore, important to analyze the investment decision of institutional investors towards the asset class very critically, including, for instance, their opinions on the asset's competitiveness, expectations, and challenges. These steps will clarify the place of BTR within the fabric of the private rental market so that analysts can properly prepare the asset class for valuation, forecasting, and modelling purposes.

Based on the stakeholder views drawn from the interviews, this study found that the asset class is not a suitable pathway for affordable rental housing supply. The research presented the following empirical findings. First, the intention to scale up rental housing supply through BTR is not realistic in the short term, given the unfriendly fiscal and regulatory environment. Second, the inner-city locational attributes of the asset class render it a premium product and far from affordable for most moderate-to-low-income households in Australia. The land acquisition process for a typical BTR developer is daunting, making it impossible to offer the units at or below the market rate. Lastly, BTR provides extra property management services, absent in build-to-sell and mum-and-dad units. The cost of using these services is included in the pricing, raising the rents above the median rents in a typical Australian suburb.

4.4. How Different Is BTR from Affordable Housing?

Two BTR projects, A and B, were selected to identify the property characteristics that differentiate BTR from affordable housing. The developers were interviewed to gather information on the projects. The case study projects were in two states in Australia: New South Wales and Victoria. Affordable housing characteristics were gathered from projects operating under the National Rental Affordability Scheme and from community and public housing providers. Based on the findings from the two approaches, the differences between BTR and affordable housing were identified and compared and are presented in Table 1.

Table 1. Differences between BTR and Affordable Housing.

Affordable Housing	Build-to-Rent
- Designed for mid-to-low-income households. - Mostly provided by community and public housing associations. - Rents are 20% below market rates. - Leases are offered on a short-term basis, usually between 6 and 12 months. - Spread across the city depending on where the project is located. - Does not always provide security of tenure.	- Designed for mid-to-high-income households. - Provided by institutional investors and property developers. - Rents are 20% above market-rate. - Leases are offered on a long-term basis, usually between 3 and 5 years or more. - Usually located in inner-city areas and middle suburbs. - Provides security of tenure (current tenants are given the first choice to renew their leases).

Table 1. *Cont.*

Affordable Housing	Build-to-Rent
• A deposit (bond) may be required prior to occupation. • Managed by a real estate agent/agency or individual investor/landlord. • May or may not provide security services to tenants. • Rent increment is dependent on the conditions given by the facilitator. • Rental units may or may not be fully furnished. • Facilities may not always be present internally, but within the respective neighborhoods.	• No bond is required. • Managed by the institutional investors through 24/7 onsite management staff. • Provides 24/7 security services to tenants. • Limits rent increment to 4%. • Provides fully furnished rental apartments. • Provides internal facilities and amenities such as shops, gym, swimming pool, children's playground, pet services, cinemas, co-working spaces, car park, etc.

Source: interviews and selected BTR projects in NSW and VIC, Australia.

Table 1 presents the BTR asset class as an upgrade of affordable housing in Australia. In addition to being new developments, most BTR projects provide tenants with a high-quality lifestyle and high-quality rental living. As a result, BTR stands on its own as an asset class and is not comparable to other rental tenures in Australia. To suggest that BTR is wholly affordable housing is flawed in many respects, at least in its present form. The luxurious attribute of the asset class reasonably justifies the high rents charged on it. Supporting this sector without eligibility criteria for investors raises certain sentiments about fairness and housing equity. The asset class may rightly be classified as a luxury product, providing the least opportunity to meet the housing requirements of mid-to-low-income households in Australia. Without the required regulatory reforms such as land release and land and withholding tax concessions, profit-oriented institutional investors will likely continue running BTR as a financial asset without considering affordable housing supply. This study found that a crop of affordable BTR projects was coming into the supply chain due to various supporting structures set up by the NSW, VIC, and QLD Governments. These are showing that it is possible to generate affordable housing outcomes with BTR, a view that is contrary to the position of many experts.

4.5. Government Support of Build-to-Rent in Australia

Australia comprises six states, New South Wales (NSW), Victoria (VIC), Queensland (QLD), Western Australia (WA), South Australia (SA), and Tasmania (TAS), and two territories (Australian Capital Territory (ACT) and the Northern Territory (NT)). Since it is the state and territory governments that regulate housing, they have embraced BTR differently and at varying rates, depending on the flow of institutional capital, the number of developments, and the stakeholder discourse to advance the sector. Other factors, such as the short- and long-term needs for rental housing, play a huge role. NSW, VIC, and QLD are progressing quite well with giving incentives to investors and facilitating the sector's advancement. Experts posit that the other states took inspiration from these three to implement similar incentives and closely related support packages. The incentives provided to the BTR industry are meant to produce quality rental accommodation and, more importantly, to ensure that these apartments are affordable. From the policy perspective, there is no point in building rental apartments that are not affordable to most residents, especially given the size of pipeline developments.

Several reforms are required to make BTR affordable. The interview results revealed that various incentives will help to reduce development costs and facilitate approvals for the commencement of BTR projects. Interviewee 8, a policy expert from the industry, stated:

I think that it's all about releasing land for BTR projects. This is where the government can really be engaged. The conversation should be about releasing land in practical locations that are useful to live in. The states will often have land which is well located but not necessarily for open-market residential use. These locations could be good because they are next to train stations and are best for transit-oriented development next to tram stops.

(Interviewee 8, policy expert)

Land release is undoubtedly an essential part of the development process. First, the ideal locations for BTR are predominantly within inner-city areas and, in some instances, middle suburbs. There is normally intense competition among commercial users for inner-city land. Aside from negotiating for the highly priced land in these areas, the initial stage of acquiring land is a challenge to BTR investors. Releasing land for BTR makes this stage easier and faster for developers to get their proposed projects running. The government can also use taxes to boost the BTR industry. Interviewee 10, a government policy expert, stated:

I think the big thing now is that BTR is not an affordable housing solution given the current tax situation. The Managed Investment Trust (MIT), Goods and Services Tax (GST), and land taxes are headwinds contributing to BTR becoming a more market-based product. Land taxes have been resolved in some states. More can be done with the MIT as it puts investors at a disadvantage and ultimately explains why BTR is priced above the market rent.

(Interviewee 10, policy expert).

A managed investment trust (MIT) in Australia is an investment vehicle set up to enable members of the public, including foreign investors, to invest passively in property. However, this study found that the MIT withholding taxes for foreign investors, along with land taxes and GST, is a major disincentive to investors, especially foreign-based ones. The Federal Government has recently reduced the MIT withholding tax for BTR investment after continuous lobbying from different stakeholder groups. Interviewee 10 posited that taxes contribute to the high rents that BTR can command and that the government could make additional reforms, in the form of supply-side incentives, to influence developers to reduce their rental rates in the long run. Figure 2 lists the incentives given to BTR by various state and territory governments.

Through an MIT, the Australian Government provides tax concessions to foreign investors who invest in BTR. Over the years, a 30% withholding tax rate was applied to BTR. This was higher than the 15% charged on other property classes, such as BTS apartments and retail. Through continuous lobbying to reduce the withholding taxes, the Federal Government announced on 9 May 2023 in its budget that the 30% MIT withholding tax for BTR was reduced to 15% from 1 July 2023. This was a major step by the government to attract more foreign capital into BTR. Experts alluded to the MIT withholding tax concerns as being the focus of policy deliberations, describing it as the major point of discussion. The concession targets BTR projects with at least 50 apartments owned by the entity for at least 10 years and offers renters at least 3 years of tenure security.

The government also supports BTR through its National Housing Infrastructure Facility (NHIF), which was established to provide infrastructure support to unlock new housing development. The NHIF can be used for electricity, gas, water, sewerage, stormwater, roads, and telecommunication. Although it is stated that the NHIF is for social and affordable housing, the BTR sector can also benefit from this fund, and this is especially relevant to the BTR affordable housing pathway. To access the NHIF, applicants are required to assess their new housing developments against the conditions of the fund to ensure that all prospective applicants meet the eligibility criteria provided. If successful, the Federal Government provides infrastructure support to developers and BTR investors to unlock new housing at the state level. Finally, the government's role in successfully integrating BTR within the framework of Australia's planning scheme is paramount. Although the planning mechanisms are influenced more at the state level, the Federal Government needs

to coordinate with the State and Territory Governments to ensure consistency. Activities with zoning and granting development permits for BTR developments can be facilitated using special mechanisms.

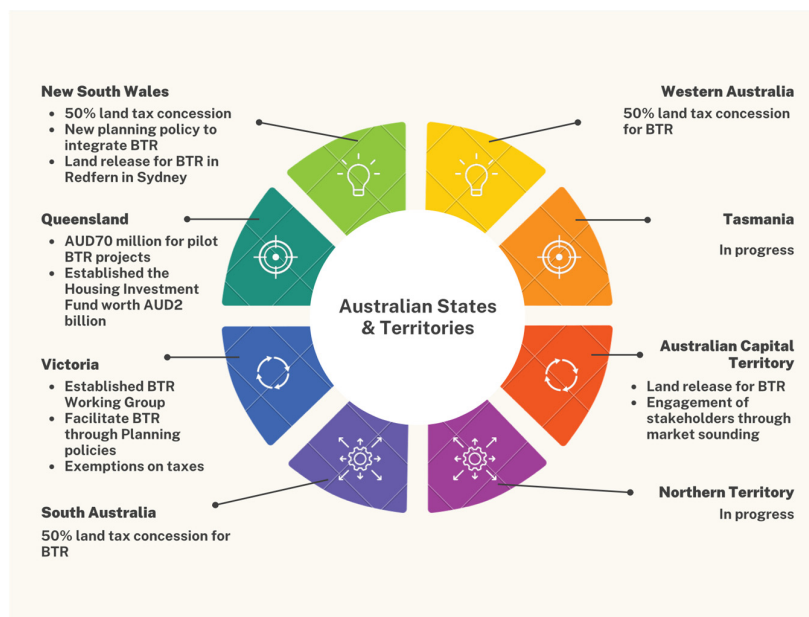


Figure 2. Government Support for BTR in Australia.

The Australian Government's housing policy direction and, for that matter, the support for the BTR industry is positive. The recent reduction in the MIT withholding tax for BTR and other upcoming policies at the state level indicates a commitment to advancing the rental sector. However, stricter requirements, such as forcing BTR developers to include at least 20% affordable housing in their BTR developments, may be the breakthrough point. This is not a new practice, as it has worked well in the U.S., where, prior to development approval, developers are required to include affordable housing in their BTR projects.

4.6. Reflections on BTR and Affordable Housing

Sceptics have given all the reasons why BTR housing cannot be viewed as an answer to affordable housing gaps in Australia. Indeed, based on the intrinsic characteristics of BTR, it is different from affordable housing. Australia's housing market is full of market BTR (mBTR) with little affordable BTR (aBTR). This study interviewed three broad stakeholder groups, namely seven policy experts (Interviewees 3, 5, 6, 7, 8, 9, 10, and 11), five institutional investors (Interviewees 2, 12, 13, 14, and 15), and two property developers (Interviewees 1 and 4). As we advance towards bridging affordable housing supply gaps, the two options of mBTR and aBTR must be accurately defined and differentiated based on the product offered and the target group for which these projects are designed. Like MFH in the U.S., Australia must be more intentional about producing aBTR for mid-income households, especially for young professionals and public servants, including teachers, nurses, doctors, bankers, etc. The support package for BTR developers could be instituted to meet terms and conditions or eligibility criteria before investors benefit from the available incentives. This viewpoint will likely attract much criticism, especially from ideologists who promote market-driven rental properties. Of course, market BTR is also important for the high end of the renters' spectrum. The perception of Australia's BTR industry, as portrayed by most industry reports, holds much optimism for investors, but its position within the framework of the housing market is not completely understood. Currently, it is viewed as a financial asset from the investor's perspective and a social asset from the housing policy perspective.

This study demonstrated that the BTR business model in Australia is predominantly market-designed. The explanation for this is that, first, before institutional investors can obtain their required risk-adjusted returns, they must price the rent in accordance with the amount invested, confirming the finding of previous studies by [27] that the returns generated are important to institutional investors. The ultramodern facilities and amenities provided, as well as the high land prices in inner-city locations, contribute to the overall cost of construction. Furthermore, the fiscal and regulatory environment also adds to the development cost. In addition, according to the definition of affordable housing in Australia, it is almost impossible for institutional investors to provide affordable housing on the expected scale, given these factors. Earlier studies in Australia and other countries, such as the findings of [9,15,38], have proven that, with the right reforms and engagement, profit-driven investors can provide affordable housing. Indeed, three institutional investors in Australia have embraced the idea of including affordable BTR in their developments. It has also been demonstrated that government pilot projects for aBTR are an important pathway to scaling up affordable rental housing supply in Australia.

5. Conclusions

There is a preconceived idea that Australia's build-to-rent housing model is a premium product, meaning it is a high-end housing model designed mostly for mid-to-high-income earners. This presumption is based on institutional investors' profit-driven business model and their unwillingness to take the acceptable risk of investing in affordable housing. However, some have also posited that BTR investors should produce affordable housing given the support they enjoy from the government. This study examined whether BTR could be used as an avenue for affordable housing supply. Expert views were solicited from 15 major stakeholders in Australia's BTR sector. Although the position of the expert, that is whether a private consultant, developer, or policymaker, is likely to influence their view on BTR, their views presented interesting contributions to the affordable housing debate. For instance, given the exposure to return-driven investments, private consultants are likely to view BTR as a premium product, while policymakers are likely to go on the tangent of affordable housing. Nonetheless, the ingredients of their arguments were analyzed and discussed in this study. To minimize biases and increase the reliability of the findings, selected operational BTR projects across the country were inspected and examined against the interview findings to reach the conclusions expressed here.

Based on expert views and selected BTR projects being operated across Australia, the study concluded that BTR, in its present form, is predominantly a premium housing product. It found that the rental price sits above the median rental price of rental apartments in Australia and, therefore, cannot be completely relied on as a substitute for affordable rental housing. BTR pricing is influenced by its inner-city locational attributes, ultramodern facilities and services, and the newness of the buildings. Developers also state that they consider the trends in the U.S. and U.K. markets to set the rents. At the time of this empirical study, three major BTR developers in Australia had included affordable housing in their projects. We concluded that, given the right structures and additional reforms, the pathway for affordable BTR is also possible in Australia. Furthermore, state-led affordable BTR is also possible, as demonstrated in the Queensland Government's pilot BTR projects, which are expected to deliver close to 490 affordable housing apartments in the first round of approvals. The various state and territory governments must arrange a special package for affordable BTR for mid-to-low-income households. The additional reforms include releasing designated land, implementing more land tax concessions, reducing the MIT withholding tax for BTR further, and using planning instruments to remove delays in development approvals. Just like the U.S. and U.K., BTR developers who want to enjoy these benefits must be compelled to include 20%, 30%, and 50% affordable housing in their BTR developments, depending on the specific locations in which these apartments are needed. Although market BTR must be given support to remain an integral part of Australia's private rental market, affordable BTR requires additional attention to respond to

the housing needs of young adults in Australia [7]. With the right reforms, affordable BTR could be used as an avenue for bridging the affordable housing supply gaps in Australia.

6. Limitations and Recommendations for Further Research

The major challenge with this study was the limited track record of BTR in Australia, a consequence of the limited number of completed projects in the country. As the market becomes more saturated and more transactional data are gathered, a comprehensive analysis of BTR projects can be conducted. The paper recommends a study to analyze BTR rents against household incomes and neighborhood characteristics in accordance with the Housing Affordability Index of Australia.

Author Contributions: Conceptualization, S.S.-I.; methodology, S.S.-I. and X.J.G.; software, S.S.-I.; validation, S.S.-I., X.J.G. and V.M.; formal analysis, S.S.-I. and X.J.G.; investigation, S.S.-I.; resources, S.S.-I.; data curation, S.S.-I.; writing—original draft preparation, S.S.-I.; writing—review and editing, X.J.G. and V.M.; visualization, S.S.-I.; supervision, X.J.G. and V.M.; project administration, X.J.G. and V.M.; funding acquisition, S.S.-I., X.J.G. and V.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research would not have been possible without the funding given by the University of Technology Sydney, Australia.

Data Availability Statement: Data cannot be shared due to privacy or ethical restrictions.

Acknowledgments: We acknowledge all the stakeholders in Australia's BTR sector who participated in the interviews, including those from the industry, academia, and government. We also acknowledge the support from the School of Built Environment of the University of Technology, Sydney, Australia.

Conflicts of Interest: The authors declare no conflict of interest except that one of the co-authors of this article is a Guest Editor of the Journal.

References

1. Glaeser, E.L. Rethinking the federal bias toward homeownership. *Cityscape* **2011**, *13*, 5–37. [CrossRef]
2. Green, R.K. Thoughts on rental housing and rental housing assistance. *Cityscape* **2011**, *13*, 39–55. [CrossRef]
3. Hatcher, C. Globalising homeownership: Housing privatisation schemes and the private rental sector in post-socialist Bishkek, Kyrgyzstan. *Int. Dev. Plan. Rev.* **2015**, *37*, 467–486. [CrossRef]
4. Abidoeye, R.; Ayub, B.; Ullah, F. Systematic literature review to identify the critical success factors of the build-to-rent housing model. *Buildings* **2022**, *12*, 171. [CrossRef]
5. Henderson, J.; Mardiamso, D.; Milou, C.; Racki, E. *The Evolution of Build-to-Rent: Unlocking the Opportunity in Australia*; Research Report; Colliers: Sydney, Australia, 2021; pp. 1–56.
6. Lawson, J.; Berry, M.; Milligan, V.; Yates, J. Facilitating investment in affordable housing—Towards an Australian model. *Hous. Financ. Int.* **2009**, *24*, 18–26.
7. Abidoeye, R.B.; Ge, J.; Ahiadu, A.A.; Adilieme, C.M.; Swanzey-Impraim, S. Perceptions of Young Adults on the Critical Success Factors of the Build-to-Rent Housing Model in Sydney, Australia. *Buildings* **2023**, *13*, 1892. [CrossRef]
8. Della Croce, R.; Yermo, J. Institutional Investors and Infrastructure Financing. OECD Working Papers on Finance, Insurance and Private Pensions. 2013, pp. 1–34. Available online: <https://www.oecd-ilibrary.org/content/paper/5k3wh99xgc33-en> (accessed on 15 May 2021).
9. Gilmour, T.; Milligan, V. Stimulating institutional investment in affordable housing in Australia: Insights from the US. In Proceedings of the Australasian Housing Researchers' Conference, Melbourne, Australia, 18–20 June 2008.
10. Pawson, H.; Martin, C.; Van Den Nouwelant, R.; Milligan, V.; Ruming, K.; Melo, M. *Build-to-Rent in Australia: Product Feasibility and Potential Affordable Housing Contribution*; Landcom: Sydney, Australia, 2019; pp. 1–118.
11. Rahman, M.M. The Australian housing market—Understanding the causes and effects of rising prices. *Policy Stud.* **2010**, *31*, 577–590. [CrossRef]
12. Reddy, W. Alternative assets—a new challenge to property? An analysis of superannuation funds. *Pac. Rim Prop. Res. J.* **2016**, *22*, 127–143. [CrossRef]
13. CBRE. Australian Viewpoint: Build-to-Rent Development Pipeline. Available online: <https://www.cbre.com.au/insights/viewpoints/australia-viewpoint-btr-development-pipeline> (accessed on 15 May 2022).
14. CBRE. Build-to-Rent in the Regions. Available online: <https://www.cbre.com.au/insights/reports/pacific-major-report-build-to-rent-in-the-regionspart-3-its-going-to-happen> (accessed on 15 May 2022).

15. Acheampong, P.; Earl, G. Can build-to-rent generate affordable housing outcomes? A whole-life costing approach to investment analysis. *Account. Financ. Res.* **2020**, *9*, 85–108. [CrossRef]
16. EY. Multifamily Housing Will You Seize the First Mover Advantage. Report. Available online: https://assets.ey.com/content/dam/ey-sites/ey-com/en_au/topics/real-estate-hospitality-and-construction/multifamily-housing-will-you-seize-the-first-mover-advantage-report.pdf (accessed on 20 May 2022).
17. Cranston, M. Build to Rent a Key for Australian Housing Affordability. The Australian Financial Review. 2017. Available online: https://www.nahpl.org.au/uploads/2/4/3/3/24335326/build_to_rent_a_key_for_australian_housing_affordability.pdf (accessed on 31 July 2023).
18. Nethercote, M. Build-to-rent and the financialization of rental housing: Future research directions. *Hous. Stud.* **2020**, *35*, 839–874. [CrossRef]
19. Rogaris, N.; Young, A. Continuing the build-to-rent conversation in Australia. *Tax. Aust.* **2020**, *55*, 260–264.
20. Bangura, M.; Lee, C.L.; Schafer, B. The Unintended Consequences of COVID-19 Economic Responses on First Home Buyers? Evidence from New South Wales, Australia. *Buildings* **2023**, *13*, 1203. [CrossRef]
21. Lin, Y.C.; Lee, C.L.; Newell, G. The significance of residential REITs in Japan as an institutionalised property sector. *J. Prop. Invest. Financ.* **2019**, *37*, 363–379. [CrossRef]
22. Swanzy-Impraim, S.; Ge, X.J.; Mangioni, V. Barriers to institutional investment in rental housing: A systematic review of market risks. *Int. J. Real Estate Stud.* **2021**, *15*, 1–15. [CrossRef]
23. Bierre, S.; Howden-Chapman, P.; Signal, L. ‘Ma and Pa’ landlords and the ‘risky’ tenant: Discourses in the New Zealand private rental sector. *Hous. Stud.* **2010**, *25*, 21–38. [CrossRef]
24. Lazarowich, M. *Granny Flats as Housing for the Elderly: International Perspectives*; Psychology Press: Philadelphia, PA, USA, 1991; Volume 7.
25. Priemus, H. Commercial rented housing: Two sectors in the Netherlands. *J. Hous. Built Environ.* **1998**, *13*, 255–277. [CrossRef]
26. Priemus, H.; MacLennan, D. The different faces of private rented housing. *Neth. J. Hous. Built Environ.* **1998**, *13*, 197–204. [CrossRef]
27. Newell, G.; Lee, C.L.; Kupke, V. *The Opportunity of Residential Property Investment Vehicles in Enhancing Affordable Rental Housing Supply*; AHURI Positioning Paper No. 166; Australian Housing and Urban Research Institute: Melbourne, Australia, 2015; Volume 2015-May, pp. 1–53.
28. Berry, M. Investment in rental housing in Australia: Small landlords and institutional investors. *Hous. Stud.* **2000**, *15*, 661–681. [CrossRef]
29. Li, W.; Rhee, G.; Wang, S.S. Differences in herding: Individual vs. institutional investors. *Pac.-Basin Financ. J.* **2017**, *45*, 174–185. [CrossRef]
30. Markowitz, H.M. Individual versus institutional investing. *Financ. Serv. Rev.* **1991**, *1*, 1–8. [CrossRef]
31. Montezuma, J. A survey of institutional investors’ attitudes and perceptions of residential property: The Swiss, Dutch and Swedish cases. *Hous. Stud.* **2006**, *21*, 883–908. [CrossRef]
32. Montezuma, J.; Gibb, K. Residential property as an institutional Asset: The Swiss and Dutch cases. *J. Prop. Res.* **2006**, *23*, 323–345. [CrossRef]
33. Gilbert, A. Rental housing: The international experience. *Habitat Int.* **2016**, *54*, 173–181. [CrossRef]
34. Brill, F.; Durrant, D. The emergence of a build to rent model: The role of narratives and discourses. *Environ. Plan. A Econ. Space* **2021**, *53*, 1140–1157. [CrossRef]
35. Hardman, J. How to value build to rent. *Prop. J.* **2018**, 40–41. Available online: <https://www.proquest.com/docview/2230834844?pq-origsite=gscholar&fromopenview=true> (accessed on 31 July 2023).
36. Scanlon, K.; Williams, P.; Blanc, F. Build to Rent in London: A Report for the University of New South Wales and NSW Landcom. 2018. Available online: <http://eprints.lse.ac.uk/id/eprint/106241> (accessed on 14 April 2022).
37. Bradley, D.S.; Nothaft, F.E.; Freund, J.L. Financing multifamily properties: A play with new actors and new lines. *Cityscape* **1998**, *4*, 5–17. [CrossRef]
38. Bratt, R.G. Affordable rental housing development in the U.S. for-profit sector: Implications of a case study of McCormack Baron Salazar. *Hous. Policy Debate* **2018**, *28*, 489–514. [CrossRef]
39. Chakraborty, A.; Knaap, G.J.; Nguyen, D.; Shin, J.H. The effects of high-density zoning on multifamily housing construction in the suburbs of six US metropolitan areas. *Urban Stud.* **2010**, *47*, 437–451. [CrossRef]
40. Ottensmann, J.R. Multifamily Housing in Large Urban Areas in the US, 1970–2010. 2020. Available online: <https://ssrn.com/abstract=3742386> (accessed on 14 April 2022).
41. Russell, J.N. Multifamily housing characteristics and tenant satisfaction. *J. Perform. Constr. Facil.* **2007**, *21*, 472–480. [CrossRef]
42. Harvard Joint Center for Housing Studies. *America’s Rental Housing*; Harvard University Cambridge: Cambridge, MA, USA, 2017.
43. Fields, D.; Uffer, S. The financialisation of rental housing: A comparative analysis of New York City and Berlin. *Urban Stud.* **2016**, *53*, 1486–1502. [CrossRef]
44. Cummings, J.L.; DiPasquale, D. The low-income housing tax credit: An analysis of the first ten years. *Hous. Policy Debate* **1999**, *10*, 251–307. [CrossRef]
45. Leviner, S. Affordable housing and the role of the low income housing tax credit program: A contemporary assessment. *Tax Lawyer* **2003**, *57*, 869–904.

46. McClure, K. Low-income housing tax credits. In *International Encyclopedia of Housing and Home*; Smith, S.J., Ed.; Elsevier: Amsterdam, The Netherlands, 2012; pp. 180–185. [CrossRef]
47. Antoniadou, H. Housing Affordability in Australia: The National Rental Affordability Scheme v. Public Housing and Welfare Programs. In Proceedings of the 19th Annual Asian Real Estate Society Conference, Gold Coast, Australia, 13–16 July 2014; pp. 1–11.
48. Australian Government. National Rental Affordability Scheme Act 2008. (Legislative Instrument no. 232, 2008 as Amended). Australia. 2014. Available online: <https://www.legislation.gov.au/Details/F2014C01091> (accessed on 12 March 2021).
49. Cohen, D.P. Improving the Supply of Affordable Housing: The Role of the Low-Income Housing Tax Credit. *J. Law Policy* **1997**, *6*, 537–570.
50. Wood, G.; Watson, R.; Flatau, P. Low income housing tax credit programme impacts on housing affordability in Australia: Microsimulation model estimates. *Hous. Stud.* **2006**, *21*, 361–380. [CrossRef]
51. Friedman, R.; Rosen, G. The challenge of conceptualizing affordable housing: Definitions and their underlying agendas in Israel. *Hous. Stud.* **2019**, *34*, 565–587. [CrossRef]
52. Alakeson, V. *The Challenges of Build to Rent for UK Housing Providers*; Resolution Foundation: London, UK, 2013.
53. Bate, A. *Building the New Private Rented Sector: Issues and Prospects (England)*; Briefing Paper; SN07094; House of Commons Library: London, UK, 2015; Volume 12.
54. Ronald, R.; Kadi, J. The revival of private landlords in Britain's post-homeownership society. *New Political Econ.* **2018**, *23*, 786–803. [CrossRef]
55. McLean, S. Average Age of Aussie First-Home Buyers Closer to 40 than 20, Research Reveals. 2020. Available online: [Realestate.com.au](https://www.realestate.com.au) (accessed on 17 July 2023).
56. British Property Federation. Who Lives in Build-to-Rent? An Analysis of Build-to-Rent Occupancy in London. 2022, pp. 1–17. Available online: https://bpf.org.uk/media/4976/lfr_report_buildtorent_250322.pdf (accessed on 12 August 2023).
57. Kemp, P.; Rhodes, D. The motivations and attitudes to letting of private landlords in Scotland. *J. Prop. Res.* **1997**, *14*, 117–132. [CrossRef]
58. Montgomerie, J.; Büdenbender, M. Round the houses: Homeownership and failures of asset-based welfare in the United Kingdom. *New Political Econ.* **2015**, *20*, 386–405. [CrossRef]
59. Wijburg, G.; Aalbers, M.B.; Heeg, S. The financialisation of rental housing 2.0: Releasing housing into the privatised mainstream of capital accumulation. *Antipode* **2018**, *50*, 1098–1119. [CrossRef]
60. Wijburg, G.; Waldron, R. Financialised privatisation, affordable housing and institutional investment: The case of England. *Crit. Hous. Anal.* **2020**, *7*, 114–129. [CrossRef]
61. Gorbachevskaya, E.Y.; Gimelshtein, I.V. Institutional rental housing market—New approaches and formats. *IOP Conf. Ser. Earth Environ. Sci.* **2021**, *751*, 012147. [CrossRef]
62. Rakodi, C. Housing markets in third world cities: Research and policy into the 1990s. *World Dev.* **1992**, *20*, 39–55. [CrossRef]
63. Smith, L.B.; Rosen, K.T.; Fallis, G. Recent developments in economic models of housing markets. *J. Econ. Lit.* **1988**, *26*, 29.
64. Wilkinson, M.; Russel, R.R. *Microeconomics: A Synthesis of Modern and Neoclassical Theory*; Halsted Press: New York, NY, USA, 1979.
65. Newell, G.; Marzuki, M.J. The emergence of student accommodation as an institutionalised property sector. *J. Prop. Invest. Financ.* **2018**, *36*, 523–538. [CrossRef]
66. van Loon, J.; Aalbers, M.B. How real estate became 'just another asset class': The financialization of the investment strategies of Dutch institutional investors. *Eur. Plan. Stud.* **2017**, *25*, 221–240. [CrossRef]
67. Browne, G.; Courtney, M. Housing, social support and people with schizophrenia: A grounded theory study. *Issues Ment. Health Nurs.* **2005**, *26*, 311–326. [CrossRef] [PubMed]
68. Chang, J.S. The docent method: A grounded theory approach for researching place and health. *Qual. Health Res.* **2017**, *27*, 609–619. [CrossRef]
69. Liu, X.; Zhou, J.; Xue, Y.; Qian, S. Analysis of property management ecological behavior in China based on the grounded theory: The influencing factors and the behavior model. *J. Clean. Prod.* **2019**, *235*, 44–56. [CrossRef]
70. Charmaz, K. *Constructing Grounded Theory: A Practical Guide through Qualitative Analysis*; Sage: London, UK, 2006.
71. Chen, S.-I.; Brown, J.W.; Mefford, L.C.; de La Roche, A.; McLain, A.M.; Haun, M.W.; Persell, D.J. Elders' decisions to enter assisted living facilities: A grounded theory study. *J. Hous. Elder.* **2008**, *22*, 86–103. [CrossRef]
72. Douglas, D. Inductive theory generation: A grounded approach to business inquiry. *Electron. J. Bus. Res. Methods* **2003**, *2*, 47–54.
73. Clarke, V.; Braun, V.; Hayfield, N. Thematic analysis. In *Qualitative Psychology: A Practical Guide to Research Methods*; Sage: New York, NY, USA, 2015; pp. 222–248. [CrossRef]
74. Jacobs, K.; Natalier, K.; Berry, M.; Seelig, T.I.M.; Slater, M. Band-aid or panacea? The role of private rental support programs in addressing access problems in the Australian housing market. *Hous. Stud.* **2007**, *22*, 901–919. [CrossRef]

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Article

Perceptions of Young Adults on the Critical Success Factors of the Build-to-Rent Housing Model in Sydney, Australia

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Abstract: Amid Australia's surging house prices, rental housing has become the safety net for young adults experiencing housing stress. The attention of policymakers is drawn towards the build-to-rent (BTR) housing model, a growing housing option for many young Australian adults. Although BTR's integration into Australia's housing and planning landscape is unfolding, the perception of young adults is lacking in policy reforms for this growing industry. This study examines the perspectives of young adults aged 18 to 34 years on the critical success factors (CSFs) of the BTR housing provision in Australia. The responses are analysed using an explanatory factor analysis, relative importance index, and ANOVA. Our findings show a critically low awareness of BTR among young adults in Australia. Respondents, between 18 and 24 years, are most concerned with public awareness, an indication of their desire for transparency and engagement in decision making at the policy level. Young adults rank regulation and government policy interventions as the most important CSF of BTR housing. This shows that they are more concerned about the affordability of BTR houses. This study concludes that young adults' viewpoints on BTR are important in ongoing policy reforms. There is a need to ensure that this asset class is accessible and affordable to this target group.

Keywords: build-to-rent; affordable rental housing; critical success factors; young adults; Australia

1. Introduction

A home can be viewed through many lenses, as a shelter, physical structure, or private refuge, or as a matter of self-identity and a social and cultural unit [1]. However, despite the importance of home ownership, young people across different nations generally face a low prospect of accessing the housing market [2–5]. This low prospect for young people in accessing the housing market has been attributed to social and economic factors such as unaffordable housing prices, insufficient income, and access to finance [2,5]. In places such as Australia, which is a predominantly home-ownership country, there are issues of shortage in housing supply [6,7]. Hence, young people in Australia are turning to alternative options for accessing housing, such as the build-to-Rent (BTR) housing model [8] and staying with parents [9,10], among other options.

The percentage of homeowners in Australia is above the average mark of the ownership hierarchy of most countries. According to the 2021 population and housing census, 67 per cent of Australian households are homeowners, while 37 per cent are renters [11]. Among the population, 83.5% of those aged between 15 and 24 and 55% of those aged between 25 and 34 are in the rental market [11]. This distribution is, however, expected to change in the coming years as the country experiences acute demographic changes and as house prices continue to surge high. Experts project that the number of households

seeking rental accommodation in Australia will increase [4,5,12,13]. Just like many advanced countries, Australia's urban residents are experiencing the effects of rising house prices. The rental sector often provides an alternative for households priced out of the homeownership market to access decent housing [14,15]. The conglomeration of Australia's population in its big cities seems to heighten the demand for housing [16–18]. Additionally, the government's migration policies continue to attract talented young professionals from around the world [18]. Unfortunately, the channels to match the growing housing demand with adequate supply remains limited across private and public actors.

The peculiar housing supply challenges in Australia relate to the limited financial capacity of individual investors and the absence of affordable rental housing programs [19–21]. A well-balanced housing market is needed to meet the housing needs of the young adults living and working in middle suburbs and inner-city areas. The build-to-rent (BTR) housing model, a new institutional asset class in Australia, is a promising avenue for providing rental housing on a massive scale [22]. In Q4 2022, 3800 BTR housing units were completed in Australia, with a further 8400 units in the pipeline [23]. The pace at which BTR is advancing has inspired experts to draw linkages between institutional investors and the affordable rental housing supply in Australia [24–27]. However, there is no clear evidence on whether the asset class could help meet the housing shortfalls [28–30]. Although the literature on Australia's BTR housing industry is growing, not many empirical studies have been conducted on the operational aspect of the asset class. Perhaps this is due to the lack of a track record of the asset class in Australia. Brill and Durrant [31] posited that the trajectory of extant literature presumes a blanket consensus on the proclivity of the asset class to affordable housing. Understanding the perspectives of the target group in question is critical to shaping the government's policy outcomes and interventional initiatives towards the BTR housing industry.

The prospective BTR housing renters, in this case Australian young adults, hold their view on the ongoing discourse on making BTR work in Australia. Abidoye et al. [8] reviewed the relevant studies to identify the critical success factors (CSFs) of the BTR housing model. The common themes in the CSFs are important to Australian young adults as rising house prices often affect this section of the population. Going forward, Australian governments at different levels are deliberating on the incentives for BTR investors across various states to help provide affordable BTR housing units. In doing so, the perception of young adults about the CSFs is relevant in the discussions in Australia. This paper is one of the first empirical studies measuring the awareness of Australian young adults on BTR and identifies which of the CSFs is most important to them. This paper fills this gap by contributing to the understanding of BTR in the Australian context. It sets a fundamental basis for policy reforms and implementation from the perspective of the prospective tenants to guide the distribution of government support for the BTR housing industry. This discourse is particularly important following the COVID-19 era, which was characterised by intermittent lockdowns, property inspection restrictions, and regulated mobility within the local government areas in Australia. The impact of these directives on property owners and renters across the country is vast [32,33].

2. Literature Review

Rental housing has been proposed as a beneficial solution for young people in urban areas, on account of the flexibility and affordability it offers. Given growing housing affordability concerns across the globe, rental housing can contribute to sustainable and inclusive cities to support the evolving needs of younger generations [34,35]. The alarming trend of housing affordability and the increasing challenge for young adults to afford homeownership has ignited scholarly discussions in numerous countries worldwide, e.g., Castro Campos et al. [36] in Hong Kong, Lux et al. [37] in Czech Republic, Ronald et al. [38] in Netherlands, and Vangeel et al. [39] in Europe.

The most recent dispositions have attempted to relate BTR to the same target group, most of whom fall within the category of mid-to-low-income households. This review

provides an outlook on the potential use of the emerging BTR asset class to serve Australian young adults. Globally, the private rental sector has been encouraged in some countries as an avenue for achieving policy goals, including addressing housing affordability issues, increasing the housing stock, and reducing pressure on public housing [7,26,40]. In many countries, the rental tenure has attracted a lot of funding in private investment [19,40,41]. For instance, rental housing investment in Australia recorded a 25% increase from 1996 to 2011 [19]. Apart from the increased private investment, the sector has aroused massive interest among policy advocates who envisage a futuristic orientation of the tenure, especially in urban settings. More enquiries are being made into using the sector to achieve specific housing policy outcomes. Although the BTR housing model is novel in Australia, it provides several pathways to assess the likelihood of serving young adults with high-quality rental accommodation in the country's big cities.

The provision of affordable housing in Australia aims to ensure the welfare of its young population [42]. Aside from the numerous propositions to alleviate housing-related poverty among the mid-to-low-income groups, this concept is recalibrated to reflect the needs of young adults [43,44]. The recurrent debates and challenges of housing affordability and housing supply issues demonstrate how these discussions are in Australia [7,41]. Over the years, access to home ownership has declined among young Australians in the following age groups: 15 to 24, 25 to 34, and 35 to 44 years [9,45–47]. Chia and Erol [9], citing data from the Household Income and Labour Dynamics in Australia (HILDA) 2017 survey, reported that home ownership for young persons aged 25 to 34 declined significantly from 52.2% to 29.2% between 1996 and 2014. Furthermore, Burke et al. [48] project a decline in Australia's homeownership rate by 2040.

The rental market in Australia is generally viewed as strong, despite localised variances across states and persistent challenges of affordability and supply of low-rental homes [49–51]. However, the rental market is not affordable to many young adults [52]. The Australian Institute of Health and Welfare (AIHW) reported that 28% of Australian residents aged 15 to 24 years experienced acute housing stress due to living in low-income households; this was most experienced by residents in the major cities [49]. In most countries, young people are more likely to face housing stress than the older population [53]. Depending on the social structure, young people are either commencing their careers and renting or have successfully secured a mortgage to buy their first home. Policies to expand affordable rental housing will likely benefit young people more than any other group. The BTR housing model has, therefore, become a major area of focus for government intervention to promote access and affordability. Though, there exists a note of caution, as pointed out by Borgesen [54]: housing interventions targeting the supply side of the housing market tend to present indirect effects.

Build-to-Rent: A Nexus for Affordable Housing

BTR is a new form of private renting categorised as a commercial asset rather than residential [22,55]. Due to its hybrid nature, it is mostly perceived as a revenue-generating asset, not as a home [31]. Concerning its theorisation, scholars present it to reflect the needs of the specific stakeholder involved. For instance, an institutional investor is likely to view BTR as a financial asset, but from the perspective of policymakers, it will be expected to generate social investment returns. The literature covers wide-ranging areas across different countries, including the understanding of the asset class, assessing its financial viability, examining government intervention models, and exploring the barriers [8,26,28,56–58]. A more forward-thinking school of thought discusses it in the light of an affordable housing provision [30,59–61]. The current conceptualisation raises questions about using it as a panacea for affordable housing. This is, however, not far-fetched, as countries such as the US and UK hold a significant proportion of rental investment in their multifamily housing sectors [62].

In the US, BTR, also known as multifamily housing (MFH), has existed since the 1960s [34,63]. It serves as an alternative investment to institutional investors, making up

43% of the total rental stock in the country [64]. Through government incentives, MFH has provided a considerable amount of affordable rental housing in the US. The UK has also had a decent track record, although not as progressive as the US. The UK government has committed billions of British pounds to the BTR housing industry to help augment the efforts to advance the private rental sector [65,66]. Again, the contribution of BTR to the UK's private rental sector in terms of stock is significant. Like Australia, the ongoing deliberations concern a better understanding of the asset class, specifically the dynamics to adequately integrate it into the planning framework and implement the right incentives to spearhead an affordable housing supply.

There are various mechanisms previously adopted or proposed in the literature to advance the BTR industry worldwide [31,67]. These mechanisms serve as a blueprint for countries that are transitioning to a full adoption of the BTR housing model. These interventions range from instituting measures to attract greater institutional investment from private actors to reforming government interventions to cushion investors' activities while supporting renters. Worldwide, BTR thrives on some general practices which reflect several success factors in countries with advanced BTR sectors. These factors are grouped and discussed in this article.

One important consideration for the advancement of BTR is the various sources of finance. BTR has attracted private finance from institutional investors such as pension funds, private equity funds, and developers [61,65]. Not-for-profit organisations are also switching to profit-oriented motives by including private investments in the private rental sector [68]. Given the growing research on the factors that will transform BTR, the perspective of Australia young adults is essential. Abidoye et al. [8] identified and ranked 32 CSFs for BTR from a review of peer-reviewed articles. Eleven of these factors were identified as prominent based on their normalised scores and are presented in Table 1.

Table 1. Selected Critical Success Factors for BTR.

S/No	Critical Factors
1	Investors and Developers' Interest and Willingness
2	Affordability/Lower Housing and Living Costs and Taxes
3	Housing Reforms and Awareness
4	Private Rental Options
5	Regulatory Regimes and Policies
6	Financialisation/Country's Economy
7	Different Financing Models
8	Social Housing
9	Social Relations and Cultural Bounds
10	Rental Loans and Mortgages
11	Land Use Planning and Allocations

Source: Abidoye et al. [8].

From the foregoing, the Australian BTR industry is nascent [30]. There is gradual improvement and efforts from the government and investors to advance the BTR housing industry. This study examines the CSFs from the point of view of young Australians.

3. Materials and Methods

3.1. Materials

This study adopts a quantitative research approach to investigate the perceptions of young adults on the CSFs of the BTR housing model in Australia. It contributes to policy reforms on increasing the affordable rental housing supply through the BTR housing model, a relatively new asset class. The views of young adults on the CSFs are required to improve the BTR industry and expand the affordability of BTR. This study adopted online surveys as they allow respondents the ease of completing the questionnaire at a time of their convenience [69,70]. The online questionnaire survey was designed and administered on the University of New South Wales's Qualtrics platform. The respondents were chosen

based on defined criteria informed by the literature. The respondents' ages range between 18 and 34 years, and all are Australian citizens or permanent residents currently living in Sydney, Australia.

The online questionnaire link was sent to the email address of the respondents. The data collection lasted for 2 months. After this period, a total of 74 participants filled the questionnaire. The initial responses were screened to exclude incomplete responses, which was found to be 41. The remaining 33 respondents correctly completed the survey, providing the requested information on their demographic profiles, awareness of the BTR housing model, and opinions on the CSFs they consider most important. Acknowledging the limited valid sample size compared to the whole population of the young adult demographic in Sydney, Australia, we aim to explore these diverse perceptions and thus generate initial insights on an under-researched significant topic that is becoming particularly critical as housing affordability concerns increase. Additionally, the relatively low number of respondents is also prevalent in other quantitative studies on property markets [70]. This does not invalidate the authenticity of our findings since a sample size of more than 30 respondents is deemed sufficient for statistical analysis as it meets the requirement of the central limit theorem, i.e., at least 30 [71]. Furthermore, the prevalence of low sample sizes in similar studies investigating phenomena in the property market is not uncommon [8,70]. Ott and Longnecker [71] affirm that in similar quantitative studies, a sample size greater than 30 is generally considered large. Our findings contribute valuable insights to inform future research and practice to establish BTR as an accessible and affordable option for young adults in Australia.

The first section of the questionnaire solicited the respondents' background information including age, gender, education, profession, salary, homeownership status, and number of siblings. The responses provided a respondent's profile and examined how this information influences their opinions on the CSFs of the BTR housing model. Participants were then asked to rate their awareness of BTR on a 3-point Likert scale—1 (Not aware at all), 2 (Somewhat aware), and 3 (Well aware). Secondly, out of the 32 CSFs of BTR identified in Abidoye et al. [8], respondents were requested to rank the factors in order of importance. Participants were asked to rate the importance of all 32 factors on a 5-point Likert scale ranging from 1 (Not important at all) to 5 (Extremely important). The CSFs are used as the baseline for this study. The last section of the questionnaire contains open-ended questions to allow the respondents to report any other factors they believed to be critical to the success of BTR housing schemes, their opinions on the feasibility of Commonwealth rent assistance to the BTR model, and their preferred location for any BTR project in their localities.

Table 2 presents the profile of the respondents, showing that 66.6% of the respondents are female, 27.3% male, and 6% undisclosed. The respondents, mostly young people, are aged between 18 and 34 years. Out of this range, 36.4% are between 31 and 34 years, 33.3% between 25 and 30 years, and 30.3% between 18 and 24 years. In terms of educational qualifications, 48.5% of the respondents hold a master's degree, 30.3% have a bachelor's degree, while 18.2% and 3% have high school diplomas and PhDs, respectively. The other background information includes employment, salary, homeownership status, and preferred housing type.

Table 2. Profile of Respondents.

Variables		Frequency (n = 33)	Percentage %
Gender	Male	9	27.3
	Female	22	66.7
	Undisclosed	2	6.0
Age	18–24	10	30.3
	25–30	11	33.3
	31–34	12	36.4

Table 2. Cont.

Variables		Frequency (n = 33)	Percentage %
Education	High School/Diploma	6	18.2
	Bachelors/Undergraduate	10	30.3
	Masters/Postgraduate	16	48.5
	PhD	1	3.0
Employment Status	Permanent Employee	17	51.5
	Entrepreneur/Freelancer	1	3.0
	Unemployed	3	9.1
	Temporary/Contract Employee	9	27.3
	Unspecified	3	9.1
Job Category	Student/Researcher	15	45.5
	Industry/Field Professional	15	45.5
	Unspecified	3	9.0
Salary (annual)	AUD 18,201–AUD 37,000	10	30.3
	AUD 37,001–AUD 90,000	13	39.4
	AUD 90,001–AUD 180,000	7	21.2
	Undisclosed	3	9.1
Homeownership Status	First Home Buyer/Renter	13	39.4
	Subsequent Home Buyer/Renter	9	27.3
	General Market Researcher	8	24.2
	Unspecified	3	9.1
Housing Status	Renting	18	54.5
	Owner-occupier	3	9.1
	Living with Parents/Relatives	12	36.4
Preferred House Type	Apartment/Unit	8	24.2
	Town House	4	12.1
	Single Family/Detached House	18	54.5
	Multifamily House	2	6.1
	Unspecified	1	3.1

3.2. Methods

Motivated by recent findings highlighting the increasing difficulty faced by the young generation of Australia in their attempts to access housing, this study sought to explore the importance of these 32 CSFs to this demographic: Investor interest, Developer interest, Affordability, Housing taxes, Housing reforms, Public awareness, Private rentals, Regulations, Economy, Alternative finance, Socializing, Cultural bounds, Credit availability, Land use planning, Urban governance, Short-term rentals, Long-term rentals, Land value capture, Location, Construction quality, Size, Urban development schemes, Housing demand, Family friendly, Communication managers, Communication residents, Willingness to move, Essential services, Parking, Facilities, Security, Satisfaction, Tenant rights, Loyalty, Flexible contract, Neoliberalisation, Sustainability, and Noise. According to Abidoye et al. [8], these 32 factors are widely acknowledged in the scholarly community as essential to the success of BTR. Our measurement items are based on these established CSFs, to investigate the perceptions of young adults on their relevance to the success of BTR in Australia.

Statistical analyses and further robustness tests were conducted using Statistical Package for Social Science (SPSS) version 26. Our analyses cover three dimensions: an exploratory factor analysis (EFA) to draw out patterns in all 32 CSFs, a relative importance index (RII) to rank the CSFs, and an analysis of variance (ANOVA) to identify variations across different groups. Initial diagnostic tests are performed to validate the data and to measure the appropriateness of the statistical models. A Cronbach's test is then conducted to determine the internal consistency of the data sourced primarily through Likert scales. The appropriate threshold for this test is 0.7, and any values above this threshold are acceptable for statistical tests [72]. Our test returned a value of 0.958, confirming that the scales adopted for our responses are reliable for further statistical analyses.

3.2.1. Exploratory Factor Analysis

EFA is appropriate in the absence of an established theory to draw out common themes and patterns from a set of variables [73]. Following the recommendations of Fabrigar and Wegener [74], we established the appropriateness of EFA for the analysis according to the following checklist: data suitability, factor extraction, factor retention, rotational method, and labelling. A correlation matrix was generated to test the relationship between the variables and the suitability of the EFA. Low correlations are unacceptable since they suggest a weak interrelation between factors [75]. Accordingly, values ranging from 0.4 to 0.70 are deemed appropriate for determining associations and drawing out common themes [74,75]. The 2-tailed Pearson Correlation tests were significant at 1% or 5%. Any correlation above 0.80 is unduly high, and our correlation matrix shows only 1 such value, at 0.81 between ‘Size’ and ‘Tenant rights’. However, this is an acceptable exception in studies with fairly small sample sizes [73].

Further, the sampling adequacy and sphericity were tested with the Kaiser–Meyer–Olkin (KMO) and Bartlett’s tests. The results of these tests are presented in Table 3. The KMO test shows a sampling adequacy of 0.736. According to Hair et al. [76], values above 0.6 are recommended for the further consideration of a sample for EFA. The Bartlett’s test also produced an approx. Chi-square value of 433.51, significant at 1%, indicating that the matrix is not an identity matrix [77]. The direct oblimin rotation method was specified to allow for correlation among our key variables, as is common in the social sciences [75].

Table 3. KMO Measure of Sampling Adequacy and Bartlett’s Test of Sphericity.

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.736
Bartlett’s Test of Sphericity	Approx. Chi-Square	433.51
	DF	176
	Significance	0.00

Four methods were considered for factor extraction and retention—total variance explained, Kaiser’s criteria (eigenvalue > 1), scree plot, and pattern matrix [77]. The item communalities were inspected to ascertain the strength of the variables for each factor cluster. The threshold in similar studies is a low communality of 0.40, which is a satisfactory indication of a strong relationship between factor clusters and component variables [75]. Our results range between 0.646 and 0.936. Kaiser’s criteria allow for the retention of any factor cluster with an eigenvalue greater than 1, while the total variance explained indicates the cumulative percentage explained by the factors to be retained. According to Hair et al. [76], a higher total variance is preferred to maximise the relationships to be drawn out through the EFA. Table 4 presents the total variance explained by our retained variables and their associated eigenvalues. Nine factor clusters were retained after our initial analysis, explaining a total variance of 81.23%.

Table 4. EFA (Total Variance Explained and Eigenvalues).

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total
1	15.592	41.032	41.032	7.600
2	2.922	7.689	48.721	7.353
3	2.713	7.138	55.859	6.646
4	2.128	5.600	61.459	6.729
5	1.976	5.199	66.658	2.659
6	1.667	4.386	71.044	4.762
7	1.497	3.938	74.983	3.468
8	1.304	3.433	78.415	6.045
9	1.069	2.812	81.228	6.606

The scree plot, presented in Figure 1, also followed the eigenvalue rule. Clusters with an eigenvalue higher than 1 are shown before the break. All other factor clusters that tailed off after the break were rejected as they do not represent a core theme in the variables [76].

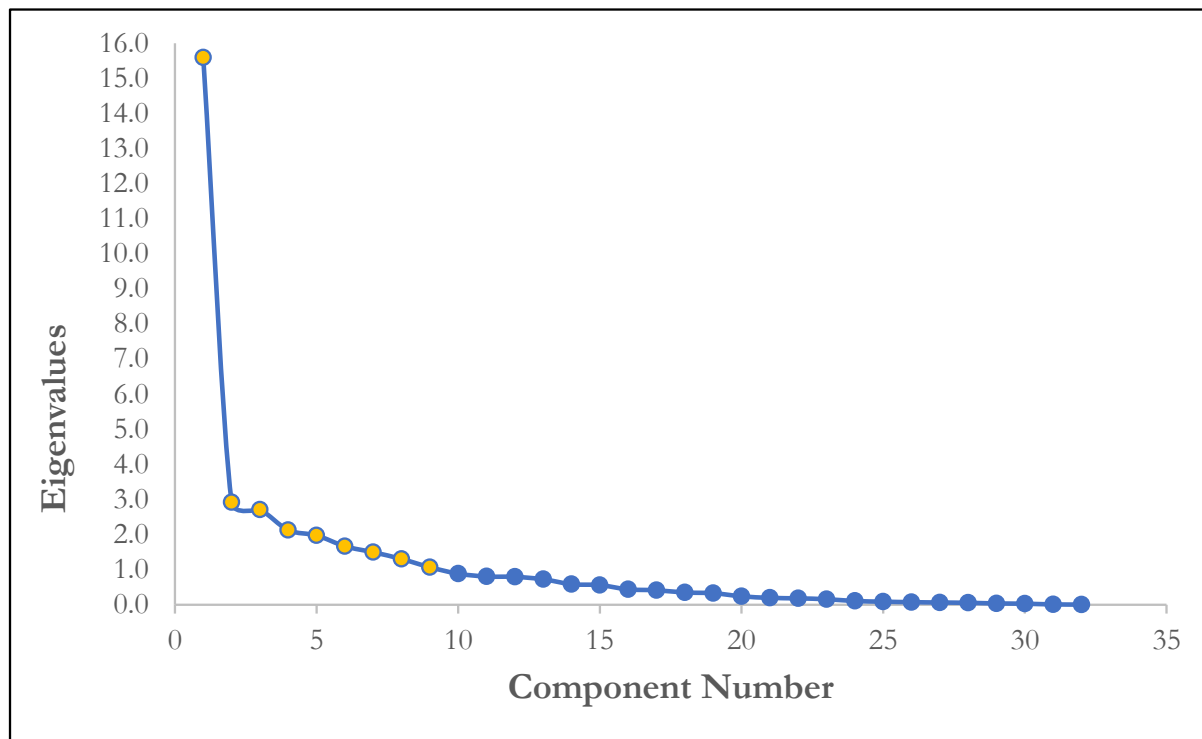


Figure 1. Scree Plot.

Finally, we examined the pattern matrix to observe the specific components of each factor cluster. The pattern matrix is more appropriate because of our choice of oblique rotation [75]. To ensure the reliability of the extracted components, our study implemented strict retention criteria. Factors that loaded on multiple components were excluded to maintain clarity and independence within each component. We also suppressed coefficients with absolute values lower than 0.30, prioritizing substantial loadings and filtering out noise [74]. By avoiding cross-loading, we minimised ambiguity and ensured that each factor was uniquely associated with its respective theme [75]. These criteria facilitated our identification of nine underlying themes in the CSFs of the BTR model in Australia, from the perspective of young adults. Table 5 presents the pattern matrix and the factor loadings of the nine factor clusters.

Table 5. EFA (Pattern Matrix).

CSF	Component								
	1	2	3	4	5	6	7	8	9
Investor interest	0.86								
Developer interest	0.75								
Affordability	0.65								
Housing taxes	0.53								
Housing reforms	0.46								
Public awareness	0.44								
Private rentals	0.44								

Table 5. Cont.

CSF	Component								
	1	2	3	4	5	6	7	8	9
Regulations		0.88							
Economy		0.75							
Alternative finance		0.72							
Socialising		0.67							
Cultural bounds		0.60							
Credit availability		0.58							
Land use planning		0.47							
Urban governance			−0.71						
Short-term rentals			−0.66						
Long-term rentals			−0.64						
Land value capture			−0.60						
Location				0.73					
Construction quality				0.69					
Size				0.59					
Urban development schemes				0.58					
Housing demand				0.57					
Family friendly				0.40					
Communication managers					0.70				
Communication residents					0.68				
Willingness to move					−0.49				
Essential services					−0.33				
Parking						0.89			
Facilities						0.82			
Security							0.80		
Satisfaction							0.44		
Tenant rights								0.75	
Loyalty								0.63	
Flexible contract								0.51	
Neoliberalisation								0.44	
Sustainability									−0.84
Noise									−0.71

3.2.2. ANOVA Analysis

BTR housing is a fairly new asset class in the Australian market, primarily motivated by the increasing proportion of renters in the housing market. While the CSFs of BTR are important for its success, different groups perceive these success factors differently. An ANOVA is used to determine the existence of such variations across different demographic groups, such as age, level of education, employment status, and salary. According to Penny and Henson [78], an ANOVA is often used to determine relationships between different groups.

Our analysis sought to identify the distinct effects of demographic traits on the established CSFs of BTR. The analysis considered respondents who showed some previous knowledge of BTR. The survey results were screened to omit respondents who were not aware of the existence of BTR in Australia. The analysis focuses on respondents who are aware of the asset class. We focused on the 11 most significant CSFs reported by Abidoye et al. [8] presented in Table 1. These CSFs are shown to be the most reported in the literature and deemed the most critical to the long-term success of BTR. These factors are the underlying themes for the ANOVA analysis, and they highlight how respondents rate the 11 CSFs (Table 1). Tests of homogeneity were conducted to confirm the appropriateness of the dependent variables for further ANOVA analysis, with the results suggesting statistically significant variations in age, salary levels, and homeownership status. Welch

and Brown–Forsythe robust tests of equality of means were also conducted to further validate the suitability of ANOVA for the analyses [78]. Dunnett’s T3 specification was made because no equal variances were assumed for the post hoc tests.

3.2.3. Relative Importance Index

Participants were asked to rate their perceived importance of the CSFs of the BTR housing model in Australia. These responses were collated by means of a 5-point Likert scale from 1 (Not important at all) to 5 (Extremely important). Adopting the relative importance index (RII), developed by Kometa et al. [79], the survey results were aggregated and transformed to facilitate a ranking of the significance of each CSF to the respondents. We limit our analysis of relative importance to the 11 most significant CSFs presented in Table 1 and consider only respondents with some prior awareness of BTR. The indices were calculated using Equation (1):

$$\text{Relative Importance Index} = \frac{\sum w}{A * N} \quad (1)$$

where;

w = the respondents’ weighting of each factor, ranging from 1 to 5, with 1 representing ‘Not at all important’ and 5 representing ‘Extremely important’;

A = the highest weight (5); and

N = the total number of the sample (33).

The indices range from 0 to 1, with bigger values indicative of a higher perceived importance by respondents [8,79]. This ranking allowed us to determine the relative importance of the CSFs as perceived by our respondents, young Australians. Akadiri’s [80] classification of these indices into 5 distinct categories was also adopted for interpretation, where $0 \leq \text{RI} < 0.2$ = Low–Unimportant; $0.2 \leq \text{RI} < 0.4$ = Medium–Low; $0.4 \leq \text{RI} < 0.6$ = Medium; $0.6 \leq \text{RI} < 0.8$ = High–Medium; and $0.8 \leq \text{RI} \leq 1$ = High.

4. Results and Discussion

4.1. Awareness of the BTR Housing Model among Australian Young Adults

To test the awareness levels of BTR among Australian young adults, the survey queried whether respondents are aware of BTR. Our initial results show that 51.5% are unaware of the BTR housing model. A further 27.3% are somewhat aware of it, while 21.2% are aware of the housing model. These statistics are presented in Figure 2. The small proportion of respondents who are aware of the model is cause for concern for any potential developments, as the youth represent a large portion of BTR renters in the Australian property market [8]. Further analysis also reveals that an awareness of BTR is not significantly different across gender, age, and education levels. However, there is a significant variation based on salary range—earners between AUD 37,001 and AUD 90,000 exhibited the highest awareness of the BTR housing model, suggesting that this group hold the most interest in this asset class. The level of naivety of the BTR housing model represents a significant avenue for policy intervention and benefit-sensitisation campaigns to foster interest from prospective end users. By taking these steps, policymakers and developers can increase awareness, accessibility, and the adoption of the BTR model, ultimately expanding affordable and sustainable housing options in Australia and alleviating housing stress [49].

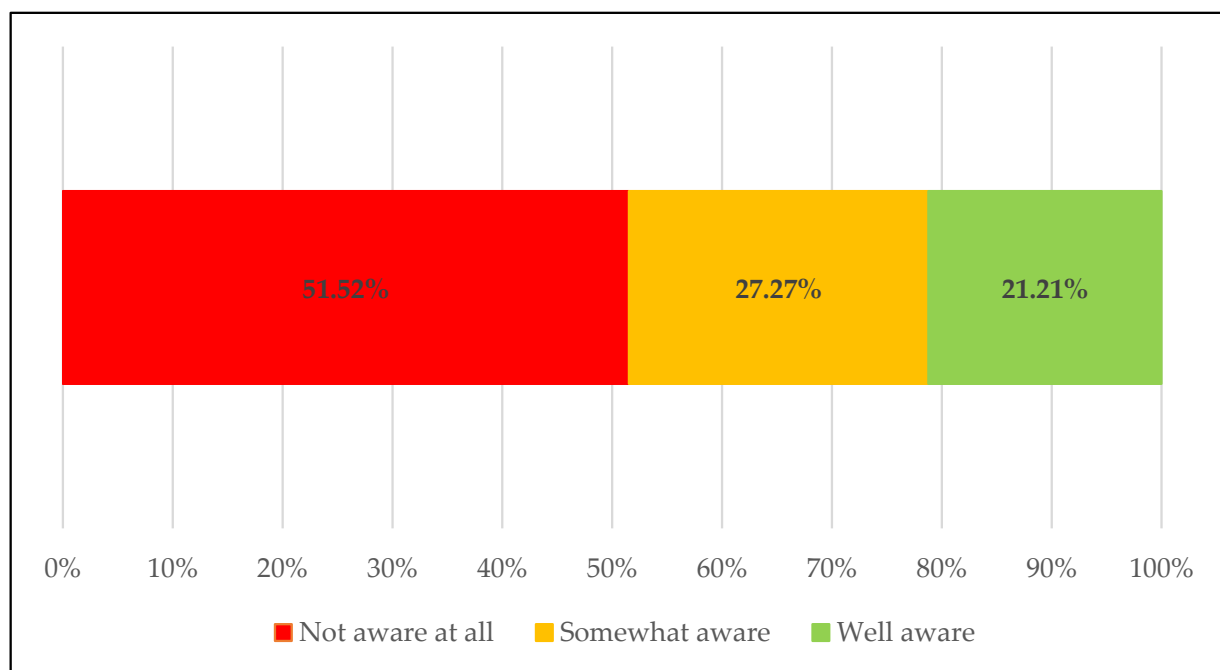


Figure 2. Awareness of BTR.

4.2. How Do Different Groups Perceive the CSFs?

The following section presents significant findings that highlight how different groups perceive factors deemed critical to the long-term success of the BTR housing model.

Our survey targeted young Australians aged between 18 and 34 years, which we further split into three subgroups for more refined findings: 18–24, 25–30, and 31–34 years. While the joint classification suggests that they may have similar housing needs, variations in certain demographic traits motivated further investigation. The tests show no significant variations between the subgroups on several CSFs, further evidence of the underlying similarities in the housing needs and purchasing power of the youth. However, there are also statistically significant differences between the different age groups on the CSF *Public Awareness of Housing Reforms*: younger respondents (18–24) rate public awareness of housing reforms as a more important factor than the other age groups.

Participants in our study were also grouped into four categories based on their annual salary: AUD 18,201–AUD 37,000, AUD 37,001–AUD 90,000, AUD 90,001–AUD 180,000, and those earning above AUD 180,000 per year. While there are notable similarities in how all the earners view the CSFs, significant variations are also apparent for the following factors: Affordability and Australia’s Economy. Ironically, respondents earning between AUD 90,001 and AUD 180,000 rate affordability concerns as more crucial, followed by the lowest earners (AUD 18,201–AUD 37,000) and then the mid-earners (AUD 37,001–AUD 90,000). Given the ongoing discussions about the high rental prices of BTR and how unaffordable they are, the state of the Australian economy and the financialisation of the asset class are highlighted as core factors [8,81,82]. Our findings indicate a positive relationship between the state of the country’s economy and earning capacity—the highest earners deem it a more important consideration.

The homeownership status of young Australians was also considered. Respondents were grouped into renters, owner-occupiers, and living with parents/relatives. Only one respondent who was aware of BTR was an owner-occupier, so that subgroup is excluded from the following analysis to compare means based on homeownership status. The remaining two groups under consideration are renters and those living with parents and relatives. Perhaps an indication of the strain on their budgets, those currently renting regard lower housing taxes as a bigger concern than respondents who depend on parents

or relatives for accommodation. On average, renters rate the state of the country's economy as only slightly important, while respondents living with parents/relatives rate the same factor as very important. A similar divide is observable in the importance of alternative financing models to the Australian young adults, a more important consideration for respondents living with parents and relatives than renters.

Collectively, these variations elicit interesting conversations on which group BTR is intended for, underpinned by the knowledge that perceptions and lived experiences determine demand [2]. The significant variations in how different age groups, salary groups, and homeownership statuses perceive the BTR housing model have important policy implications for ensuring its success as an affordable housing option for the young generation. Firstly, policymakers need to tailor their communication and education strategies to effectively reach and engage these specific groups. By understanding the factors that resonate most with each demographic, targeted campaigns can be developed to address their unique concerns and preferences. Secondly, policy support should be directed towards salary ranges and homeownership statuses that exhibit higher importance ratings, as these groups are more likely to be receptive to the BTR model. Financial incentives and regulatory measures can be designed to encourage developers to focus on these target groups, thus increasing the availability and accessibility of BTR housing for the young generation. In the long term, these targeted strategies and the effectiveness of the housing type could enhance the intention to achieve homeownership among Australia's young adults [83].

4.3. Common Themes Present in the CSFs

Using EFA, we established nine broad themes from the 32 critical success factors presented in Table 6. Based on our analysis of the themes in the CSFs, these nine dimensions explain the relevance of the BTR housing model to young Australians—Public Interest and Awareness (41%), Regulatory Framework and Finance (7.7%), Governance and Alternative Rentals (7.1%), Property Fundamentals and Demand (5.6%), Communication (5.2%), Facilities (4.4%), Safety Needs (3.9%), Rights and Flexibility (3.4%), and Sustainability (2.8%). Our findings indicate that critical success factors of investor interest, developer interest, affordability, taxes, reforms, public awareness, and rentals belong to a common theme, while the factors of regulations, economy, alternative finance, socialising, cultural bounds, credit availability, and land use planning belong to another theme. These themes align with the findings of Brill and Raco [84] on the interrelationship between investors, real estate professionals, and government initiatives/support for the success of the BTR housing model.

Collectively, these nine factor clusters account for 81.23% of the total variance in the relevance of the CSFs, establishing a basis for the strength of these dimensions to the ultimate choice of a BTR housing option [76]. These key themes are indicators of the factors relevant to the continued success of the BTR housing model for young Australians.

The first theme derived several interconnected factors. Investor and developer interest are closely related, as the willingness of investors to provide funding depends on the opportunities and profitability offered by developers [27,50,55]. Affordability is a central factor that influences both investor and developer interest, as well as the attractiveness of BTR housing for young adults [42,59]. Housing taxes and reforms are also crucial in shaping the regulatory environment, affecting investor and developer decisions and overall affordability. Public awareness plays a role in generating demand for BTR housing, while private rentals contribute to the availability and competition within the market. These factors form an intricate network, as investor and developer interest drive the supply of affordable BTR options, which in turn are influenced by housing taxes, reforms, public awareness, and the presence of private rentals [8,83].

Table 6. Common Themes in the CSFs of the BTR Housing Model.

Component	Labels	CSFs
1	Public Interest and Awareness	Investor interest Developer interest Affordability Housing taxes Housing reforms Public awareness Private rentals
2	Regulatory Framework and Finance	Regulations Economy Alternative finance Socialising Cultural bounds Credit availability Land use planning
3	Governance and Alternative Rentals	Urban governance Short-term rentals Long-term rentals Land value capture
4	Property Fundamentals and Demand	Location Construction quality Size Urban development schemes Housing demand Family friendly
5	Communication	Communication managers Communication residents Willingness to move Essential services
6	Facilities	Parking Facilities
7	Safety Needs	Security Satisfaction
8	Rights and Flexibility	Tenant rights Loyalty Flexible contract Neoliberalisation
9	Sustainability	Sustainability Noise

The next major component reflects the regulatory framework and finance, highlighting the need for a holistic approach to facilitate the sustainable growth of BTR as a viable option for young adults in Australia. Regulations and land use planning shape the regulatory environment and availability of land, directly influencing the feasibility and supply of BTR projects [33,40]. The state of the economy impacts investor sentiment, credit availability, and alternative finance options, affecting the financial viability and growth of the sector. Socialising and cultural bounds foster a sense of community and enhance the social appeal of BTR properties. Credit availability, in turn, depends on the economic conditions and lending practices [4,28,29,60]. The availability of credit and alternative finance sources, such as crowdfunding, have profound implications for the willingness of financial institutions to advance credit for major projects.

4.4. Relative Importance of the CSFs to Australian Young Adults

The CSFs of BTR were ranked through the relative importance technique to draw out the perceived importance of each factor to young Australians. This ranking is highlighted in Figure 3, showing each CSF's relative importance index in descending order.

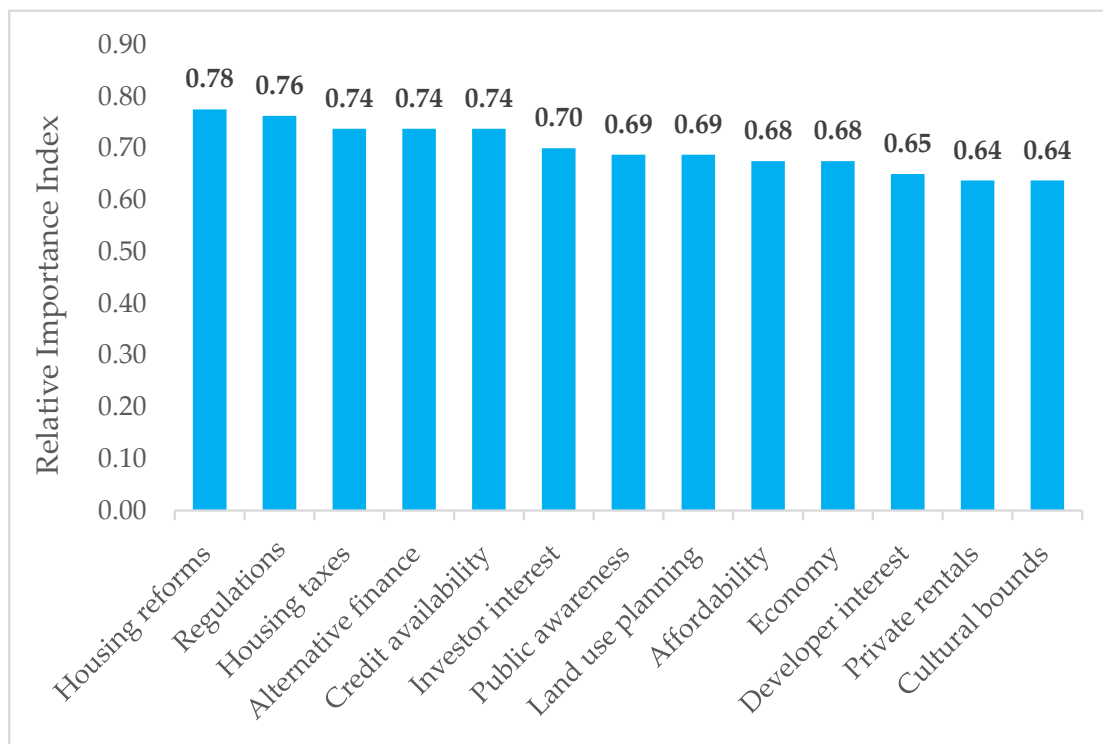


Figure 3. Relative Importance Index of CSFs among Young Australians.

Our findings show that the factors analysed were important as they all scored above 0.60 on the index. Notably, the top three factors of consideration were housing reforms, regulations, and taxes. The implication of this is that policy and regulatory instruments are considered the most crucial to the success of the BTR housing model and initiatives. The findings align with the positions of Acheampong and Earl [28] and Amar and Armitage [81] that regulatory incentives such as tax concessions and zoning are important factors for BTR's success in becoming an affordable housing model. Importantly, the importance of regulatory incentives is now reflected as some states in Australia have started implementing land tax concessions for BTR developments [85].

Among the factors examined, developer interest, private rentals, and cultural bounds were found to be the least important in determining the success of the build-to-rent housing model. These findings suggest that factors such as the active involvement and enthusiasm of developers, the reliance on private rental arrangements, and the influence of cultural boundaries may have a relatively limited impact on the overall success of this housing model. The fact that young adults rate investor interest as a more critical factor than developer interest is also significant, indicating that investors are among the most influential stakeholders. Moreover, the low ranking of cultural bounds as a CSF suggests that although the concept of home encompasses cultural identity, affordability and regulatory concerns are particularly key to young adults in Australia [86].

5. Conclusions

This study assessed the CSFs of the BTR housing model from the perspectives of young adults in Australia, motivated by growing housing affordability concerns among this demographic. With young adults consistently being priced out of homeownership,

BTR has emerged as a promising avenue to tackle the issue. However, unlike countries like the UK and the US where BTR is gaining ground, it is still relatively new in Australia. The perspectives of young adults are particularly crucial for shaping government policies and interventions to ensure the long-term success of BTR. We adopted an online questionnaire survey, targeting citizens and permanent residents of Australia aged between 18 and 34. Statistical analyses were then conducted using SPSS software, encompassing three dimensions of interest: an ANOVA to examine variations across different groups, an EFA to identify patterns among the 32 identified CSFs, and a RII to rank the CSFs based on their perceived importance.

The core findings of this study shed light on the awareness levels and perceptions of young Australians regarding the CSFs in BTR housing. A significant proportion of respondents had a low awareness of the BTR asset class, with 51.5% being completely unaware and 27.3% only somewhat aware. This lack of awareness among young adults, who represent a substantial potential market for BTR, is concerning. Moreover, it indicates a potential disconnect between the housing needs of young Australians and the practicality of the available solutions. Efforts should be made to increase awareness among young Australians, enabling them to consider BTR as a viable and affordable housing choice. We also identified varying opinions on the perceived importance of the CSFs across different groups. Younger respondents (18–24) assigned a higher importance to the public awareness of housing reforms, indicating their recognition of the role of awareness in driving positive change. This underscores the necessity for focused initiatives aimed at augmenting public awareness and engagement specifically among this age group, given their heightened levels of concern regarding an active involvement in the development process. Additionally, participants' annual salaries and homeownership statuses influenced their perceptions. Higher earners prioritised affordability, reflecting the discourse around rental costs, while renters expressed concerns about housing taxes. Those living with parents/relatives placed a greater importance on the state of the country's economy and alternative financing models. Overall, these findings emphasise the need for tailored approaches to address the diverse perspectives of different demographic groups within the context of the BTR housing model.

Our findings also have several practical implications for the successful implementation of BTR housing among young adults in Australia. First, raising awareness about BTR as a viable housing option is crucial to alleviate housing stress, by effectively communicating its benefits and unique features, such as long-term rental security and professional management. Second, considering individual factors, such as salary and homeownership status, is essential in tailoring BTR offerings to meet the specific needs and financial capacities of young adults in different socioeconomic groups. Customised rental pricing structures and flexible financial arrangements can help accommodate their varying circumstances. Additionally, emphasising involvement and community engagement is key to attracting young adults to BTR. Providing opportunities for active participation, such as co-design or community consultation, could enhance the sense of ownership and belonging. Last, addressing affordability concerns is critical to increasing the uptake of BTR among young Australians. Financial interventions, such as rent subsidies or government incentives, can make the BTR housing model more financially accessible and appealing to this demographic.

Although our findings provide valuable insights into the CSFs of the BTR housing model from the perspectives of young adults in Australia, it is important to acknowledge its limitations. Firstly, the study's sample size of 33 participants is relatively small. However, it is worth noting that such sample sizes are common in other built environment research studies. Moreover, the focus of this study was not to generalise the findings across all demographic groups, but rather to highlight the pertinent issues from the specific viewpoints of young adults. Nonetheless, future studies could benefit from larger sample sizes to enhance the robustness and generalisability of the findings. Also, to ensure the long-term success of the BTR housing model, it is crucial for future research to consider the

perspectives of all stakeholders involved, including investors, developers, policymakers, and community members. By incorporating a broader range of perspectives, a more comprehensive understanding of the complex dynamics and challenges surrounding the BTR housing model can be achieved. Finally, previous studies have highlighted the importance of factors such as affordability, location, and amenities in the success of BTR projects. While this study provided valuable insights from the perspective of young adults, future research should build upon existing knowledge and explore additional factors to further enrich the understanding of BTR's potential and limitations.

Author Contributions: Conceptualization, R.B.A., A.A.A. and C.M.A.; methodology, A.A.A., C.M.A. and S.S.-I.; software, A.A.A. and C.M.A.; validation, R.B.A., J.G. and S.S.-I.; formal analysis, A.A.A. and C.M.A.; investigation, A.A.A., C.M.A. and S.S.-I.; resources, R.B.A. and J.G.; data curation, R.B.A., A.A.A. and C.M.A.; writing—original draft preparation, A.A.A., C.M.A. and S.S.-I.; writing—review and editing, R.B.A., J.G. and S.S.-I.; visualization, A.A.A. and C.M.A.; supervision, R.B.A.; project administration, R.B.A.; funding acquisition, R.B.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the UNSW Faculty of Arts, Design and Architecture Research Support Scheme, Grant Number PS63237.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: The authors appreciate all the youths that responded to the questionnaire survey. The constructive comments of the anonymous reviewers are much appreciated. This paper is part of a research project which focuses on the build-to-rent housing provision for young adults, from which other papers will be published with a different objective/scope but sharing the same background.

Conflicts of Interest: We do not have any major conflict of interest to disclose, but we understand that one of the co-authors of this paper is a guest editor for this special issue.

References

- Walsh, E. “Family-Friendly” Tenancies in the Private Rented Sector. *J. Prop. Plan. Environ. Law* **2019**, *11*, 230–243. [CrossRef]
- Abidoye, R.B.; Puspitasari, G.; Sunindijo, R.; Adabre, M. Young Adults and Homeownership in Jakarta, Indonesia. *Int. J. Hous. Mark. Anal.* **2021**, *14*, 333–350. [CrossRef]
- Forrest, R.; Xian, S. Accommodating Discontent: Youth, Conflict and the Housing Question in Hong Kong. *Hous. Stud.* **2017**, *33*, 1–17. [CrossRef]
- Mackie, P.K. Young People and Housing: Identifying the Key Issues. *Int. J. Hous. Policy* **2016**, *16*, 137–143. [CrossRef]
- McKee, K. Young People, Homeownership and Future Welfare. *Hous. Stud.* **2012**, *27*, 853–862. [CrossRef]
- Hulse, K.; Morris, A.; Pawson, H. Private Renting in a Home-Owning Society: Disaster, Diversity or Deviance? *Hous. Theory Soc.* **2019**, *36*, 167–188. [CrossRef]
- Pawson, H.; Milligan, V. New Dawn or Chimera? Can Institutional Financing Transform Rental Housing? *Int. J. Hous. Policy* **2013**, *13*, 335–357. [CrossRef]
- Abidoye, R.; Ayub, B.; Ullah, F. Systematic Literature Review to Identify the Critical Success Factors of the Build-to-Rent Housing Model. *Buildings* **2022**, *12*, 171. [CrossRef]
- Chia, J.; Erol, I. Young Australians Living with Parents: Free and Pay Board as Popular Housing Tenure Choices. *J. Hous. Built Environ.* **2022**, *37*, 1667–1692. [CrossRef]
- Parkinson, S.; Rowley, S.; Amity, K.; Spinney, A.; Reynolds, M. *Young Australians and the Housing Aspirations Gap*; Australian Housing and Urban Research Institute Limited: Melbourne, Australia, 2019.
- ABS. *The Survey of Income and Housing (SIH)*; ABS: Canberra, Australia, 2022.
- Aalbers, M.B.; Hochstenbach, C.; Bosma, J.; Fernandez, R.; Bosma, J.R. The Death and Life of Private Landlordism: How Financialized Homeownership Gave Birth to the Buy-To-Let Market. *J. Hous. Theory Soc.* **2021**, *35*, 541–563. [CrossRef]
- Easthope, H. Making a Rental Property Home. *Hous. Stud.* **2014**, *29*, 579–596. [CrossRef]
- Green, R.K. Thoughts on Rental Housing and Rental Housing Assistance. *Cityscape* **2011**, *13*, 39–55. [CrossRef]
- Hatcher, C. Globalising Homeownership: Housing Privatisation Schemes and the Private Rental Sector in Post-Socialist Bishkek, Kyrgyzstan. *Int. Dev. Plan. Rev.* **2015**, *37*, 467–486. [CrossRef]
- Borsellino, R.; Charles-Edwards, E.; Bernard, A.; Corcoran, J. Forty Years of Internal Migration in Australian Regions: A Sequence Analysis of Net Migration, Turnover, and Retention. *Aust. Geogr.* **2021**, *52*, 425–452. [CrossRef]
- Erol, I.; Unal, U. Internal Migration and House Prices in Australia. *Reg. Stud.* **2022**, *57*, 1207–1222. [CrossRef]

18. Harrap, B.; Hawthorne, L.; Holland, M.; McDonald, J.T.; Scott, A. Australia's Superior Skilled Migration Outcomes Compared with Canada's. *Int. Migr.* **2022**, *60*, 91–107. [CrossRef]
19. Hulse, K.; Yates, J. A Private Rental Sector Paradox: Unpacking the Effects of Urban Restructuring on Housing Market Dynamics. *Hous. Stud.* **2017**, *32*, 253–270. [CrossRef]
20. Rowley, S.; James, A.; Gilbert, C.; Gurran, N.; Ong, R.; Phibbs, P.; Rosen, D.; Whitehead, C. *Subsidised Affordable Rental Housing: Lessons from Australia and Overseas*; Australian Housing and Urban Research Institute Limited: Melbourne, Australia, 2016.
21. Flaherty, A. Can Build-to-Rent Play a Greater Role in Tackling the Rental Crisis? Available online: <https://www.realcommercial.com.au/news/can-build-to-rent-play-a-greater-role-in-tackling-the-rental-crisis> (accessed on 21 June 2023).
22. CBRE Australia ViewPoint BTR Development Pipeline 2021 | CBRE Australia. Available online: <https://www.cbre.com.au/insights/viewpoints/australia-viewpoint-btr-development-pipeline-2021> (accessed on 21 June 2023).
23. Savills Australia Build to Rent Market Update. Available online: <https://pdf.savills.asia/asia-pacific-research/australian-research/australia-student-accommodation/savills-australia-build-to-rent-market-update-feb22.pdf> (accessed on 21 June 2023).
24. Berry, M.; Hall, J. Institutional Investment in Rental Housing in Australia: A Policy Framework and Two Models. *Urban Stud.* **2005**, *42*, 91–111. [CrossRef]
25. Kerans, M. Bridging the Affordable Rental Housing Gap: Establishing a Viable Funding Model to Attract Institutional Investment. Ph.D. Thesis, University of Technology Sydney, Sydney, Australia, 2008.
26. Swanzy-Impraim, S.; Ge, X.; Mangioni, V. Barriers to Institutional Investment in Rental Housing: A Systematic Review of Market Risks. *Int. J. Real Estate Stud.* **2021**, *15*, 1–15. [CrossRef]
27. Wijburg, G.; Waldron, R. Financialised Privatisation, Affordable Housing and Institutional Investment: The Case of England. *Crit. Hous. Anal.* **2020**, *7*, 114–129. [CrossRef]
28. Acheampong, P.; Earl, G.W. Can Build-To-Rent Generate Affordable Housing Outcomes? A Whole-Life Costing Approach to Investment Analysis. *Account. Financ. Res.* **2020**, *9*, 85. [CrossRef]
29. Livingstone, N. Safe as Houses? Thinking on the Rise of Investment into UK Residential Markets. *J. Prop. Invest. Financ.* **2022**, *40*, 324–329. [CrossRef]
30. Nethercote, M. Build-to-Rent and the Financialization of Rental Housing: Future Research Directions. *Hous. Stud.* **2019**, *35*, 839–874. [CrossRef]
31. Brill, F.; Durrant, D. The Emergence of a Build to Rent Model: The Role of Narratives and Discourses. *Environ. Plan. A* **2021**, *53*, 1140–1157. [CrossRef]
32. Qi, J.; Ma, C. Australia's Crisis Responses during COVID-19: The Case of International Students. *J. Int. Stud.* **2021**, *11*, 2166–3750. [CrossRef]
33. Wright, C.F.; Groutsis, D.; Kaabel, A. Regulating Migrant Worker Temporariness in Australia: The Role of Immigration, Employment and Post-Arrival Support Policies. *J. Ethn. Migr. Stud.* **2022**, *48*, 3947–3964. [CrossRef]
34. Bratt, R.G. Affordable Rental Housing Development in the U.S. For-Profit Sector: Implications of a Case Study of McCormack Baron Salazar. *Hous. Policy Debate* **2018**, *28*, 489–514. [CrossRef]
35. Yates, J. Evaluating Social and Affordable Housing Reform in Australia: Lessons to Be Learned from History. *Int. J. Hous. Policy* **2013**, *13*, 111–133. [CrossRef]
36. Castro Campos, B.; Yiu, C.Y.; Shen, J.; Liao, K.H.; Maing, M. The Anticipated Housing Pathways to Homeownership of Young People in Hong Kong. *Int. J. Hous. Policy* **2016**, *16*, 223–242. [CrossRef]
37. Lux, M.; Kubala, P.; Sunega, P. Why so Moderate? Understanding Millennials' Views on the Urban Housing Affordability Crisis in the Post-Socialist Context of the Czech Republic. *J. Hous. Built Environ.* **2023**. [CrossRef]
38. Ronald, R.; Schijf, P.; Donovan, K. The Institutionalization of Shared Rental Housing and Commercial Co-Living. *Hous. Stud.* **2023**. [CrossRef]
39. Vangeel, W.; Defau, L.; De Moor, L. Young Households' Diminishing Access to Homeownership Attainment in Europe. *Sustainability* **2023**, *15*, 6906. [CrossRef]
40. Chen, J.; Wu, F.; Lu, T. The Financialization of Rental Housing in China: A Case Study of the Asset-Light Financing Model of Long-Term Apartment Rental. *Land Use Policy* **2022**, *112*, 105442. [CrossRef]
41. Yanotti, M.B.; Wright, D. Residential Property in Australia: Mismatched Investment and Rental Demand. *Hous. Stud.* **2021**, *38*, 1110–1131. [CrossRef]
42. Yates, J.; Gabriel, M. *Housing Affordability in Australia*; Australian Housing and Urban Research Institute: Melbourne, Australia, 2006; Volume 3.
43. Berry, M. Why Is It Important to Boost the Supply of Affordable Housing in Australia—And How Can We Do It? *Urban Policy Res.* **2003**, *21*, 413–435. [CrossRef]
44. Wood, G.; Ong, R. The Australian Housing System: A Quiet Revolution? *Aust. Econ. Rev.* **2017**, *50*, 197–204. [CrossRef]
45. Bourassa, S.C.; Haurin, D.R.; Haurin, R.J.; Hendershott, P.H. Independent Living and Home Ownership: An Analysis of Australian Youth. *Aust. Econ. Rev.* **1994**, *27*, 29–44. [CrossRef]
46. McDonald, P.; Baxter, J. Home Ownership among Young People in Australia: In Decline or Just Delayed? *Aust. J. Soc. Issues* **2005**, *40*, 471–487. [CrossRef]
47. Yates, J. Explaining Australia's Trends in Home Ownership. *Hous. Financ. Int.* **2011**, *26*, 6–13.

48. Burke, T.; Nygaard, C.; Ralston, L. *Australian Home Ownership: Past Reflections, Future Directions*; AHURI Final Report 328; SSRN: Rochester, NY, USA, 2020.
49. AIHW. *Australia's Youth: Housing Stress*; Australian Institute of Health and Welfare: Canberra, Australia, 2021.
50. Berry, M. Investment in Rental Housing in Australia: Small Landlords and Institutional Investors. *Hous. Stud.* **2000**, *15*, 661–681. [CrossRef]
51. Wulff, M.; Dharmalingam, A.; Reynolds, M.; Yates, J. *Australia's Private Rental Market: Changes (2001–2006) in the Supply of, and Demand for, Low Rent Dwellings*; Australian Housing and Urban Research Institute: Melbourne, Australia, 2009.
52. Pawson, H.; Hulse, K.; Morris, A. Interpreting the Rise of Long-Term Private Renting in a Liberal Welfare Regime Context. *Hous. Stud.* **2017**, *32*, 1062–1084. [CrossRef]
53. Ghasri, M.; Stone, W.; Easthope, H.; Veeroja, P. *Predicting Risk to Inform Housing Policy and Practice*; Australian Housing and Urban Research Institute: Melbourne, Australia, 2022.
54. Borgersen, T.-A. A Housing Market with Cournot Competition and a Third Housing Sector. *Int. J. Econ. Sci.* **2022**, *XI*, 13–27. [CrossRef]
55. EY. Build-to-Rent: An Opportunity for Institutional Investors to Bridge the Housing Deficit. *Insurance Asset Risk*, 8 August 2019.
56. Fyfe, A.; Hutchison, N. Senior Housing in Scotland: A Development and Investment Opportunity? *J. Prop. Invest. Financ.* **2020**, *39*, 525–544. [CrossRef]
57. Montague, A. *Review of the Barriers to Institutional Investment in Private Rented Homes*; Department for Communities and Local Government: London, UK, 2013.
58. Rogaris, N.; Angeline, Y. Continuing the Build-to-Rent Conversation in Australia. *Tax. Aust.* **2020**, *55*, 260–264. [CrossRef]
59. Cranston, M. Build to Rent a Key for Australian Housing Affordability. *Aust. Financ. Rev.* **2017**.
60. Joshua, C.; Robert, R. *Increasing the Supply of Affordable Housing*; Taxation Institute of Australia: Canberra, Australia, 2017.
61. Scanlon, K.; Williams, P.; Blanc, F. *Build to Rent in London: A Report for the University of New South Wales and NSW Landcom*; London School of Economics and Political Science: London, UK, 2018.
62. Newell, G.; Lin Lee, C.; Kupke, V.; Housing, A. *The Opportunity of Residential Property Investment Vehicles in Enhancing Affordable Rental Housing Supply Authored By*; Australian Housing and Urban Research Institute: Melbourne, Australia, 2015.
63. Bradley, D.; Nothaft, F.; Freund, J.L. Financing Multifamily Properties: A Play with New Actors and New Lines. *Cityscape* **1998**, *4*, 5–17. [CrossRef]
64. Joint Centre for Housing. *America's Rental Housing 2017*; Joint Centre for Housing: Cambridge, UK, 2017.
65. Alakeson, V. *The Challenges of Build to Rent for UK Housing Providers Resolution Foundation Acknowledgements*; Resolution Foundation: London, UK, 2013.
66. Framer, M.; Donnel, R. *Build-to-Rent: Pushing the Boundaries*; Arcadis: Birmingham, UK, 2013.
67. Brill, F.; Özogul, S. Follow the Firm: Analyzing the International Ascendancy of Build to Rent. *Econ. Geogr.* **2021**, *97*, 235–256. [CrossRef]
68. Morrison, N. Institutional Logics and Organisational Hybridity: English Housing Associations' Diversification into the Private Rented Sector. *Hous. Stud.* **2016**, *31*, 897–915. [CrossRef]
69. Abidoye, R.; Lim, B.T.H.; Lin, Y.C.; Ma, J. Equipping Property Graduates for the Digital Age. *Sustainability* **2022**, *14*, 640. [CrossRef]
70. Akintoye, A.; Fitzgerald, E. A Survey of Current Cost Estimating Practices in the UK. *Constr. Manag. Econ.* **2000**, *18*, 161–172. [CrossRef]
71. Ott, R.L.; Longnecker, M.T. *An Introduction to Statistical Methods and Data Analysis*; Cengage Learning: Boston, MA, USA, 2015.
72. Attaran, S.; Celik, B.G. Students' Environmental Responsibility and Their Willingness to Pay for Green Buildings. *Int. J. Sustain. High. Educ.* **2015**, *16*, 327–340. [CrossRef]
73. Taherdoost, H.; Sahibuddin, S.; Jalaliyoon, N. Exploratory Factor Analysis; Concepts and Theory. *Adv. Appl. Pure Math.* **2014**, *460*, 375–382.
74. Fabrigar, L.R.; Wegener, D.T. *Exploratory Factor Analysis*; Oxford University Press: Oxford, UK, 2011.
75. Costello, A.B.; Osborne, J. Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most from Your Analysis. *Res. Eval. Pract. Assess. Res. Eval.* **2005**, *10*, 7. [CrossRef]
76. Hair, J.F.; Black, W.C.; Babin, B.J.; Anderson, R.E. *Multivariate Data Analysis*; Pearson: London, UK, 2010.
77. Williams, B.; Onsman, A.; Brown, T.; Andrys Onsman, P.; Ted Brown, P. Exploratory Factor Analysis: A Five-Step Guide for Novices. *J. Emerg. Prim. Health Care (JEPHC)* **2010**, *8*, 2010–990399. [CrossRef]
78. Penny, W.; Henson, R. Analysis of Variance (ANOVA). In *Mathematics for Business, Science and Technology: With MATLAB and Spreadsheet Applications*, 2nd ed.; Orchard Publications: San Antonio, TX, USA, 2006; pp. 166–177.
79. Kometa, S.T.; Olomolaiye, P.O.; Harris, F.C. Attributes of UK Construction Clients Influencing Project Consultants' Performance. *Constr. Manag. Econ.* **1994**, *12*, 433–443. [CrossRef]
80. Akadiri, O.P. Development of a Multi-Criteria Approach for the Selection of Sustainable Materials for Building Projects. Ph.D. Thesis, The University of Wolverhampton, Wolverhampton, UK, 2011.
81. Amar, J.; Armitage, L. The Conversation: Build-to-Rent Is Seen as Affordable, but It's Yet to Help Those Most in Need. *The Conversation*, 7 December 2022.
82. Li, C.; Zhu, J.; He, S. Panacea or Pandora's Box? An Institutional Analysis of the Contested Long-Term Rental Apartments Development in China. *Habitat Int.* **2023**, *131*, 102715. [CrossRef]

83. Gu, H.; Kim, K. *Is Public Rental Housing a Stepping Stone for Young Adults' Housing? Effect of Rental Housing Type on the Intention to Achieve Homeownership and the Mediation Effect of Residential Satisfaction*; Korean Association for Housing Policy Studies: Seoul, Republic of Korea, 2023.
84. Brill, F.; Raco, M. Putting the Crisis to Work: The Real Estate Sector and London's Housing Crisis. *Political Geogr.* **2021**, *89*, 102433. [CrossRef]
85. Dorrington, B. Cedar Pacific Raising \$500 m for Build-to-Rent Fund. Available online: <https://propj.com.au/alternatives/cedar-pacific-raising-500m-for-build-to-rent-fund/> (accessed on 21 June 2023).
86. Fowler, A.R.; Lipscomb, C.A. Building a Sense of Home in Rented Spaces. *Int. J. Hous. Mark. Anal.* **2010**, *3*, 100–118. [CrossRef]

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Article

Transition of Youth's Housing Issues: A Survey in the Nanjing Metropolitan Coordinating Region, China

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Abstract: The housing problem of young people is one of the manifestations of the imbalanced and insufficient development of China's housing market. Solving housing issues for young people and improving their living conditions is of great significance for promoting the sustainable and healthy development of the real estate market. In order to analyze the housing issues of young people in China during the post-pandemic era, this paper investigates young people in the Nanjing Metropolitan Coordinating Region through questionnaires and interviews. The content of the questionnaire survey mainly includes the current housing situation, choice of renting or purchasing a home, expectations of real estate market, and future plans for purchasing a house of young people. The research results indicate that there are problems in the current housing market, such as strong purchasing preferences, imbalanced supply structure in the rental market, limited financial support for purchasing housing, low housing security levels, and small coverage of the housing provident fund. In order to solve the housing problems of young people, government departments should actively promote the formation of a multi-level housing supply structure, accelerate the promotion of the same rights for renting and purchasing, establish a standardized housing rental market, optimize the housing security policy for young people, and expand the coverage of the housing provident fund. The findings of this study have significant policy implications for easing the housing pressure on young people and building a youth-development-oriented city.

Keywords: post-pandemic era; Nanjing Metropolitan Coordinating Region (NMCR); young people; housing issues; expectations

1. Introduction

The report of the 20th National Congress of the Communist Party of China once again pointed out that housing should adhere to the basic housing attributes of "housing without speculation". This will make us better placed to meet the housing needs of all of our people. As the primary issue of people's livelihood in China, the housing problem has always been widely concerned by academia and politics. In the new development stage, real estate should not be used as a short-term means to stimulate the economy [1]. The 2022 Central Economic Work Conference further emphasized the importance of supporting rigid and improved housing demand to solve the housing problems of new citizens and young people. As a major group in the net inflow of urban population, young people are an indispensable and important force in promoting the economic development of cities. According to the data from the 7th National Population Census of China, the proportion of young people aged 20–45 is 34.26%. The housing problem will not only affect the urban settlement process of this group of young people, but also suppress their future willingness to get married and have children. Since COVID-19 has brought unprecedented psychological and physiological pressure to people, and a lack of ideal nontherapeutic

approaches, China has taken strict urban management measures [2]. Against this reality, the stability of employment and the income level of residents have been affected. As a result, although their affordability to purchase a home has declined, the pressure of their house loans will not be alleviated. Therefore, in the context of the post-pandemic era, the high price of housing has brought more housing pressure on young people [3]. There is an urgent need for an in-depth study of the housing problems faced by young people.

Since the housing reform in 1998, the era of urban housing marketization has arrived, and housing prices have continued to rise. The housing problem of population in China was becoming increasingly acute. [4]. Based on the policy documents of China over the years, from 2005 onwards, the Chinese government started regulating the real estate market. It took measures to stabilize housing prices, to prevent speculation and to encourage migrant workers to buy their own homes. Between 2007 and 2010, the country continued to increase housing support for workers from rural areas and to improve the living conditions of rural migrant workers. From 2010 onwards, government departments took a two-pronged approach to both purchasing and renting houses, and issued a series of regulatory policies to address housing issues in a multifaceted manner, such as encouraging the construction of public housing, granting subsidies for home purchases, implementing a housing policy for talented people, and so on. In recent years, the Chinese government has proposed to accelerate the establishment a housing system that ensures supply through multiple sources, provides housing support through multiple channels, and encourages both housing purchase and renting.

The real estate market has experienced a period of rapid development for over 20 years, and housing construction has achieved certain results [5]. However, the housing situation in large cities is still severe. The financialization of housing properties has become more and more prominent [6–8], and housing prices have risen rapidly under the superimposition of multiple demand groups such as rigid demand for housing, improvement demand, and investment demand [9–11]. Although the growth rate has slowed down in recent years due to the COVID-19 epidemic, housing prices remain high overall. According to the National Bureau of Statistics, the average sales price of residential commercial housing in China in 2022 will be 10,375 CNY/square meter. Although China's residential commercial housing price have achieved its first decline in a decade, it is still higher than 10,000 CNY/square meter. Under the influence of the cultural background of "live and work in peace and contentment", young people generally have the need to buy a home. The loan burden brought by high housing prices has become a pressure that most young people need to face. In the post-pandemic era, young people's expectations of the real estate market have weakened, and the demand for home ownership has declined in the short term. This may be due to the economic downturn and the increasing prominence of systemic risks in the real estate market, resulting in a lack of confidence in the real estate market expectations of young people [12–14].

The stable and healthy development of the real estate market plays an important role in driving investment, promoting consumption, and ensuring employment [15–17]. It is an economic and livelihood issue that China attaches great importance to. With the gradual weakening of the demand side, the problem of unbalanced and insufficient development of the real estate market has also become more prominent [18–20]. Therefore, governments at all levels have introduced policies to regulate the development of the real estate market from both the supply and demand sides. After sorting out the real estate-related policy documents released by China in recent years, it is found that since 2021, a series of real estate regulatory policies have been implemented with the main focus on deepening supply-side structural reform, such as implementing the "three red lines" for real estate enterprise financing, managing the concentration of real estate loans, setting a upper limit on the proportion of real estate loans for developers, implementing the "two centralized" land supply policy, and so on. At the same time, measures such as issuing consumption vouchers and increasing the amount of housing provident fund loans will continue to unleash the vitality of consumers on the demand side. In July 2023, the meeting

of the Political Bureau of the Central Committee of the CPC made a precise analysis of the current supply-and-demand relationship in the real estate market. It points out the need to adapt to the new situation of significant changes in the supply and demand relationship in China's real estate market.

In light of the current circumstances, considering the importance of housing for young people, this paper explores the housing issues for young people in the post-pandemic era. Compared to the previous literature, research in this field is still insufficient. Existing research mainly focuses on housing problems during the COVID-19 epidemic, which transformed the housing market in a number of ways [21–23], and these shifts are often negative [24–26]. Some scholars have pointed out that the impact of COVID-19 has increased the systemic financial risk in the housing market [27], and the valuation of the housing market has fallen considerably [28–30]. In addition, the income of practitioners in the housing market and related industries is gradually decreasing [31]. At the same time, issues such as unemployment and salary cuts are prominent [32]. As is well known, income is an important factor affecting residents' housing purchases [33]. Affected by the epidemic, residents' income fluctuates greatly, and their housing payment ability may decrease [34,35]. This phenomenon ultimately leads to a decrease in the number of homebuyers [36]. Furthermore, the decline in home purchase rates among low-income individuals is even greater [37]. Moreover, people's housing preferences have also been affected to some extent [38,39]. The need to live away from urban centers has become a new demand for housing [40–42]. People are placing more emphasis on the importance of private space [43,44]. It can be seen that there is relatively little research on housing issues in the post-pandemic era, and there is also room for research on housing issues for young people. More importantly, few scholars have focused on the housing issues of young people in the Nanjing Metropolitan Coordinating Region and analyzed the housing difficulties of these youth groups in the post-pandemic era.

Under the negative impact of the COVID-19 epidemic, what are the aspects of the housing problems of young people in the post-pandemic era? How have young people's housing consumption behaviors and perceptions changed compared with those before the outbreak of the COVID-19 epidemic? Based on the theory of rational expectations, how will the expectations of young people in the housing market be affected? What are the inherent contradictions in housing problems? How can effective measures be proposed to address the housing problems of young people in the context of the new development pattern? In order to solve the above problems, this paper conducts thematic research on the current housing situation of young people in the Nanjing Metropolitan Coordinating Region and examines the new characteristics of the housing issues of young people in the new situation.

The rest of the paper is organized as follows: firstly, this paper elaborates on the current situation of the housing market in the Nanjing Metropolitan Coordinating Region. Secondly, an analysis is conducted on the housing problems faced by young people, including the situation of home purchase, rental options, and purchase alternatives. Next, this study identifies actual housing issues and deduces the underlying contradictions that contribute to them. Finally, we put forward some policy recommendations to address the housing problems of young people during the post-epidemic era.

2. Analysis of the Current Situation

In order to understand the current housing situation of young people in the post-pandemic era, the Real Estate Economics and Finance Group of Anhui University of Technology launched their "Special Research on Housing Problems of New Citizens and Young People in the Nanjing Metropolitan Coordinating Region" in July 2023. This survey was conducted in nine cities in the Nanjing Metropolitan Coordinating Region. The Nanjing Metropolitan Coordinating Region mainly consists of nine cities, making it the first interprovincial metropolitan area planned and constructed in China. The development model of the metropolitan area is to promote one city as a leader to drive the development of

a large number of cities and surrounding towns. The research involves various issues such as individual situation, basic family economic situation, household purchasing situation, housing situation, and the use of the housing provident fund. On the basis, this section analyzes the factors influencing young people's housing rental and purchase choices in the Nanjing Metropolitan Coordinating Region, as well as their views on housing prices and housing policies.

The nine cities in the Nanjing Metropolitan Coordinating Region are Nanjing, Changzhou, Zhenjiang, Huai'an, Yangzhou, Wuhu, Chuzhou, Ma'anshan, and Xuancheng. The basic situation of each city is shown in Table 1. Among them, Nanjing, as a newly designated first-tier city, ranks first among the nine cities in terms of per capita GDP, number of permanent residents, housing prices and monthly rent. Changzhou, as a second-tier city, has a per capita GDP close to that of Nanjing in 2022, but its population size is 4,125,100 fewer than that of Nanjing, and the city's housing prices and rents are relatively lower than those of Nanjing. The internal differentiation of various indicators in third-tier cities such as Zhenjiang is significant. The other two fourth-tier cities have relatively small resident populations, but the gap between the levels of housing prices and rents and the third-tier cities is relatively small.

Table 1. Basic information of the nine cities in Nanjing Metropolitan Coordinating Region.

Name of City	Category of City	Per Capita GDP in 2022 (Unit: 10,000 CNY/Person)	Permanent Population in 2022 (Unit: 10,000)	Average Price of Commercial Housing in 2022 (Unit: CNY/Square Meter)	Rent for July 2023 (Unit: CNY/Month/Square Meter)
Nanjing	New First-Tier City	17.88	949.11	26,772	56.13
Changzhou	Second-Tier City	17.82	536.60	15,441	24.69
Zhenjiang	Third-Tier City	15.58	322.22	9486	18.49
Huai'an	Third-Tier City	10.41	455.31	10,021	16.50
Yangzhou	Third-Tier City	15.52	458.29	13,994	23.54
Wuhu	Third-Tier City	12.16	373.10	10,105	19.65
Chuzhou	Third-Tier City	8.98	405.00	6985	17.49
Ma'anshan	Fourth-Tier City	11.61	218.60	9202	17.47
Xuancheng	Fourth-Tier City	7.69	249.50	8155	16.96

Data sources: city class classification is based on the "2023 City Business Attractiveness Ranking"; per capita GDP and resident population data are from the City Statistical Yearbook of Nine Cities; average price of commercial properties and rent data are from the official website of Anjuke. Anjuke is a leading real estate information service platform in China, which was officially founded in 2007 and contains a large amount of real estate market transaction data.

According to UNESCO regulations, this paper defines young people as those between the ages of 16 and 45, and targets residents within the Nanjing Metropolitan Coordinating Region. Drawing on the survey method of Li et al. [45], a questionnaire survey was conducted through face-to-face interviews. A total of 2000 questionnaires were collected, excluding invalid questionnaires such as "under 16 years old" and "over 45 years old". A total of 1802 valid questionnaires were collected. The respondents' cities are all located in the Nanjing Metropolitan Coordinating Region, covering cities of different grades from the first to the fourth tier, and the samples are highly representative.

Some individual characteristics of the interviewed young people are described in Table 2. Among them, 861 are male and 941 are female. In terms of respondents' age, the sample size of 16–35 years old is the largest (75.6%), and the proportion of 35–40 years old (21.75%) and 40–45 years old (2.65%) is relatively small. Moreover, all of them are in line with the age group of young people as defined by the World Health Organization. From the perspective of marital status, the proportion of the married group is 59.4%, and the proportion of the unmarried group is 40.6%, which is a relatively balanced distribution of both groups. From the perspective of educational distribution, the highest educational level is mostly concentrated in vocational education (31.52%) and undergraduate education (34.46%), and the proportion of postgraduate education is only 5.5%. From the perspective

of years of working experience, the proportion of young people who have been working for 1–5 years is 37.62%, and the proportion who have been working for 6–10 years is relatively high, accounting for 46.33%. In terms of work units, the number of employees working in private/foreign/joint/collective enterprises is the largest, with the number of people accounting for 47.45%. The number of people working in government departments, public institutions, and state-owned enterprises accounted for 16.37% of the total. In terms of annual income, the highest proportion of the population is between CNY 50,000 to 100,000, accounting for 59.93%.

Table 2. Demographic statistics.

Demographic Characteristics		Number	Proportion (%)
Gender	Man	861	47.70%
	Woman	941	52.20%
Age	16–27 years	549	30.47%
	28–36 years	891	49.45%
	37–45 years	362	20.09%
Education level	Junior high school and below	146	8.10%
	High school/vocational high school	367	20.37%
	Professional training	568	31.52%
	Undergraduate course	621	34.46%
	Master	68	3.77%
	Doctor	32	1.78%
Working life	Less than one year	106	5.88%
	1–5 years	572	31.74%
	6–10 years	602	33.41%
	11–20 years	438	24.31%
	More than 20 years	84	4.66%
Work unit	Private/foreign/joint venture/collective enterprise	855	47.45%
	Government departments/public institutions/state-owned enterprises	295	16.37%
	Others	652	36.18%
Annual income	Below CNY 50,000	178	9.88%
	CNY 50,000–100,000	1080	59.93%
	CNY 100,000–200,000	450	24.97%
	CNY 200,000–500,000	86	4.78%
	CNY Over 500,000	8	0.44%

Data sources: Special Research on Housing Problems of New Citizens and Young People in the Nanjing Metropolitan Coordinating Region in 2023.

2.1. Current Situation of Young People's Residence in the Nanjing Metropolitan Area

The situation of young people buying homes in the Nanjing Metropolitan Coordinating Region in the post-pandemic era is shown in Figure 1. Obviously, there is a negative correlation between the city's housing prices and the proportion of local young homeowners. That is, the higher the price of housing in a city, the greater the proportion of young people who cannot afford to purchase a house. Among them, the highest housing price is Nanjing, the average price of commercial housing in Nanjing in 2022 was 26,772 CNY/square meter, and its rent reached 56.13 CNY/month/square meter in July 2023, in which the proportion of young people who have not purchased a house is as high as 39.9%. The lowest housing price is Chuzhou; the average price of commercial housing in Chuzhou in 2022 is only 6985 CNY/square meter, and the proportion of young homeowners is as high as 81.22%.

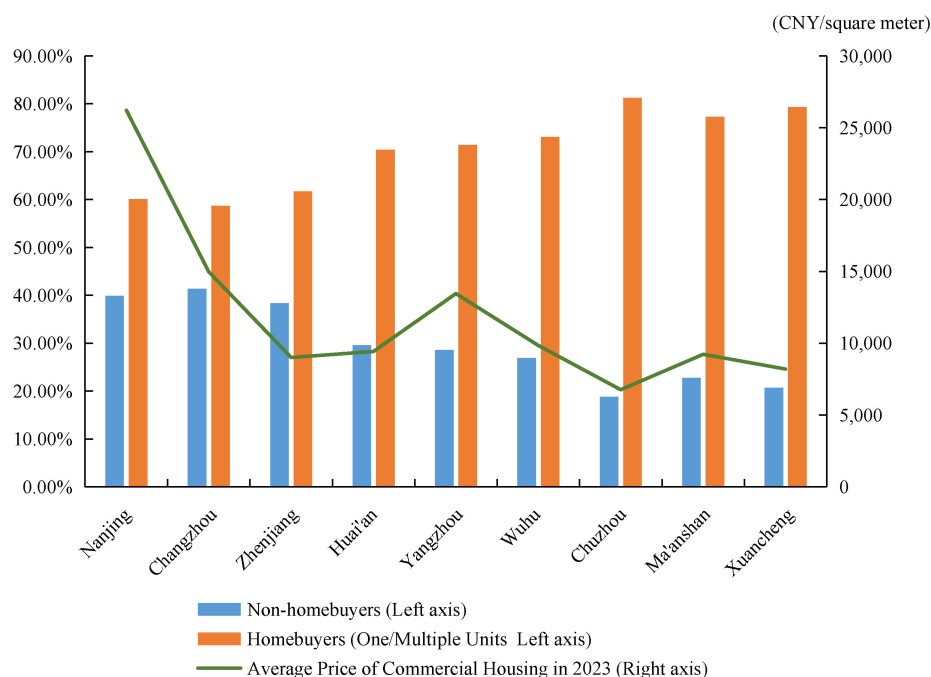


Figure 1. Homeownership among young people in the Nanjing Metropolitan Coordinating Region. Data source: Special Research on Housing Problems of New Citizens and Young People in the Nanjing Metropolitan Coordinating Region in 2023; average prices of commercial housing in 2023 are based on January–July commercial housing transaction prices from Anjuke.

Cities in the Nanjing Metropolitan Coordinating Region have large differences in housing prices and different salary levels, so the housing pressure on young people varies from city to city. Due to their short working years and relatively low income levels, young people have less savings. Therefore, young people who want to fulfill their desire to buy a home in big cities usually face a downpayment threshold. It is difficult for young people to complete the downpayment solely based on personal savings. In addition to having to face higher housing prices, young people working in big cities also have a higher proportion of other daily consumption expenditures. So, even if they can cope with the downpayment of housing, the pressure of monthly home loans in the later stage will make the young group hesitant.

In order to understand how young people solve the housing problem other than buying a commercial home, this paper researches young people's living styles. As shown in Table 3, the largest number of young people choose to live with their parents, relatives, and friends, accounting for 33.15%. Faced with the high pressure of housing expenses, young people choose to live with their parents, relatives, and friends. This way of living not only reduces their rental pressure, but also increases their funding for other expenses and improves their quality of life. However, this arrangement has some problems, such as small living area, a lack of independent space, and long work commuting distance. Moreover, this approach reduces the living quality of young people and deviates from their practical needs for a peaceful and prosperous life. In addition, among the various types of indemnificatory housing, public rental housing and low-cost housing provide relatively more housing support for young people, with about one-fifth of young people choosing these two types of housing. It is worth noting that the proportion of young people choosing indemnificatory housing is still at a relatively low level, accounting for only 4.87%. And there is still a large gap between the amount of specialized indemnificatory housing provided for young people in China and their actual needs. Furthermore, among the various market rental methods, the number of young people choosing direct rental by individual landlords and intermediary rental accounted for a relatively large proportion. By contrast, the proportion of young people choosing centralized long-term rental apartments

operated by institutions and decentralized long-term rental housing was lower, with both accounting for less than 5%.

Table 3. Type of residence for non-homebuyers.

Type of Residence	Proportion
Living with Parents, Family, and Friends	33.15%
Public Rental Housing and Low-Rent Housing	18.91%
Housing Provided by the Work Unit	13.30%
Rental Housing in Urban Villages Directly Leased by Individual Landlords	12.55%
Market Rental Housing Rented through Intermediaries	11.05%
Affordable Housing	4.87%
Centralized Long-Term Rental Apartments Operated by Institutions	4.31%
Decentralized Long-Term Rentals Operated by Institutions	1.87%

Data source: Special Research on Housing Problems of New Citizens and Young People in the Nanjing Metropolitan Coordinating Region in 2023.

As can be seen from the above analysis, in response to the greater housing needs of young people, there is a gap in the supply of both indemnificatory housing and market rental housing. These types of housing have greater development potential in the future.

2.2. Factors Influencing of Young People's Rental and Purchase Choices

In order to understand the status of homeownership among young people, this paper analyzes their motivation to purchase housing. As the Figure 2 shows, housing needs, children's educational needs, and marital needs are the top three factors considered by young homeowners. For non-homebuyers, housing needs, marital needs, and work needs are the main motivators. In contrast, family hopes, psychological fulfillment, and investment in value-added are less important. For young people, the rigid demand for housing far exceeds the demand for investment. This may be related to the implementation of a series of real estate policies by the country, which have effectively suppressed the increase in speculative demand, for example, purchase and loan restrictions policies.

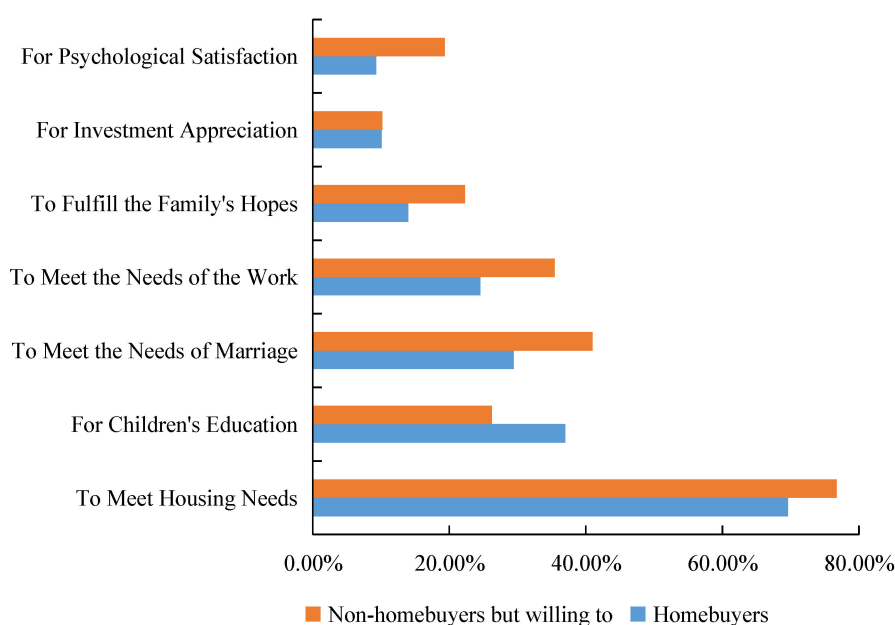


Figure 2. Motivation for young people to purchase homes in the Nanjing Metropolitan Coordinating Region. Data source: Special Research on Housing Problems of New Citizens and Young People in the Nanjing Metropolitan Coordinating Region in 2023.

As shown in Table 4, the four main sources of funds for young people to purchase a home include their own funds, bank commercial loans, housing provident fund loans, and loans from friends and relatives. Additionally, personal savings after work and financial support from parents are the main sources of their own funds. On the basis of their own economic capabilities, young people in large cities generally achieve their home-buying goals by borrowing housing loans from financial institutions. However, in the reality of high housing prices in big cities, the current amount of financial loans is difficult to meet the financial needs of young people who want to purchase a home. According to research data, only 19.86% of young people chose housing fund loans. The lower usage ratio reflects the problem of limited coverage of the current housing provident fund system. The support for housing finance needs to be further increased in the next stage.

Table 4. The source of funds for young people’s housing purchase and the influencing factors of home buying and renting decisions.

Source of Funds for Purchasing a Home (Multiple-Choice Question)	Percentage	Influencing Factors of Home Buying Decision (Multiple-Choice Question)	Percentage	Influencing Factors of Home Renting Decisions (Multiple-Choice Question)	Percentage
Own Funds	79.28%	Housing Price	93.44%	Commuting Distance	61.06%
Bank Commercial Loans	48.51%	Transportation Accessibility	83.61%	Rent	53.42%
Housing Provident Fund	19.86%	House Type	77.70%	Quality of Living	35.62%
Loans from Relatives and Friends	17.58%	Surrounding Supporting Facilities	66.89%	Surroundings	25.83%

Data source: Special Research on Housing Problems of New Citizens and Young People in the Nanjing Metropolitan Coordinating Region in 2023.

The main influencing factors for young people to buy a home include housing price, transportation, home type structure, surrounding facilities, and so on. Although housing prices in big cities have not risen significantly in recent years [46], they are still at a high level, and remain the primary factor influencing young people’s home purchase. In addition, young people are more concerned about the level of public services such as transportation accessibility and supporting facilities in the vicinity of the housing, and even attach more importance to transportation accessibility than to the household structure.

In contrast, for young people living in rented housing, the main factors affecting them in the rental process include the distance to work, the price of rent, the quality of living, and the surrounding environment. The main reason young people rent apartments in big cities is to fulfill their work needs. Since their jobs have not yet stabilized and it is difficult for them to buy a home in the short term, young people choose to rent an apartment close to their workplace in order to save commuting time. Rent is still one of the important influencing factors. If rents for housing near the workplace are too high, young people may choose to rent housing across districts or cities, thus reducing the pressure on housing expenses. However, this also contributes to the current common problem of separation of work and housing [47]. It is worth noting that young people are relatively less concerned about the quality of living and the surrounding environment. Under the premise of considering commuting costs and rental prices, young people are forced to reduce their requirements for living quality and surrounding environment, which will raise issues of social integration and economic development for young people in large cities.

2.3. Young People’s Expectations for the Housing Market and House Purchase Plans

In the post-pandemic era, China’s economic development is still facing the three major difficulties of supply shocks, insufficient demand, and weakened expectations. Undoubtedly, in the process of real estate market development, it is also troubled by these difficulties. Therefore, based on understanding the expectations of young people regarding

the housing market and their future home purchase plans, this paper further analyzes the existing problems in the development of the real estate market in the post-pandemic era.

As can be shown from Figure 3, affected by subjective and objective factors, young people in each city in Nanjing Metropolitan Coordinating Region have different expectations on the changes of housing prices in the coming year. Most of the young people think that the local housing prices will be basically unchanged or decline a little in the coming year. Moreover, the proportion of the bearish group is much higher than that of the bullish group. In addition, the proportion of young people who think housing prices will rise and fall a lot is less than 10 percent. Most young people believe that housing prices will only fluctuate to a small extent. This also reasonably explains why many young people are still holding a wait-and-see attitude in the decision-making process. Maybe it is because young people's expectations for the future development of the property market have been weakening. They believe that housing prices are approaching their peak and there is little room for future growth [48].

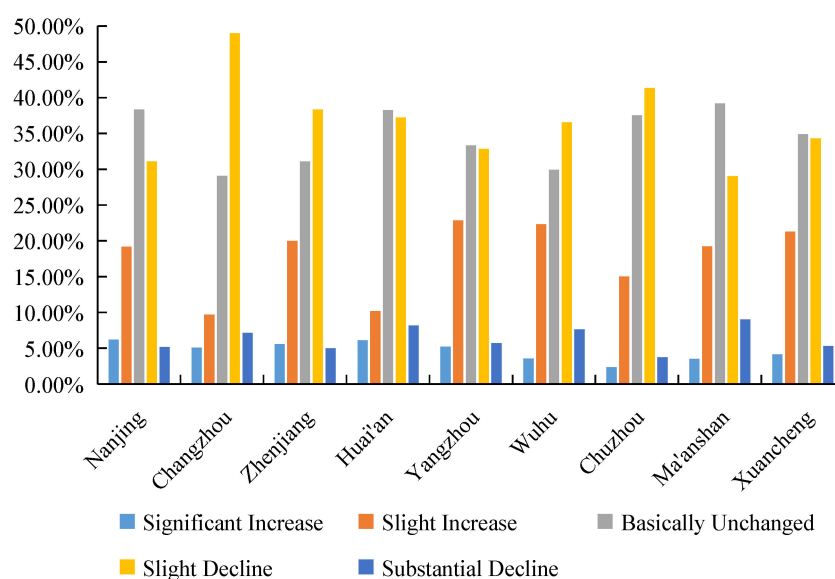


Figure 3. Young people's expectations of housing prices in the coming year. Data source: Special Research on Housing Problems of New Citizens and Young People in the Nanjing Metropolitan Coordinating Region in 2023.

As can be shown from Figure 4, there is a paradox in the current real estate market of “increased pressure felt by residents and a decrease in actual housing prices”. According to research data, the youth in Yangzhou and Wuhu generally believe that the pressure to buy a home compared to the previous two years has not changed. With the exception of Yangzhou and Wuhu, young people in other cities generally felt that the pressure to buy a home had increased compared to two years ago. However, by comparing the average price of commercial properties in the first half of 2023 and 2021, this paper finds that house prices in eight of the nine cities in the Nanjing metropolitan area have declined compared to two years ago.

Among the nine cities, the city with the largest drop in average commodity housing prices is Nanjing, with a drop of 10.1%. Obviously, the decline in housing prices is significant, but the pressure on young people to buy houses has not eased as a result. The inherent logic of this contradiction is worth exploring in depth. Currently, due to the slowdown in economic growth in China, the employment of young people will also be affected. The income instability of young people continues to increase, which also leads to their relatively weak housing affordability [49]. In addition, although house prices have fallen in recent years, they are still above the affordable price range for young people. This is mainly due to the fact that house prices grew too fast in the early period and almost reached their peak.

After the decline, prices have still not reached normal levels. Therefore, young people are not sensitive to the decline in the average price of urban commercial housing.

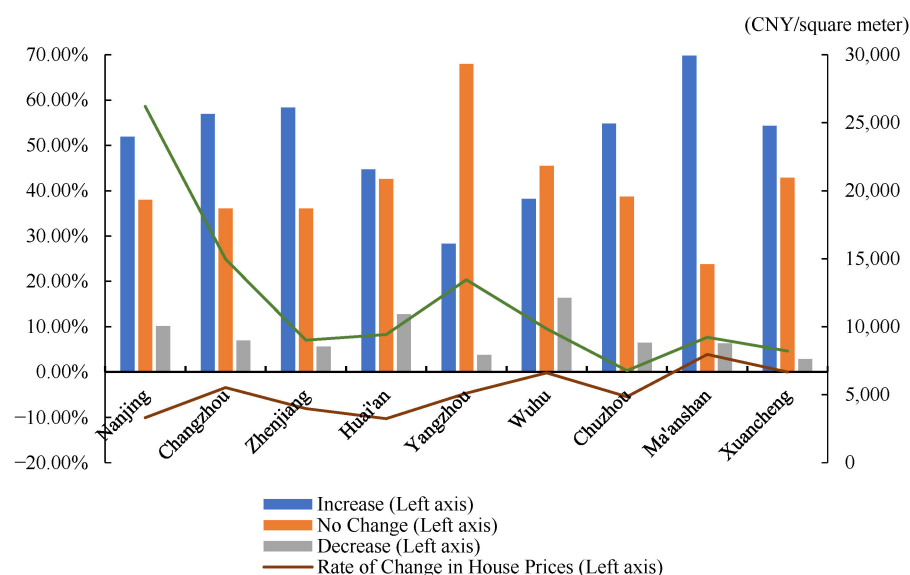


Figure 4. Changes in current pressure on young people to buy a home. Data source: Special Research on Housing Problems of New Citizens and Young People in the Nanjing Metropolitan Coordinating Region in 2023. Data on the rate of change in housing prices is based on commercial housing transaction prices from Anjuke.

Understanding the future housing purchase plans of young people is of great significance for solving their housing problem. There are many different types of factors that can affect the future housing ownership plans of young people.

For non-homebuyers, future homeownership plans are primarily driven by rigid housing needs. For young people who have already purchased a house, their main motivation for future home purchases is to improve their current living environment or invest in real estate. The future willingness of young people to purchase houses is shown in Figure 5. Firstly, regardless of whether they have already bought a house or not, the proportion of young people who have no intention of buying a house in the future is the highest, exceeding 40%. Secondly, the proportion of young people who have plans to purchase a house in the future but have not determined a specific purchase time is the highest. This group of young people have a demand for buying a home, but currently still hold a wait-and-see attitude. Thirdly, the proportion of young people planning to purchase houses within the next three years is the lowest. Even for young people who have not purchased a house, the proportion of people planning to buy a house within the next three years is only 27.01%.

Overall, although young people are less enthusiastic about homeownership than in previous years, the percentage of those who plan to buy a home in the future still outnumbers those who do not plan to buy a home. This shows that young people's willingness to buy a home is still high, but they expect to buy a home at a later date. The main reasons for this result include the following four points. Firstly, the epidemic has intensified the income fluctuations of young families, leading to a continuous decrease in the funds used by families to support home purchases. Young people have limited personal savings and housing consumption ability due to their short time in the workplace. Secondly, according to the theory of conformity psychology, an individual's behavior is easily influenced by external factors. As the willingness of young people to engage in marriage and childbirth decreases, their plans for marriage and childbirth will gradually be postponed. The demand for marriage housing, school district housing, and nesting related to this will also be correspondingly delayed. Furthermore, due to the impact of real estate

regulation policies and the epidemic, housing prices have shown a downward trend [50]. Especially in third and fourth tier cities, young people lack confidence in the development of the real estate market and are expected to see further declines in housing prices, so they tend to adopt a wait-and-see attitude. Finally, with the development and improvement of the housing rental market, the lifestyle of young people has changed. Young people are more willing to rent in the vicinity of their workplaces to reduce commuting time and improve the quality of life.

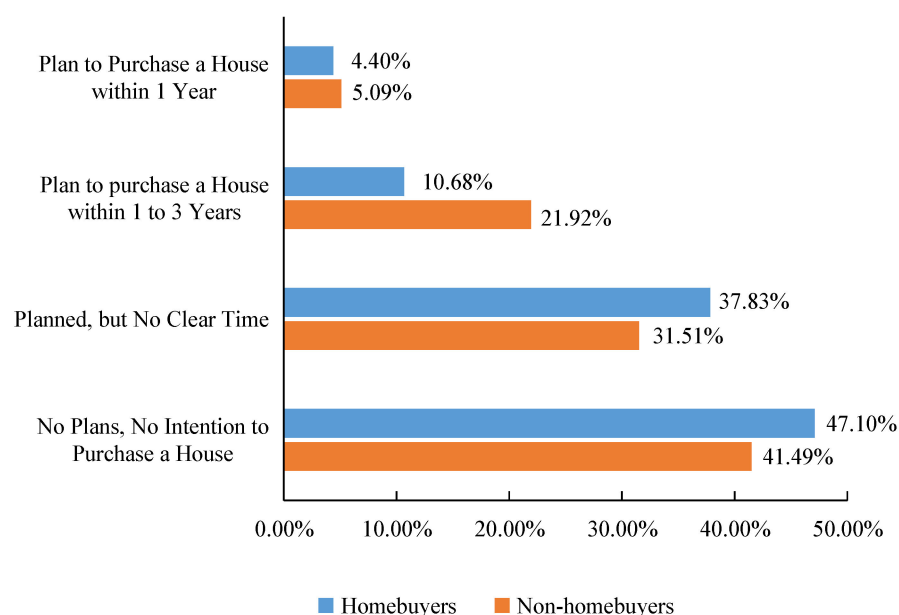


Figure 5. Young people's future home purchase plans. Data source: Special Research on Housing Problems of New Citizens and Young People in the Nanjing Metropolitan Coordinating Region in 2023.

3. Housing Problems of Young People in the Nanjing Metropolitan Coordinating Region

3.1. The Contradiction between Young People's Strong Preference for Homeownership and the Weakness of Housing Affordability

According to the preliminary survey, this paper finds that the number of young people in the Nanjing Metropolitan Coordinating Region who have purchased a home exceeds the number who have not. A large proportion of young people who have not purchased a home choose to live in their parents' or friends' homes. Fewer young people choose to rent a home. Compared to rental housing, purchased housing is more stable and comfortable, which can enhance the sense of integration and happiness of young people. Homebuyers can not only enjoy basic public services around the house, but also avoid the hassle of relocation. Furthermore, when housing prices rise, homeowners can enjoy the asset appreciation, rental appreciation, and other investment income [51,52]. More importantly, in addition to its residential and investment attributes, housing also has social attributes. In contemporary society, housing has gradually become a symbol of social identity, status, and success. To a certain extent, the number and value of properties owned reflect the class status of young people. In the marriage market, young people who have purchased a home are more competitive than the non-homeowner group. Considering emotional needs, investment returns and other factors, young people's preference for homeownership is stronger than renting.

However, young people's actual ability to pay for housing is insufficient because of their short working years, lower wages, and low savings. On the one hand, the high housing prices contrast sharply with the wages of young people with unstable careers. For young people, their income level is extremely low, and some can only maintain their

basic living needs. Once young people are separated from the support of their parents, relying only on personal savings is difficult to achieve homeownership in the short term. On the other hand, young people pursue a higher quality of life. They spend more on social entertainment, daily meals, clothing, and so on. It makes young people even more difficult realize wealth accumulation and bear the pressure of purchasing housing funds when their salary level is not high. As a result, many young people are now buying homes with the help of their parents' savings. A pattern has developed whereby parents help them with the downpayment and young people are responsible for the subsequent repayment of the loan.

3.2. The Contradiction between the Strong Demand for Rental Housing and the Imbalance in the Supply Structure of the Rental Market

Guiding young people towards the option of renting is one of the most important ways of helping them to overcome their housing difficulties. It adheres to the principle of nonspeculation in real estate and implements a long-term mechanism for the stable and healthy development of the real estate market. The increased mobility of the population in metropolitan areas is a significant reason for the strong demand for rental housing. With the acceleration of urbanization, large cities and downtown areas provide more employment opportunities and higher salaries for young people. Although high housing prices make it impossible for them to buy a home locally, the development of public transportation provides them options for renting housing within an acceptable commuting range. Rental housing can not only lower the cost of living and reduce the burden of home ownership on the squeeze on consumption, but also effectively solve the problem of separating jobs and housing for young people in big cities.

However, there are still some pain points and difficulties in the development of the current housing rental market. First of all, tenants' rights and interests can hardly be safeguarded when tenants and purchasers do not have the same rights and interests. Take Nanjing Metropolitan Coordinating Region as an example. Young people are more inclined to gather in Nanjing, but the supply capacity of education, medical care, employment, and other high-quality public resources in big cities is limited. It is difficult to match public service resources with the needs of a huge influx of people. The allocation of these public resources is skewed in favor of groups that have already purchased homes and settled down. In addition, there is a lack of professional rental organizations with mature operations. The rental industry is characterized by rapid growth in demand, low barriers to entry, a small number of competitors, and imperfect regulation. At present, China's housing rental industry is still in the early stage of development. In recent years, frequent problems with the operation of long-stay apartments have led to a decline in young people's trust in rental agencies. They are more willing to rent homes directly from landlords or through agents. The low degree of institutionalization is likely to lead to the rental housing structure mismatch, stability reduction, and other problems.

Last but not least, the development of rental housing market is sluggish [53]. There is a mismatch between the supply side and the demand side. It is well known that tight land resources and restricted housing construction in urban centers have resulted in a limited number of housing units available for rent. As a result of insufficient supply but high demand, rental prices for housing in urban areas are generally high, making it difficult to provide young people with high-quality and low-cost rental housing. In addition, given the low incomes of young people, some regions tend to provide low-level rental services, and there is a relative lack of medium- and high-end rental resources. The imbalance in the supply structure makes it difficult for young people to meet their demand for quality rental housing. This also limits the role that the rental market can play in solving the housing problems of young people.

3.3. The Contradiction between the Lack of Financial Support Tools and the High Pressure on Home-Buying Funds

Young people are often faced with down payment threshold and loan repayment difficulties. At the same time, renting in big cities will also face high rent pressure. In the context of high housing prices, it is difficult to achieve housing freedom only by relying on young people's personal salary and savings income. Even if parents provide some deposit support to make up for the downpayment, young people still need to rely on borrowing mortgage loans from financial institutions to achieve their housing goals. The main housing loan options available to young people include commercial loans and housing fund loans, but both of these means of financial support have certain defects.

On the one hand, in the case of commercial loans, young people are in a vulnerable position in terms of credit market. As most young people lack collateral and guarantees and have unstable incomes, it is difficult for banks to assess their ability to repay and then grant them housing loans. Even if young people have access to commercial housing loans, the interest rates on commercial housing loans in China are not low and the pressure on their monthly mortgage repayments remains high. On the other hand, as far as the housing provident fund loans are concerned, the coverage rate of the current housing provident fund system is still relatively low, so many young people have not participated in the system. There are certain restrictions on the loan amount, withdrawal, and use of housing provident fund. The loan amount in some big cities is difficult to meet the housing demand of young people, which can not effectively relieve the housing pressure of young people.

3.4. The Contradiction between the Low Level of Housing Security for Young People and the High Demand for Social Security in Reality

Accelerating the development of indemnificatory rental housing can help alleviate the housing difficulties faced by new citizens and other groups. It also can provide young people basic housing security for living and working in the city. At present, China's indemnificatory rental housing is mostly oriented towards urban low-income families and key introduced talents. Housing security and housing support for most groups of young people is lacking.

To begin with, although some cities have also introduced institutional policies on housing security for newly employed youth, there is a lack of effective promotion. Many young people do not understand the specific content and implementation requirements of the policy and even question the fairness of the policy. They are unwilling to take the initiative to learn about and apply for indemnificatory rental housing. Furthermore, most cities have already provided indemnificatory rental housing such as public rental housing and low-rent housing. Settling-in allowance and rental subsidies have also become important means for attracting talents to settle down in various regions. However, the demand for affordable housing among young people far exceeds the current supply. Because of short working experience and low incomes, young people will realize that it is hard in the short term to rely on buying houses in the city to solve their housing problems. Therefore, they have a greater need for government-subsidized rental housing. Due to the complex application conditions, opaque distribution process and asymmetric policy information, it is more than difficult for young people to obtain housing security. Finally, the supply of indemnificatory rental housing is inadequate and the internal structure is unbalanced. There is a large gap in indemnificatory rental housing in large cities with large net population inflows. Moreover, because of the imperfect supporting system of subsidized housing in terms of a secure living environment, transportation facilities, education, and medical care, it is not very attractive to young people. The indemnificatory rental housing lacks professional construction, leasing, and operational management organizations. It is unable to provide differentiated indemnificatory housing for young people with different abilities to pay. So, it will lead to a serious mismatch between supply and demand.

3.5. The Contradiction between the Small Coverage of the Housing Provident Fund and the Large Role of Housing Support

The housing provident fund system was first pilot-implemented in Shanghai in 1991, which is a social, friendly, and policy-oriented housing social security system. It helps to increase the supply of funds in the housing market, change the housing concepts of urban residents, and promote housing consumption. Specifically, young people can not only apply for housing provident fund loans with lower interest rate, but also use the housing provident fund to repay the loan part of the property. In addition, with the reform of the housing provident fund system, young people can also withdraw their housing provident fund to pay rent, which greatly reduces their housing burden.

However, there are also certain shortcomings in the housing provident fund system, such as limited public participation and inadequate design of the “wealth-sharing” mechanism. The most prominent problem with the housing provident fund system is the low coverage rate. As an inclusive housing finance system, housing provident fund, is one of the public services that residents should enjoy. Therefore, the housing fund system should be open to the entire population and guarantee fair opportunities for workers to participate. Nevertheless, in 2022, the number of employees who paid up to the country’s housing provident fund was 169.7957 million, accounting for only 36.97% of the urban employment. This coverage of the system is small. On the one hand, in order to reduce expenses and operating costs in the short term, some enterprises deliberately underpay, omit, or fail to pay the housing provident fund, depriving employees of their legitimate rights and interests. In addition, the lower cost of violating regulations exacerbates the existence of this phenomenon, forming a vicious cycle. On the other hand, some young people may give up the long-term rights of housing provident fund in order to increase their short-term wage income due to reasons such as lack of legal knowledge of the housing provident fund system. So, their willingness to participate in housing provident fund may decrease.

4. Policy Recommendations

4.1. Promote the Formation of a Multi-Level Housing Supply Structure

In view of the contradiction between young people’s strong preference for home-ownership and the affordability issue in the metropolitan area, it is urgent to promote the formation of a multi-level housing supply structure. The government needs to promote the formation of a multi-level housing supply structure from the following aspects.

First, the structure of housing supply should be continuously adjusted, and a differentiated housing system should be established to provide diversified housing options for youth groups. The government should advocate a gradient housing consumption pattern for residents. The government should encourage middle-income and low-income families to purchase affordable housing, provide low-income families with appropriate rent-subsidized rental housing, and provide low-rent housing guarantees for the lowest-income families. Secondly, the government should guide young people to establish the concept of gradient housing consumption through policy appeals. Consumers should be encouraged to choose different ways of housing consumption at different ages, taking full account of their family income levels and consumption affordability. At the same time, real estate development enterprises should be supported to engage in the development and construction of rental housing, and certain preferential policies should be given in terms of bank loans and tax collection.

4.2. Accelerate the Promotion of Equal Rights for Renters and Purchasers

The housing problem and the inequality of public services have exacerbated the mobility of young people. Also, the differing rights between renting and purchasing have become a new dividing line for welfare among urban and rural residents. Therefore, it is necessary to accelerate the promotion of equal rights for renters and buyers to protect the rights and interests of young people in public services.

First, the government should formulate relevant policies to clarify the principle of equal rights for renting and purchasing and specific measures. This will help to ensure that young people enjoy equal rights and interests in renting and purchasing housing. The content of the policy should specifically include measures to ensure the standardization of the rental market, rent control and subsidies for home purchase. Secondly, an open platform for rental and purchase information should be established on the basis of the market, which can provide information on rental and purchase. At the same time, the legal protection of rental and purchase contracts should be strengthened, emphasizing information transparency and the protection of rights and interests. Thirdly, the construction of supporting public services in young people's residential areas should be strengthened, including in the areas of education, medical care, culture, and recreation. When young people can enjoy quality educational resources, convenient medical services, and rich and diverse cultural and recreational activities, their quality of life and sense of well-being will be enhanced.

4.3. Establish a Standardized Housing Rental Market

As the development strategy of the Nanjing Metropolitan Coordinating Region is being implemented in depth, the floating population gathering in central cities and industrial parks in various cities. Based on this background, rental housing will play a crucial role in addressing the housing issues faced by young people and other groups, as well as in promoting new urbanization.

Firstly, the government should formulate and improve relevant laws and regulations on rental housing, clarify the rights and obligations of both parties, standardize the signing and execution of rental contracts, and protect the rental rights and interests of young people. Secondly, the government should actively activate the existing rental housing market by providing tax support and encouraging the development of large-scale institutions. We should advocate for a market-oriented approach, supplemented by government macroeconomic regulation, to flexibly adjust housing supply resources and provide more accurate rental services for young people. This will effectively alleviate the supply–demand contradiction of rental housing and improve the efficiency of housing supply. Thirdly, a sound regulatory mechanism for the rental market should be established, and the supervision of housing intermediaries and rental platforms should be strengthened to ensure the fair, transparent, and orderly operation of the rental market.

4.4. Optimize Housing Security Policies for Young People

The floating population, mainly composed of young people, is highly concentrated in specific areas such as industrial parks in Nanjing and other cities. This concentration leads to significant variations in the demand for indemnificatory rental housing in the metropolitan area. Therefore, the position of affordable rental housing in the housing supply system of various regions should be determined based on the actual needs of local young people. Each city should accurately grasp the supply and demand of housing, and formulate development concepts and policies for affordable housing that are in line with local conditions.

Firstly, large cities with a high net inflow of population should conduct a special survey on the demand for rental housing as soon as possible, and systematically sort out the current situation of housing supply structure. Local governments should have a deep understanding of the housing demand characteristics of young people, and then determine the future housing supply system structure, the number and methods of raising affordable rental housing, in order to provide targeted housing security services; Secondly, we should accelerate the implementation of supporting measures to promote the housing rental market, encourage real estate developers and investors to invest in rental housing, and increase the supply of rental housing. At the same time, the government can introduce corresponding policies, such as reducing rental taxes and lowering rental levels, to attract more young people to choose to rent and improve their housing security level.

4.5. Expand the Coverage of the Housing Provident Fund

As a social security system for housing, the housing provident fund plays an indispensable role in promoting housing consumption among young people. With the continuous expansion of housing provident fund coverage, it will help young people raise and integrate housing funds, and improve their housing affordability.

Firstly, housing provident fund management agencies in various regions should actively collaborate with government departments, banks, associations, etc., to form a housing provident fund publicity group and hold lectures on relevant knowledge of the housing provident fund. This can make more young people realize the important role of the housing provident fund in housing support, and it is necessary for the unit to contribute to their housing provident fund. Secondly, the government should speed up the introduction of legislation on housing fund management and establish a housing system oriented towards the integration of metropolitan areas. The mandatory and binding nature of the norms related to housing provident funds should be increased at the legal level. For units and enterprises that should have paid but did not, or refused to cooperate, penalties should be increased to raise the cost of violating the law. Thirdly, more consideration should be given to the real housing needs of young people, and flexible mechanisms should be developed for housing fund contributions, withdrawals, and loans. For example, a “mandatory + voluntary” contribution mechanism should be adopted. Flexible withdrawal methods should be implemented and the range of withdrawals should be increased. In addition, the loan amount should be adjusted according to the city’s housing prices.

5. Discussion

In the context of the post-pandemic era, the supply and demand relationship in the real estate market appears a new situation. The high price of housing brings greater housing pressure on young people. This paper uses this as an entry point for research. Through questionnaires and field interviews, we investigate the housing situation and home purchase plans of young people in Nanjing Metropolitan Coordinating Region and analyze the research data in depth. The research results are beneficial for promoting young people to achieve a comfortable life and work. In addition, this study has important research significance in promoting the improvement of housing policies and the construction of youth development-oriented cities.

The main findings of our analysis are as follows. Currently, young people show a strong preference for homeownership when it comes to rent-purchase options. However, due to the weaker housing affordability of youth groups, it is difficult to support their preference for home ownership. Youth groups often face greater financial constraints when purchasing a home. Therefore, at this stage, China’s financial means to support residents’ housing consumption still needs to be increased. Although the youth group’s demand for rental housing is continuously released, there is an imbalance in the supply structure of the rental market, which is unable to satisfy their demand for rental housing. At the same time, the supply of subsidized housing for youth groups also remains at a low level. In addition, the housing provident fund has not been able to maximize its role in supporting the housing consumption of the youth group due to its small coverage. In order to solve the above existing problems, this paper puts forward the following five main policy recommendations. Firstly, the formation of housing gradient consumption should be promoted to meet the reasonable housing needs of young people. Secondly, we should accelerate the promotion of equal rights for renters and buyers, and safeguard the rights and interests of young people in public services. Thirdly, the establishment and development of a standardized housing rental market should provide more rental options for young people. Fourthly, housing security policies for young people should be optimized on an urban basis. Lastly, the coverage of the housing fund should be expanded to promote young people’s ability to pay for housing. When a multi-level housing supply structure is formed and the equal rights for renting and purchasing are steadily implemented, the housing rental market will better meet the housing problem of young people. And the

crowding out effect of housing consumption on other consumption will also be weakened. Therefore, the economy will achieve sustainable development.

6. Conclusions

After analyzing the field research data of the Nanjing Metropolitan Coordinating Region, China, this paper found that young people currently have a strong preference for self owned housing. The supply structure of the rental market is imbalanced. The financial support for housing is limited. The level of housing security is low and the coverage of housing provident fund is narrow. We have put forward corresponding policy recommendations for this. In addition, this paper also has some limitations. First, the questionnaire coverage is limited and the sample selection is not sufficient. The area of our research is mainly concentrated in the center of the nine cities in the Nanjing Metropolitan Coordinating Region. It does not cover the young people in the township suburbs of the Nanjing Metropolitan Coordinating Region well. And the distribution of this survey respondents in all age groups is uneven, with nearly half of the population aged 28–36. Second, the research method is not deep enough. Young people's housing is a complex issue with many influencing factors. This paper focuses on the descriptive analysis of the field research data, objectively describing the current housing situation of the youth groups in the post-pandemic era and their future expectations of the real estate market. We hope that future research can construct more accurate and scientific theoretical models and conduct empirical analysis to make our conclusions more reasonable.

Author Contributions: Conceptualization, Y.W. (Yidong Wu) and Y.Z.; methodology, L.Z.; investigation, J.Z.; resources, Y.W. (Yixin Wang); data curation, Y.Z. and L.Z.; writing—original draft preparation, Y.Z. and L.Z.; writing—review and editing, Y.Z., J.Z. and Y.W. (Yidong Wu); visualization, Y.W. (Yidong Wu) and L.F.; supervision, Y.W. (Yidong Wu) and L.F.; project administration, L.Z. and J.Z.; funding acquisition, Y.W. (Yidong Wu) All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the the Ministry of Education of Humanities and Social Science Project (NO.23YJC790154); National Natural Science Foundation of China (NO.72374003); Key Research Project of Humanities and Social Sciences in Universities in Anhui Province (2022AH050272); The University Synergy Innovation Program of Anhui Province (NO.GXXT-2022-098).

Data Availability Statement: Data are contained within the article.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Li, B.; Li, R.; Wareewanich, T. Factors Influencing Large Real Estate Companies' Competitiveness: A Sustainable Development Perspective. *Land* **2021**, *10*, 1239. [CrossRef]
2. Li, R.; Yue, X.; Crabbe, M. COVID-19 in Wuhan, China: Pressing Realities and City Management. *Front Public Health* **2021**, *8*, 596913. [CrossRef] [PubMed]
3. Ardiyono, S.K. COVID-19 pandemic, firms' responses, and unemployment in the ASEAN-5. *Econ. Anal. Policy* **2022**, *76*, 337–372. [CrossRef] [PubMed]
4. Zou, Y. Paradigm shifts in China's housing policy: Tug-of-war between marketization and state intervention. *Land Use Policy* **2022**, *122*, 106387. [CrossRef]
5. Wang, Y.; Li, Y.; Huang, Y.; Yi, C.; Ren, J. Housing wealth inequality in China: An urban-rural comparison. *Cities* **2020**, *96*, 102428. [CrossRef]
6. Chen, J.; Wu, F. Housing and land financialization under the state ownership of land in China. *Land Use Policy* **2022**, *112*, 104844. [CrossRef]
7. Gil, J.; Martínez, P.; Sequera, J. The neoliberal tenant dystopia: Digital polyplatform rentierism, the hybridization of platform-based rental markets and financialization of housing. *Cities* **2023**, *137*, 104245. [CrossRef]
8. Zhang, M.; Luo, Z.; Qiao, S.; Gar-On Yeh, A. Financialization, platform economy and urban rental housing: Evidence from Chengdu, China. *Appl. Geogr.* **2023**, *156*, 102993. [CrossRef]
9. Chen, Z.; Wang, C. Effects of intervention policies on speculation in housing market: Evidence from China. *J. Manag. Sci. Eng.* **2022**, *7*, 233–242. [CrossRef]

10. Lan, H.; Moreira, F.; Zhao, S. Can a house resale restriction policy curb speculation? Evidence from a quasi-natural experiment in China. *Int. Rev. Econ. Financ.* **2023**, *83*, 841–859. [CrossRef]
11. Yang, X.; Wu, Y.; Shen, Q.; Dang, H. Measuring the degree of speculation in the residential housing market: A spatial econometric model and its application in China. *Habitat Int.* **2017**, *67*, 96–104. [CrossRef]
12. Altman, E.I.; Hu, X.; Yu, J. Has the Evergrande debt crisis rattled Chinese capital markets? A series of event studies and their implications. *Financ. Res. Lett.* **2022**, *50*, 103247. [CrossRef]
13. Jia, Z.; Wen, S.; Lin, B. The effects and reacts of COVID-19 pandemic and international oil price on energy, economy, and environment in China. *Appl. Energy* **2021**, *302*, 117612. [CrossRef] [PubMed]
14. Tanrıvermiş, H. Possible impacts of COVID-19 outbreak on real estate sector and possible changes to adopt: A situation analysis and general assessment on Turkish perspective. *J. Urban Manag.* **2020**, *9*, 263–269. [CrossRef]
15. Hui, E.C.M.; Chan, K.K.K. Foreign direct investment in China's real estate market. *Habitat Int.* **2014**, *43*, 231–239. [CrossRef]
16. Wang, Y.; Zhou, Y.; Yu, X.; Liu, X. Is domestic consumption dragged down by real estate sector?—Evidence from Chinese household wealth. *Int. Rev. Financ. Anal.* **2021**, *75*, 101749. [CrossRef]
17. Xiang, J.; Liu, C.; Li, Y. The impact of household real estate and self-employment: Evidence from China. *Econ. Model.* **2021**, *94*, 873–884. [CrossRef]
18. Deng, Q.S.; Alvarado, R.; Cheng, F.N.; Cuesta, L.; Wang, C.B.; Pinzón, S. Long-run mechanism for house price regulation in China: Real estate tax, monetary policy or macro-prudential policy? *Econ. Anal. Policy* **2023**, *77*, 174–186. [CrossRef]
19. Pu, G.; Zhang, Y.; Chou, L.-C. Estimating financial information asymmetry in real estate transactions in China—An application of two-tier frontier model. *Inf. Process. Manag.* **2022**, *59*, 102860. [CrossRef]
20. Yang, G.-L.; Fukuyama, H.; Chen, K. Investigating the regional sustainable performance of the Chinese real estate industry: A slack-based DEA approach. *Omega* **2019**, *84*, 141–159. [CrossRef]
21. Bas, M. The impact of the COVID-19 pandemic on the residential real estate market on the example of Szczecin, Poland. *Procedia Comput. Sci.* **2022**, *207*, 2048–2058. [CrossRef] [PubMed]
22. Nanda, A.; Xu, Y.; Zhang, F. How would the COVID-19 pandemic reshape retail real estate and high streets through acceleration of E-commerce and digitalization? *J. Urban Manag.* **2021**, *10*, 110–124. [CrossRef]
23. Zhang, W.; Li, B.; Roca, E. Moments and momentum in the returns of securitized real estate: A cross-country study of risk factors driving real estate investment trusts before and during COVID-19. *Heliyon* **2023**, *9*, e18476. [CrossRef] [PubMed]
24. Renigier-Biłozor, M.; Żróbek, S.; Walacik, M.; Janowski, A. Hybridization of valuation procedures as a medicine supporting the real estate market and sustainable land use development during the COVID-19 pandemic and afterwards. *Land Use Policy* **2020**, *99*, 105070. [CrossRef] [PubMed]
25. Tsai, I.C.; Chiang, Y.-H.; Lin, S.-Y. Effect of COVID-19 lockdowns on city-center and suburban housing markets: Evidence from Hangzhou, China. *J. Asian Econ.* **2022**, *83*, 101544. [CrossRef] [PubMed]
26. Żróbek-Róžańska, A. Stay or leave the city? Students and rented accommodation during COVID-19 pandemic. *Cities* **2022**, *128*, 103788. [CrossRef]
27. Huang, W.; Lan, C.; Xu, Y.; Zhang, Z.; Zeng, H. Does COVID-19 matter for systemic financial risks? Evidence from China's financial and real estate sectors. *Pac.-Basin Financ. J.* **2022**, *74*, 101819. [CrossRef]
28. Bergeaud, A.; Eyméoud, J.-B.; Garcia, T.; Henricot, D. Working from home and corporate real estate. *Reg. Sci. Urban Econ.* **2023**, *99*, 103878. [CrossRef]
29. Chong, J.; Phillips, G.M. COVID-19 Losses to the Real Estate Market: An Equity Analysis. *Financ. Res. Lett.* **2022**, *45*, 102131. [CrossRef]
30. Hu, M.R.; Lee, A.D.; Zou, D. COVID-19 and Housing Prices: Australian Evidence with Daily Hedonic Returns. *Financ. Res. Lett.* **2021**, *43*, 101960. [CrossRef]
31. Liang, X.; Rozelle, S.; Yi, H. The impact of COVID-19 on employment and income of vocational graduates in China: Evidence from surveys in January and July 2020. *China Econ. Rev.* **2022**, *75*, 101832. [CrossRef] [PubMed]
32. Mazur, M.; Dang, M.; Vega, M. COVID-19 and the march 2020 stock market crash. Evidence from S&P1500. *Financ. Res. Lett.* **2021**, *38*, 101690. [CrossRef] [PubMed]
33. Li, R.Y.M. Generation X and Y's demand for homeownership in Hong Kong. *Pac. Rim Prop. Res. J.* **2015**, *21*, 15–36. [CrossRef]
34. Tsai, I.C. Changes in social behavior and impacts of the COVID-19 pandemic on regional housing markets: Independence and risk. *J. Behav. Exp. Financ.* **2022**, *35*, 100698. [CrossRef] [PubMed]
35. Bangura, M.; Lee, C.L.; Schafer, B. The Unintended Consequences of COVID-19 Economic Responses on First Home Buyers? Evidence from New South Wales, Australia. *Buildings* **2023**, *13*, 1203. [CrossRef]
36. Zhai, W.; Peng, Z.-R. Where to buy a house in the United States amid COVID-19? *Environ. Plan. A Econ. Space* **2021**, *53*, 9–11. [CrossRef]
37. Hall, A.; Thomas, D. Declining Home Ownership Rates in Australia, Parliament of Australia. 2019. Available online: https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/BriefingBook46p/HomeOwnership (accessed on 1 July 2019).
38. Gamal, A.; Rohmah, L.; Muhyi, M.M. Housing preference shifting during COVID-19 pandemic in Indonesia. *J. Urban Manag.* **2023**, *12*, 268–283. [CrossRef]
39. Schulz, R.; Watson, V.; Wersing, M. Teleworking and housing demand. *Reg. Sci. Urban Econ.* **2023**, *101*, 103915. [CrossRef]

40. Ahsan, M.M.; Sadak, C. Exploring housing market and urban densification during COVID-19 in Turkey. *J. Urban Manag.* **2021**, *10*, 218–229. [CrossRef]
41. Gnat, S. Convergence of residential property prices in the Szczecin agglomeration in the context of the COVID-19 pandemic. *Procedia Comput. Sci.* **2022**, *207*, 2039–2047. [CrossRef]
42. Gupta, A.; Mittal, V.; Peeters, J.; Van Nieuwerburgh, S. Flattening the curve: Pandemic-Induced revaluation of urban real estate. *J. Financ. Econ.* **2022**, *146*, 594–636. [CrossRef]
43. Akbari, P.; Yazdanfar, S.-A.; Hosseini, S.-B.; Norouzian-Maleki, S. Housing and mental health during outbreak of COVID-19. *J. Build. Eng.* **2021**, *43*, 102919. [CrossRef]
44. Chmielewska, A.; Ciski, M.; Renigier-Bilozor, M. Residential real estate investors' motives under pandemic conditions. *Cities* **2022**, *128*, 103801. [CrossRef]
45. Li, R.; Chau, K.; Zeng, F. Ranking of Risks for Existing and New Building Works. *Sustainability* **2019**, *11*, 2863. [CrossRef]
46. Cheung, K.S.; Yiu, C.Y.; Xiong, C. Housing Market in the Time of Pandemic: A Price Gradient Analysis from the COVID-19 Epicentre in China. *J. Risk Financ. Manag.* **2021**, *14*, 108. [CrossRef]
47. Blumenberg, E.; King, H. Jobs–Housing Balance Re-Re-Visited. *J. Am. Plan. Assoc.* **2021**, *87*, 484–496. [CrossRef]
48. Gamber, W.; Graham, J.; Yadav, A. Stuck at home: Housing demand during the COVID-19 pandemic. *J. Hous. Econ.* **2023**, *59*, 101908. [CrossRef]
49. Yaacob, M.; Siti Hajar Abu Bakar, S.; Wan Abdul Aziz, W. Housing For Young People: What Are Their Opportunities? *Soc. Manag. Res. J.* **2017**, *14*, 15–31. [CrossRef]
50. Qian, X.; Qiu, S.; Zhang, G. The impact of COVID-19 on housing price: Evidence from China. *Financ. Res. Lett.* **2021**, *43*, 101944. [CrossRef]
51. Campbell, J.; Cocco, J. How do house prices affect consumption? Evidence from micro data. *J. Monet. Econ.* **2007**, *54*, 591–621. [CrossRef]
52. Yuan, C.; He, X.; Kim, Y. Home ownership, housing price and social security expenditure. *China Econ. Rev.* **2017**, *46*, 290–305. [CrossRef]
53. Li, Y.; Qi, Y.; Liu, L.; Hou, Y.; Fu, S.; Yao, J.; Zhu, D. Effect of increasing the rental housing supply on house prices: Evidence from China's large and medium-sized cities. *Land Use Policy* **2022**, *123*, 106420. [CrossRef]

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Co-Living at Its Best—An Empirical Study of Economies of Scale, Building Age, and Amenities of Housing Estates in Hong Kong

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Abstract: Co-living is commonly considered as an arrangement for rental housing. However, co-living in housing estates by sharing common amenities among co-owners has been practiced for many years in high-density cities. Yet, there have been very few empirical studies on the estate premium and the economies/diseconomies of scale effect on house prices, probably due to the lack of data. This study is a novel attempt to examine the economies/diseconomies of scale effect using the hedonic price model to estimate the impact of the number of housing units in a housing estate on house prices, *ceteris paribus*, using Hong Kong housing transaction data. The results confirm the hypothesis of estate premium and the economies of scale effect of co-living in housing estates. Economies of scale are observed, with larger estates commanding a premium of up to 5031 units, beyond which the effect declines, hinting at potential diseconomies. Building age moderates this effect, as we observe a larger scale effect in especially younger estates with lower maintenance costs. Additional tests confirm the positive correlation between amenities and prices, with an optimal amenity number enhancing prices, while excess amenities lead to diminishing returns. A case study reinforces these findings, demonstrating a general trend of decreasing management fees with increasing estate size, supporting the notion of economies of scale. Overall, this study contributes valuable insights for developers and homebuyers, emphasizing the importance of balancing estate size and amenities for cost-sharing advantages and effective management in co-living housing estates.

Keywords: co-living; economies of scale; housing estates; Hong Kong

1. Introduction

Residential properties with co-living structures have gained popularity due to the allure of shared operating costs and access to high-quality amenities (such as swimming pools, jacuzzi, saunas, tennis courts, gardens, and restaurants) [1]. For individual residential properties, operating and maintenance costs may be prohibitively high and access to amenities may be limited. However, co-living residential spaces with efficient building maintenance and management have the appeal of lower operating costs. Consequently, the concept of sharing costs among residents has been embraced by many homebuyers, leading to the emergence of housing estates, especially in densely populated cities like Hong Kong [2]. These large-scale housing estates, characterized by high-rise residential towers, also typically offer ample open spaces and amenities, with some even featuring clubhouses resembling those found in hotels. Employing professional property management with robust security systems and efficient maintenance services further justifies the appeal of such co-living housing arrangements [3]. Nevertheless, the advantages of co-living in housing estates may be outweighed by their inconveniences. For instance, excessive

congestion or poor management could induce significant costs for co-living residential properties [4].

The concept of sharing spaces and facilities in a housing estate can be viewed as an alternative form of co-living, as co-living is defined as housing arrangements in which individuals have a private self-contained housing space (a house, a flat, or a bedroom) but share a range of communal facilities with others [5]. Co-living has emerged as a new way of urban living that emphasizes community and convenience [5]. However, most previous studies on co-living spaces have focused on small-scale arrangements, such as room sharing within a house [3,6].

This paper aims to investigate the large-scale effect of co-living, in the form of residential ownership, by examining the economies/diseconomies of scale in housing estates. So far, limited research has been conducted on the economies or diseconomies of scale in co-living within housing estates, primarily due to the scarcity of data on large-scale residential developments worldwide. We utilize data from Hong Kong as the city's many big housing estates are ideal for providing a wealth of data with multiple transactions within a district that shares common geographical, economic, and local amenity features. Using a revealed preference approach, we conduct an empirical study supplemented by qualitative evidence to examine the hypotheses regarding the economies and diseconomies of scale in co-living.

Specifically, this study leverages a comprehensive housing transaction database in a single district in Hong Kong with many fairly similar high-rise housing estates to examine the premiums or discounts associated with housing estates in that district. In particular, this study investigates the influence of the number of housing units in a housing estate on transaction prices, indicating economies or diseconomies of scale. The research question focuses on the financial costs and benefits of co-living from the perspective of homebuyers. In theory, residents desire access to superior facilities without bearing high management and maintenance costs. Sharing with fellow residents can help reduce operating and maintenance expenses, but may also introduce additional negative externalities (such as congestion and quarrels) and transaction costs (due to poor management). This study therefore posits two hypotheses: (1) housing estates command a premium due to economies of scale, and (2) beyond a certain threshold, economies of scale transition into diseconomies of scale as a result of increased negative externalities and transaction costs. Moreover, we are interested in (3) examining the effect of housing estate age on the relationship between housing estate premium and economies of scale, as operating and maintenance costs tend to become more substantial for aging housing estates. We are also interested in (4) examining the relationship between estate amenities and housing estate premium, as amenities constitute a major benefit of co-living in housing estates.

This paper is divided into six sections, with the subsequent section reviewing the relevant literature on co-living arrangements within housing estates and the factors influencing co-living prices. Section 3 provides an overview of the data and research design, while Sections 4 and 5 present and discuss the empirical results. Finally, Section 6 concludes the paper.

2. Related Literature

Co-living arrangements in residential properties have garnered significant attention in recent years as a response to the escalating housing rents in major cities [3,7–9]. Many individuals turn to co-living as a means to attain homeownership in a more delayed fashion or as a viable alternative when traditional homeownership seems unattainable [10,11]. Co-living refers to a living arrangement where individuals, sometimes unrelated individuals, or families, live together in a shared space, typically in a residential property or community. This arrangement involves sharing common areas, amenities, and sometimes even resources such as kitchens, living rooms, and bathrooms while also maintaining private living spaces like bedrooms [3].

Co-living can take various forms, including short-term rental markets and small-scale home sharing facilitated by platforms like Airbnb, which promote sharing economies and sustainability [12,13]. The concept of co-living often emphasizes community interaction, socialization, and the sharing of responsibilities and resources among residents [14,15]. This study argues that co-living has also been a prevalent practice in many housing estates within high-density cities. These housing estates can be viewed as co-living arrangements, where homeowners come together to share common spaces and estate facilities available within the estates [16].

The management of these common facilities becomes crucial. Facility management, which involves the coordination of space, infrastructure, people, and organization, plays a significant role in the administration, day-to-day operations, and shaping organizational culture [17–20]. The emergence of housing estates resembling hotels can be attributed to residents' desire to enjoy the comforts and conveniences typically associated with hotel accommodations. These housing estates offer a wide range of clubhouse amenities, contributing to a luxurious living experience and enhancing the perceived value of the properties [21]. Agents will also present home buyers with the value of these amenities [22].

Furthermore, efficient building maintenance and management services ensure a hassle-free lifestyle for residents [23,24]. One of the primary motivations for residents to opt for hotel-like housing estates is the opportunity to share costs associated with the provisions and the upkeep of facilities. Maintaining and managing these amenities individually would be financially burdensome for homeowners, making the shared cost model an attractive solution [25]. This shared cost model allows residents to access superior amenities while mitigating the financial strain, leading to the popularity of housing estates, particularly in high-density cities like Hong Kong.

However, it is important to acknowledge that there are drawbacks to co-living arrangements, one of which is the potential loss of privacy [26,27]. Privacy is considered a crucial element of individuals' quality of life, and the absence of privacy in co-living situations can have a negative impact on residents [27]. It is worth noting, however, that the social interactions and support provided within co-living environments may serve as a potential counterbalance to the concerns related to privacy [28,29].

The service quality gap and the level of consumer satisfaction are influenced by the discrepancy between consumers' perceptions and expectations [30]. When there is an increased number of residents involved, the upkeep and maintenance of different aspects become more challenging, which can impact resident satisfaction [31–33]. In a study conducted by Au-Yong [34], the factors contributing to the breakdown of lift systems in low-cost, high-rise residential buildings were examined. The findings revealed that ineffective maintenance significantly affected resident satisfaction, highlighting the importance of regular and effective facility maintenance in high-density residential buildings.

Olanrele and Thontteh conducted a study that assessed and compared the delivery of facilities management services in public high-rise residential buildings in Nigeria. Their findings indicated that the availability of services and resident satisfaction varied among different estates, suggesting that the quality of services and the social class of residents can influence satisfaction levels [30]. Mokhsin et al. developed a mobile application aimed at improving communication and information sharing for high-rise residential management [35]. This innovative approach has the potential to reduce costs and enhance resident satisfaction. The study highlights the challenges and difficulties faced in enhancing resident satisfaction in high-density residential settings, especially when more residents are involved.

Indeed, co-living arrangements can be viewed as exhibiting economies of scale, particularly in terms of cost sharing and resource utilization. By living together and sharing common spaces, amenities, and facilities, residents can benefit from reduced costs per capita. The pooling of resources allows for greater efficiency and economies in terms of maintenance, utilities, and other shared expenses. Moreover, co-living fosters opportunities for

collaborative consumption, where residents can collectively purchase and utilize resources more effectively, potentially leading to cost savings and improved resource allocation.

However, diseconomies of scale within co-living arrangements are possible. The loss of privacy and potential conflicts arising from shared living spaces can lead to a reduction in overall resident satisfaction. As the number of co-living residents increases, coordination and decision-making processes may become more complex, potentially hindering effective management and decision making. Furthermore, the maintenance and management of facilities can become challenging with a larger number of residents, potentially decreasing service quality and resident satisfaction.

Therefore, the extent to which the advantages outweigh the disadvantages in co-living arrangements depends on how to implement effective governance structures, communication channels, and maintenance protocols that can help address challenges associated with increased resident numbers and ensure a positive co-living experience. The success of co-living all depends on striking a balance between the benefits of scale and the effective management of potential drawbacks, thus optimizing the overall experience for residents.

3. Materials and Methods

3.1. Data

We collected 23,979 housing transaction data from the EPRC [36], which covered all the residential property transactions in the district of Tseung Kwan O (Figure A1), Hong Kong, from January 2011 to December 2019. We focused on a single district to minimize variations in geography, local economies, and public amenities. All samples were transactions of apartment units, the dominant housing type in Hong Kong. The data set also contained various attributes for controlling their effects on prices. These variables included our primary variable of interest, i.e., estate dummy (co-living or not) and the number of housing units of each estate; and housing structures such as gross floor area, building age, and floor level. As the sale of units of housing estates is open to all interested parties, this implies that co-living households nearby could be strangers. Detailed descriptions of the variables are provided in Table 1.

Table 1. Descriptions of variables.

Category	Variable	Description
Price	P	Housing transaction prices in Hong Kong million dollars (HKD million) based on the price at the Agreement of Sale & Purchase
Housing Types	EST	0 = non-estate type, i.e., single block of apartment units, 1 = estate type, i.e., with co-living households to share estate facilities
	NU	Number of housing units in the estate: 0, 1, 2, 3, ...
Structure Attributes	GFA	Gross floor area: square feet
	NBED	Number of bedrooms: 1, 2, 3, ...
	FLR	Floor level: 1, 2, 3, ...
	AGE	Building age: number of months from the date of the building permit
	BW	Size of bay windows: square feet
	DIR	8 orientations of living room main windows: East (E), West (W), North (N), South (S), Northeast (NE), Northwest (NW), Southeast (SE), Southwest (SW)
Amenities	AMN	No. of amenities within an estate: 0, 1, 2, 3, ...
Time	MONTH	Dates of the transactions in yyyy-mm
District	DISTR	1 district: Tseung Kwan O (Figure A1)

As shown in Figure 1, there are 34 housing estates in Tseung Kwan O in the sample, and the number of housing units in an estate range from 688 to 6768. The average number of amenities provided in each estate is about 15. All of them were actively transacted in the market during the study period as shown in the number of transactions of each estate in Figure 1.

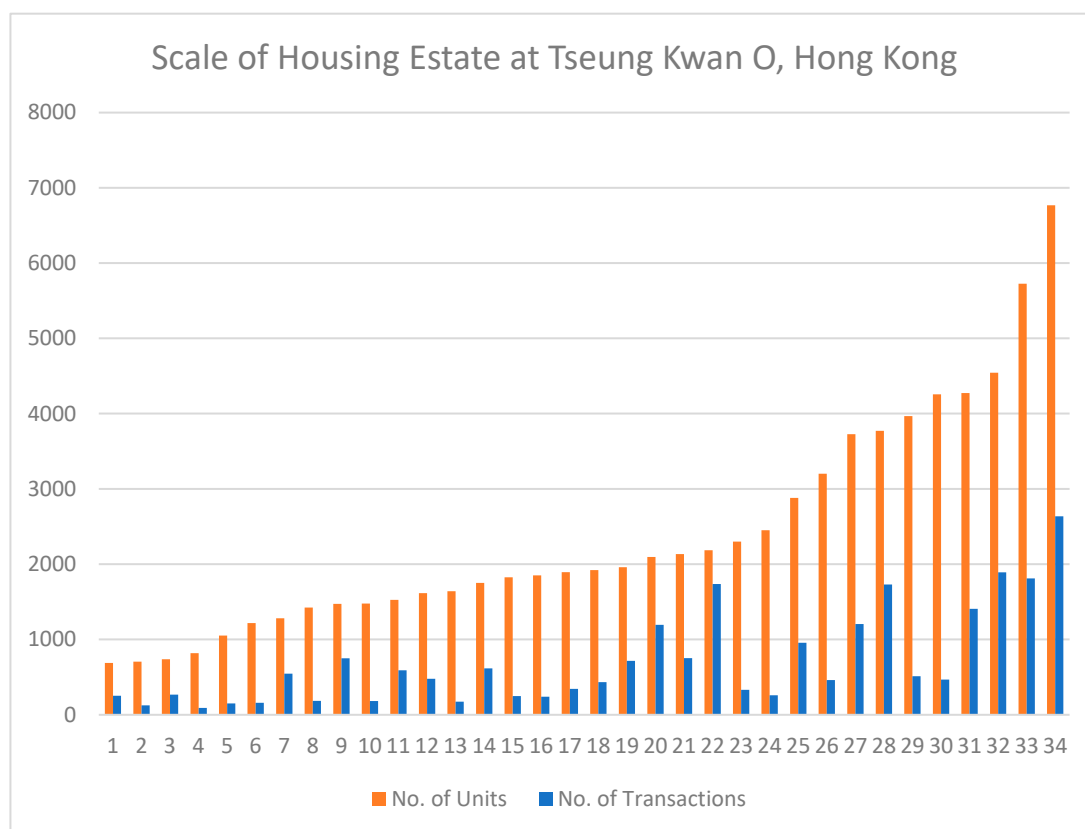


Figure 1. No. of housing units and no. of housing transactions of housing estates in Tseung Kwan O, Hong Kong in the data sample.

3.2. Methodology

The hedonic price model is commonly used to examine the effects of housing attributes. Rosen [37] theoretically interpreted the hedonic method and more scholars extended it to the housing market [38,39]. The model suggests that consumers' utility is derived from their properties or characteristics. Goods are valued for their utility-bearing attributes, and the bundles of characteristics define a set of implicit prices.

3.3. Baseline Model

This study conducts a conventional semi-log hedonic price model analysis (Equation (1)) on the individual housing level using the listed housing transaction price to test the economy of scale effect of co-living. Many studies have favored and highlighted the advantages of the semi-logarithmic functional form compared to other linear forms. Malpezzi [40] highlights that the semi-logarithmic form simplifies the interpretation of regression coefficients by representing them as the percentage change in price given a unit change in the housing attribute. Additionally, it accommodates variations in the current value of each housing characteristic and helps mitigate heteroskedasticity issues. Based on these advantages, we adopted the natural logarithm of price ($\ln(P)$) as the dependent variable in our model.

We first conducted a baseline analysis of the premium or discount for co-living in a housing estate. Due to the limitation of non-estate data in the Tseung Kwan O district as shown in Table 2, our baseline analysis was based on the total sample of Hong Kong. We used a total of 169,339 observations for this analysis across the sample period.

$$\ln(P_i) = c_1 + \alpha_1 EST_i + \sum_{m=1}^M \sum_{k=2}^K \beta_{m,k} X_{i,m,k} + \varepsilon \dots \dots \quad (1)$$

where $\ln(P_i)$ represents the natural logarithm of the transaction prices and EST_i represents the estate type dummy. The coefficient a_1 of estate dummy EST_i measures the average premium or discount for housing-estate-type units, (i.e., scope effect). $X_{i,m,k}$ represent all other control variables, including structure attributes and amenities (GFA, NBED, FLR, AGE, AMN, and BW) of each unit i , direction dummies where the main windows of a living room of house i are located, and time dummies in the month when the listing of house i ends. We also include the district fixed effect. In essence, Model 1 is the baseline model testing the price difference between estate-type and non-estate-type housing units.

Table 2. Descriptive statistics.

Variable	Description	Mean	Std. Dev.	Min	Max
$\ln(P)$	Natural Logarithm of Prices (in HKD M)	1.61	0.41	0.01	3.99
NU	No. of Units	3408.62	1766.33	688	6768
GFA	Gross Floor Area	729.80	184.65	281	2560
NBED	No. of Bedrooms	2.47	0.57	1	5
FLR	Floor Level	26.43	15.88	1	76
AGE	Building Age	155.07	76.25	1	376
BW	Bay Windows	31.45	8.75	3	68
AMN	No. of Amenities	15.28	7.82	0	26
MONTH	No. of Months from 2011M01	45.31	31.95	0	108
No. of valid samples		23,979			

Notes: The dataset includes housing transactions of 108 months, from 2011M01 to 2019M12, at Tseung Kwan O. The DIR variable refers to 8 dummy directions: 993 data in the East, 960 data in the South, 1131 data in the West, 771 data in the North, 3811 data in the Southeast, 3840 data in the Southwest, 4081 data in the Northwest, and 4011 in the Northwest.

We next explore our main research question regarding economies/diseconomies of scale in housing estates by employing a specification estimation with a test sample from housing transactions in the Tseung Kwan O district. This district was selected for its emblematic large-scale, homogeneous, and amenity-rich residential developments, which presents a pertinent context for exploring scale effects in housing markets, as detailed in the Appendix A.

$$\ln(P_i) = c_2 + \alpha_2 NU_i + \alpha_3 (NU_i)^2 + \sum_{m=1}^M \sum_{k=2}^K \beta_{m,k} X_{i,m,k} + \varepsilon \dots \dots \quad (2)$$

where $\ln(P_i)$ represents the natural logarithm of the transaction prices and NU_i represents the number of housing units i within the estate. The coefficient of the number of housing units within the estate NU_i measures the average premium or discount for one more housing unit in the estate, (i.e., the scale effect). We also include the quadratic term of the number of housing units, as we expect changing marginal utility in the economies of scale. $X_{i,m,k}$ represent all other control variables. In essence, Model 2 examines the economies and diseconomies of scale of co-living in housing estates.

Subsequently, we examine the role of building age in moderating scale effects by implementing Model 3. Within this model, we incorporate an interaction term—the product of the number of units and the estate's age—to explore its moderating impact of building age on the scale effects discernible in the housing transaction prices within the TKO area.

$$\ln(P_i) = c_3 + \alpha_4 NU_i + \alpha_5 (NU_i * AGE_i) + \sum_{m=1}^M \sum_{k=2}^K \beta_{m,k} X_{i,m,k} + \varepsilon \dots \dots \quad (3)$$

where the interaction term, $NU_i * AGE_i$, is introduced to evaluate the moderation effect. Its coefficient elucidates the nuanced influence of building age on the scale effect in the housing transaction prices.

4. Results

4.1. Empirical Results of the Economies and Diseconomies of Scale of Housing Estates

Table 3 shows the empirical results of the estimations. The baseline model (Model 1), using all housing transactions in Hong Kong, shows a strong positive coefficient on estate-type housing units, indicating that homebuyers are willing to pay a 7.8% premium on average for estate-type developments. Such a premium is well perceived in the markets, though it is not the focus of our study to examine the determinants of the premium.

Table 3. Empirical results of number of units and age.

Variable	Model 1 (All HK Trans)	Model 2 (TKO Estates)	Model 3 (TKO Estates)
Dependent Variable	$\ln(P_i)$	$\ln(P_i)$	$\ln(P_i)$
EST_i	0.078 (31.87) ***		
NU_i	-	1.254×10^{-4} (23.27) ***	3.234×10^{-5} (11.31) ***
NU_i^2	-	-1.247×10^{-8} (−18.65) ***	
$NU_i \times AGE_i$			-3.487×10^{-8} (−2.26) **
Housing Structure Fixed Effect	Yes	Yes	Yes
District Fixed Effect	Yes	No	No
	-	(a single district)	(a single district)
Time Fixed Effect	Yes	Yes	Yes
No. of Observations	169,339	18,888	18,888
Adj. R-squared	0.86	0.73	0.73

, * represent significance at the 5% and 1% levels, respectively.

Model 2, confined to estate-type transactions in Tseung Kwan O only, examines our main research question of economies of scale in co-living residential arrangements. The results show an inverted U-shaped effect of the number of housing units in the estate on housing prices (Figure 2). In fact, the coefficient of the number of units is positive and significant, which confirms the economies of scale hypothesis that a larger housing estate can have a higher premium in housing prices before the threshold in diseconomies of scale, *ceteris paribus*. The estimated coefficients are statistically significant at the 1% level.

We next observe a negative coefficient for the quadratic term, indicating decreasing returns when housing estates become too large. The turning point is estimated to be about 5031 housing units ($-1.254 \times 10^{-4} / (2 \times -1.247 \times 10^{-8})$), which covers about 81% of all the transactions in the sample. This implies that the market generally optimizes the economies of scale effect of housing estates until the estates become too big to manage. This finding is consistent with some previous research results [41], indicating that there is an optimal range for housing estate development scale. Subsequently, further exploration investigates the moderating effects of various factors on this scale effect.

Model 3 is the model testing the moderating effect of building age on the scale effect of a housing estate on housing prices. The results show that the scale effect is more valuable in younger housing estates, where building maintenance costs are much lower. This supports the hypothesis that the premium on the scale effect is on sharing amenities but avoiding high maintenance costs. The results indicate that estates will have a positive scale effect until they pass 77.3 years of age ($-3.234 \times 10^{-5} / -3.487 \times 10^{-8}$)/12, which exceeds the general design life span (50 years) of housing structures in Hong Kong. While acknowledging the impact of building age in younger estates, the result suggests a greater appeal for investors due to notable scale effects. For developers, focusing on sensible development scale planning early on means that the advantages of scale effects will not markedly diminish as buildings age, offering even more justification for well-thought-out housing development projects.

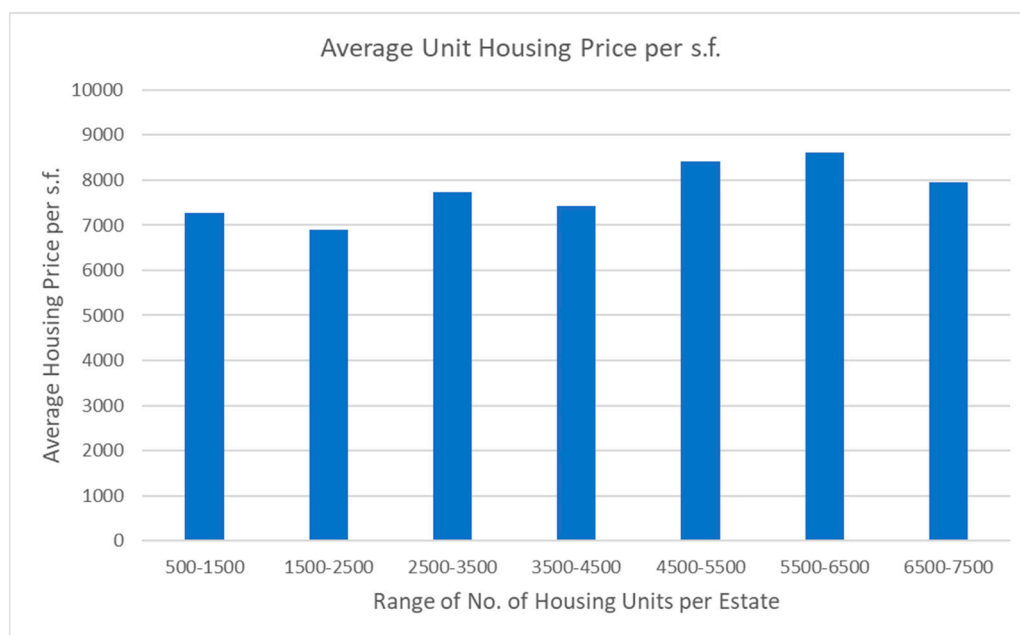


Figure 2. Inverted U-shape relationship between estate scale and average house prices. The horizontal axis refers to the range of number of housing units within a housing estate, and the vertical axis refers to the average housing prices per square foot transacted.

4.2. Additional Analyses on Amenities

We further conducted two additional tests on the effects of the number of amenities on housing premium. Table 4 shows the empirical results of the estimations. Model 4 examines the non-linear effects of the number of amenities on housing premia. The results also show an inverted U-shaped effect of the number of amenities in the estate on housing prices, with the turning point at about 31 amenities ($-0.024/(2 \times -0.0004)$). The estimated coefficients are statistically significant at the 1% level. In Model 5, we introduced an interaction term to examine how the number of amenities moderates the scale effect of housing estates on price premiums. The results show the positive and significant effects of the number of units and the number of amenities on prices, but the negative and significant coefficient of the interaction term between the number of units and the number of amenities implies that the positive scale effect on price premium will become negative (i.e., diseconomies of scale) when the number of amenities exceeds 21 ($-0.0001/(-4.67 \times 10^{-6})$).

4.3. Case Study

The economies of scale benefits are likely to be derived from the sharing of more and better amenities, as well as the sharing of management and maintenance costs of the estates. Trying to triangulate the association between estate scale, number of amenities, and management fees, we conducted a case analysis of eighteen residential complexes, for which we could obtain sufficient information, in the district. These selected estates collectively represent a significant portion (more than half) of the residential complexes previously analyzed in the Tseung Kwan O district. The selection criteria encompassed a diverse range of scales and features, providing insights into co-living dynamics across different contexts.

Among these samples, seven estates provided a less-than-average number of amenities, i.e., fewer than 15 amenities, as shown in blue dots in Figure 3. Conversely, the remaining eleven estates exhibited more comprehensive amenities, totaling 15 or more, as shown in orange dots in Figure 3. Notably, the mean property management fee for complexes with a less-than-average number of amenities was HKD 2.2 per square foot, while those with a greater-than-average number of amenities averaged around HKD 2.9 per square foot. This observation implies a potential correlation between an increased number of amenities

and a corresponding rise in property management costs, as the maintenance and operation demand of a greater-than-average number of amenities could escalate overall expenses, especially when the amenities become old and dilapidated. However, it is noteworthy that we have observed instances where certain estates with abundant amenities exhibit comparatively lower management fees. This intriguing observation persists across both groups characterized by high and low amenity counts.

Table 4. Empirical results of number of amenities.

Variable	Model 4 (TKO Estates)	Model 5 (TKO Estates)
Dependent Variable	$\ln(P_i)$	$\ln(P_i)$
AMN_i	0.024 (20.53) ***	0.023 (38.49) ***
AMN_i^2	−0.0004 (−10.99) ***	
NU_i		0.0001 (26.93) ***
$NU_i \times AMN_i$		-4.67×10^{-6} (−25.68) ***
Housing Structure Fixed Effect	Yes	Yes
District Fixed Effect	No (a single district)	No (a single district)
Time Fixed Effect	Yes	Yes
No. of Observations	18,888	18,888
Adj. R-squared	0.74	0.75

*** represents significance at the 1% levels.

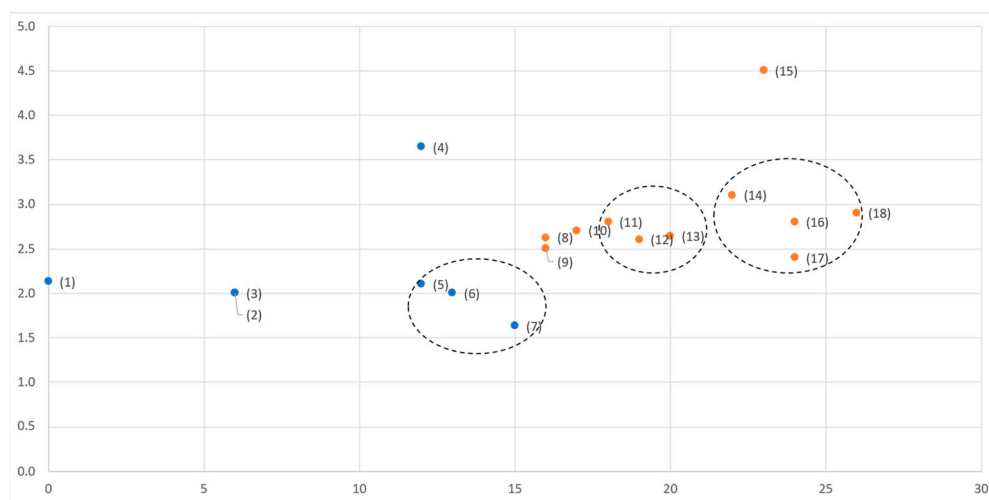


Figure 3. Relationship between amenities and property management fees in eighteen residential complex cases. The x-axis represents the quantity of amenities, while the y-axis represents the property management fees per square foot floor area in HKD. Blue dots represent estates offering below-average number of amenities (less than 15), while orange dots denote those with 15 or more number of amenities. The residential complex sample numbers in parentheses have been arranged in ascending order based on the number of amenities. The amenity quantity data and management fee information are sourced from the Centaline Property Agency (<https://hk.centalnet.com/info/en/index>, accessed on 10 August 2023).

Expanding on the insights gained from the observations regarding the relationship between amenity counts and management fees, a deeper understanding of the underlying dynamics comes into focus. While the number of amenities positively correlates with unit management fees, another significant determinant emerges—the scale effect. Figure 4

shows a nuanced relationship between estate scale and unit management fees emerges. Notably, when the scale of estates is between around 1000 units and 2500 units, a discernible increase in management fees is apparent. This trend signifies the potential higher costs of sharing the facilities per square foot of floor area. This scenario probably reflects that within a certain lower range of scale, the heightened provision of amenities can result in a substantial rise in the costs associated with management and maintenance shared by each square foot of floor area.

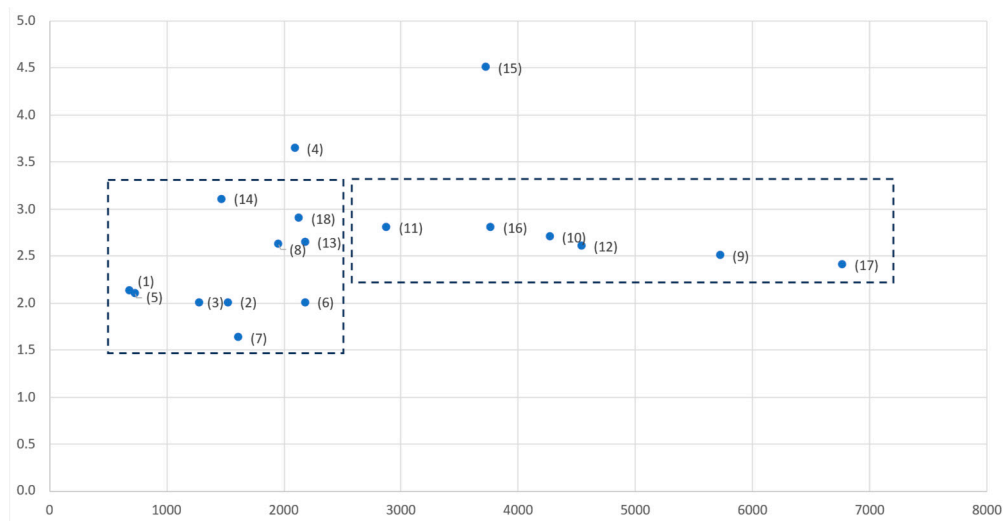


Figure 4. Relationship between estate scale and property management fees in eighteen case studies. The x-axis indicates estate scale, while the y-axis depicts property management fees per square foot in HKD. The serial number label corresponds to Figure 3. The data for the quantity of residential units and the property management fees are sourced from Centaline Property Agency.

However, complexes exhibit a contrasting trend beyond an estate scale of 2500 units. With an increase in scale, these complexes manifest a substantial decrease in management fees. This observation aligns with the concept of economies of scale, signifying the effective allocation of costs in larger-scale properties with an appropriate number of amenities. The downward trend implies that the benefits of scale outweigh the potential costs associated with increased management complexity.

The symbiotic relationship from Figures 3 and 4 implies that when an estate goes above and beyond in terms of the optimal number of provided amenities, it can inadvertently trigger a shift towards diseconomies of scale. This outcome is attributed to the heightened costs associated with the management and maintenance of an extensive range of amenities. In essence, while ample facilities contribute positively to residents' living experience, the balance must be carefully maintained to avoid crossing the threshold into diseconomies of scale. The sustainability of lower management fees with increasing estate scales and the possibility of rising costs due to managing larger communities necessitates further investigation, highlighting the multifaceted nature of the scale-management costs relationship.

This case analysis aligns with the previous models proposed in the study, supporting the hypothesis of the presence of economies of scale on housing estate developments. These findings collectively support the conclusions drawn from the quantitative models, enhancing understanding of co-living dynamics and emphasizing the cost-sharing benefits of larger estates with an optimal number of amenities.

5. Discussion

This empirical study investigates the economies and diseconomies of scale in housing estates, focusing on amenity-sharing arrangements. Findings offer insights into the

premium for estate-type units, economies of scale within estates, and moderating effects of building age and amenities. First, Model 1 identified a significant 7.8% premium for estate-type housing units, reflecting buyer willingness to pay for amenity sharing in a housing estate. Model 2 examines economies of scale, showing an inverted U-shaped effect. Larger estates command a premium up to around 5031 units, beyond which the positive effect diminishes, indicating potential diseconomies of scale. Model 3 underscores a subtle, yet significant value in younger estates, deriving not from immediate price impact but from potential future gains. This discovery, tied to lower maintenance and contemporary amenities, sends a clear message to developers and policymakers: reasonable development planning at early development stages is crucial to unlock all benefits from the scale effect. Additional tests confirm the relationship between amenities and prices, with an optimal amenity number enhancing prices, but excessive amenities leading to diminishing returns (Model 4). Model 5 shows this amenity effect can shift economies of scale to diseconomies.

The case study of eighteen complexes reinforces the findings. It shows a positive correlation between amenities and unit management fees, alongside the influence of estate scale on fees. Larger estates exhibit decreasing management costs, supporting economies of scale. However, the study also indicates when the group of estates providing more amenities charges higher on average management fees, which can be a cause of diseconomies of scale. This is attributed to not only the costs of purchasing and installing the amenities, but also related to managing and maintaining them. Consequently, an over-provision of amenities can result in these costs not being effectively shared, causing an overall increase in expenses per housing unit as the scale grows. These insights contribute to a comprehensive understanding of the interplay between scale, amenities, and management costs in housing developments.

In summary, this study illuminates the dynamics of sharing or co-living arrangements in housing estates. These insights are pertinent for developers and homebuyers, emphasizing the importance of optimizing estate size and amenities for cost-sharing advantages and effective management. Future research can expand these insights to other regions and property types, enhancing our understanding of co-living's influence on housing markets.

6. Conclusions

This study provides two major contributions. First, it tests the hypothesis of estate premium and the economies/diseconomies of scale effect of co-living in housing estates. The results confirm a premium (of about 7.8%) from an estate-type housing unit in comparison with a non-estate-type housing unit. The result reveals the market preference for co-living in housing estates. Furthermore, the results show a housing estate's economies of scale effect, as the scale effect on prices is increasing at a decreasing rate up to about 5031 units, which covers almost 81% of the sample. The scale effect, however, is positive and stronger in younger estates, implying that the benefits of co-living in housing estates are sharing management and maintenance costs of facilities in aging buildings.

In high-density and high-rise cities, such as Hong Kong, housing units are generally in apartment-sharing building structures and open spaces. This develops a vertical city model, enabling hotel-like residential developments with shared clubhouse facilities and spaces [41,42]. Cost sharing among homeowners in the estates allows them to enjoy more and better facilities and management and maintenance services. Yet, it can be very costly to operate and maintain these facilities; it usually requires an account of sinking funds from a large number of contributors for many years to ensure sustainable operations of the facilities [43,44]. Thus, the premium of aged housing estates can come from a large amount of sinking funds, besides the benefits of space and facilities.

This study is novel in its exploration of the costs and benefits of co-living among owner-occupied homeowners in big cities. This finding has important practical and policy implications for developing and governing co-living spaces in cities, especially on the scale of the developments [41,45]. However, the study is limited by being confined to a single district in Hong Kong, and due to the lack of a full set of data on management fees, the

empirical study cannot test the scale implications on management fees. A case study of 18 housing estates in the district was therefore incorporated to examine the relationships between estate scale, number of facilities, and management fees. The case study results support the empirical findings.

Building upon this study's findings concerning economies and diseconomies of scale in co-living models, an intriguing avenue for future research would be studying the relationship between these models and fluctuations in the global real estate market more deeply. Specifically, the capability of co-living to act as a way to make housing more affordable warrants further exploration. Additionally, moving beyond the economic lens of this study, the environmental dividends of co-living warrant a crucial exploration, notably its potential to enhance energy sharing and mitigate an estate's carbon emissions, thereby facilitating sustainable urban development. The escalating global emphasis on environmental conservation and sustainability underscores the urgency and relevance of such an investigation. Moreover, there remains an untapped opportunity to assess the potentials and challenges of implementing co-living models in diverse socio-economic and cultural landscapes. This entails exploring the role of scale in various contexts, including urban renewal areas or slums, where the interplay of social diversity and resident identity may lead to distinct patterns in residential satisfaction and safety perceptions. Understanding the psychological factors that underlie these differences in scale effects will shed light on effective implementation strategies. Furthermore, comparing different co-living models, particularly those serving various age demographics, presents an opportunity to explore possible differences or similarities in economic benefits, management effectiveness, and local economic impacts, enriching our understanding of co-living's diverse implications across varied urban contexts.

In conclusion, this study not only provides valuable insights into the economies and diseconomies of scale in co-living but also opens doors to an array of intriguing research opportunities. By examining the interplay between co-living and real estate markets, probing its environmental impact, and considering its applicability across diverse contexts, future research can make significant contributions to the field of urban development and housing.

Author Contributions: Conceptualization, K.S.C., D.T. and C.Y.Y.; methodology, K.S.C., D.T. and C.Y.Y.; formal analysis, Z.C., K.S.C., D.T. and C.Y.Y.; investigation, Z.C., K.S.C., D.T. and C.Y.Y.; resources, Z.C., K.S.C. and D.T.; data curation, Z.C., K.S.C. and D.T.; writing—original draft preparation, Z.C., K.S.C., D.T. and C.Y.Y.; writing—review and editing, Z.C., K.S.C., D.T. and C.Y.Y.; supervision, K.S.C., D.T. and C.Y.Y.; project administration, K.S.C., D.T. and C.Y.Y.; funding acquisition, K.S.C. and C.Y.Y. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the University of Auckland Business School, grant number (Grant Ref.: 9507-3722103) and the University of Auckland Early Career Researcher Excellence Award 2022 (Grant Ref.: 9490-3726886).

Data Availability Statement: House price data were collected from the EPRC database [36] which is accessible via subscription from the Chinese University of Hong Kong. The amenity quantity data and management fee information are publicly available at the Centaline Property Agency (<https://hk.centanet.com/info/en/index>, accessed on 10 August 2023).

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Background of Tseung Kwan O Housing Estate Developments

Tseung Kwan O (TKO) new town, with a population of 396,000 over 17.18 km² in 2016, located in the eastern part of the New Territories, Hong Kong, is renowned for its vibrant residential estates. TKO has witnessed rapid development and transformation over the years, evolving into a bustling and thriving community. The distinctive characteristic of TKO lies in its homogeneous estate features, where large-scale housing developments dominate the landscape.

The estates in TKO are marked by their uniform architectural styles, reflecting a cohesive and harmonious design approach. The housing estates in the area showcase a blend of modern aesthetics and practical functionality. With their high-rise buildings and well-planned layouts, the estates exude a sense of order and efficiency, creating a visually appealing and homogenous environment for residents.

The development of TKO's estates has been notable for its speed and scale. The area has experienced a remarkable surge in population and urbanization, leading to the creation of numerous large-scale housing developments. These developments, comprising both public housing estates and private residential complexes, have provided a wide range of housing options to cater to the diverse needs of residents.

What sets the estates of TKO apart is the wealth of facilities they offer within each residential complex. These estates are designed with the aim of providing residents with a comprehensive and self-contained living environment. Each estate is equipped with a multitude of amenities and facilities, including clubhouse facilities, recreational spaces, shopping centers, educational institutions, and healthcare services. The abundance of facilities within the estates ensures that residents have easy access to essential services and recreational opportunities, fostering a convenient and fulfilling lifestyle.

In summary, Tseung Kwan O is characterized by its homogeneous estate features, rapid development, and a multitude of facilities within each estate. The cohesive architectural designs, coupled with the extensive amenities, contribute to the appeal and livability of the residential estates in TKO, making it an attractive choice for individuals seeking a well-planned and amenity-rich living environment.



Figure A1. Map of Tseung Kwan O, Hong Kong. Source: Esri [46]. The map was created using ArcGIS® software by Esri. ArcGIS® and ArcMap™ are the intellectual property of Esri and are used herein under license. Copyright © Esri. For more information about Esri® software, please visit www.esri.com (accessed on 10 August 2023).

References

1. Times Property. The Rising Trend of Co-Living Spaces. *Times Property*, 25 January 2023. Available online: <https://timesproperty.com/news/post/rising-trend-of-co-living-spaces-blid3772?fbclid=IwAR3-h72w5CdeuF6CsecmOdI-8kkkpjaoKxXUhfWOrkeH25jL7Ep2TS3vNA#2>(accessed on 2 February 2023).
2. Leung, K.M.; Yiu, C.Y. How do the poor survive in an unaffordable city?—An empirical study of informal housing households living in Hong Kong. *Int. J. Urban Sci.* **2022**, *26*, 398–419. [CrossRef]

3. Corfe, S. *Co-Living: A Solution to the Housing Crisis?* Social Market Foundation: London, UK, February 2019; Available online: <https://thinkhouse.org.uk/site/assets/files/1885/smf0219.pdf> (accessed on 2 February 2023).
4. Springer, T.; Waller, N. Maintenance of residential rental property: An empirical analysis. *J. Real Estate Res.* **1996**, *12*, 89–99. [CrossRef]
5. Coricelli, F. The co-'s of co-living: How the advertisement of living is taking over housing realities. *Urban Plan.* **2022**, *7*, 296–304. [CrossRef]
6. Yiu, C.Y.; Cheung, K.S.; Xiong, C. Economies of scale of co-living—An empirical study of the New Zealand rental housing markets. *Pac. Rim Prop. Res. J.* **2023**, *28*, 1–19. [CrossRef]
7. Maalsen, S. I cannot afford to live alone in this city and I enjoy the company of others: Why people are share housing in Sydney? *Aust. Geogr.* **2019**, *50*, 315–332. [CrossRef]
8. Kim, J.; Woo, A.; Cho, G.-H. Is shared housing a viable economic and social housing option for young adults? Willingness to pay for shared housing in Seoul. *Cities* **2020**, *102*, 102732. [CrossRef]
9. Heath, S.; Davies, K.; Edwards, G.; Scicluna, R. *Shared Housing, Shared Lives: Everyday Experiences across the Lifecourse*; Routledge: London, UK, 2017.
10. Druta, O.; Ronald, R.; Heath, S. Urban singles and shared housing. *Soc. Cult. Geogr.* **2021**, *22*, 1195–1203. [CrossRef]
11. Forrest, R.; Murie, A.; Williams, P. *Home Ownership: Differentiation and Fragmentation*; Routledge: London, UK, 2021.
12. Cheung, K.S.; Yiu, C.Y. Touristification, Airbnb and the tourism-led rent gap: Evidence from a revealed preference approach. *Tour. Manag.* **2022**, *92*, 104567. [CrossRef]
13. Yiu, C.Y.; Cheung, K.S. Urban zoning for sustainable tourism: A continuum of accommodation to enhance city resilience. *Sustainability* **2021**, *13*, 7317. [CrossRef]
14. Von Zumbusch, J.S.H.; Lalicic, L. The role of co-living spaces in digital nomads' well-being. *Inf. Technol. Tour.* **2020**, *22*, 439–453. [CrossRef]
15. Markle, E.A.; Rodgers, R.; Sanchez, W.; Ballou, M. Social support in the cohousing model of community: A mixed-methods analysis. *Community Dev.* **2015**, *46*, 616–631. [CrossRef]
16. Durrett, C.; McCamant, K. *Creating Cohousing: Building Sustainable Communities*; New Society Publishers: Gabriola Island, BC, Canada, 2011.
17. Bengtsson, B. Tenants' dilemma-on collective action in housing. *Hous. Stud.* **1998**, *13*, 99–120. [CrossRef]
18. Yip, N.M.; Forrest, R. Property owning democracies? Home owner corporations in Hong Kong. *Hous. Stud.* **2002**, *17*, 703–720. [CrossRef]
19. Alexander, K. (Ed.) *Facilities Management: Theory and Practice*; Routledge: London, UK, 2013.
20. Ho, D.C.; Gao, W. Collective action in apartment building management in Hong Kong. *Habitat Int.* **2013**, *38*, 10–17. [CrossRef]
21. Small, K.A.; Steimetz, S.S. Spatial hedonics and the willingness to pay for residential amenities. *J. Reg. Sci.* **2012**, *52*, 635–647. [CrossRef]
22. Xiong, C.; Cheung, K.S. Understanding sellers' agents in the residential property market. *Int. J. Strateg. Prop. Manag.* **2021**, *25*, 179–189. [CrossRef]
23. Losada-Baltar, A.; Jiménez-Gonzalo, L.; Gallego-Alberto, L.; Pedroso-Chaparro, M.D.S.; Fernandes-Pires, J.; Márquez-González, M. We are staying at home: Association of self-perceptions of aging, personal and family resources, and loneliness with psychological distress during the lock-down period of COVID-19. *J. Gerontol. Ser. B* **2020**, *76*, 10–16. [CrossRef] [PubMed]
24. Gaeta, L.; Brydges, C.R. Coronavirus-related anxiety, social isolation, and loneliness in older adults in Northern California during the stay-at-home order. *J. Aging Soc. Policy* **2020**, *33*, 320–331. [CrossRef]
25. El-Haram, M.A.; Horner, M.W. Factors affecting housing maintenance cost. *J. Qual. Maint. Eng.* **2002**, *8*, 115–123. [CrossRef]
26. De Macedo, P.F.; Ornstein, S.W.; Elali, G.A. Privacy and housing: Research perspectives based on a systematic literature review. *J. Hous. Built Environ.* **2022**, *37*, 653–683. [CrossRef] [PubMed]
27. Bashari, S.; Hashim, A.H.; Samah, A.A.; Ahmad, N. The moderating effect of privacy in the relationships between residential livability and residents' life satisfaction. *J. Constr. Dev. Ctries.* **2021**, *26*, 45–62. [CrossRef]
28. McCartney, S.; Rosenvasser, X. Privacy territories in student university housing design: Introduction of the hierarchy of isolation and privacy in architecture tool (HIPAT). *SAGE Open* **2022**, *12*, 21582440221089953. [CrossRef]
29. Cho, G.H.; Woo, A.; Kim, J. Shared housing as a potential resource for community building. *Cities* **2019**, *87*, 30–38. [CrossRef]
30. Olanrele, O.; Thontteh, E. FM service delivery and quality service measurement in public high rise residential buildings in Nigeria: The use of SERVQUAL and satisfaction index. *J. Manag. Sustain.* **2014**, *4*, 145–155. [CrossRef]
31. Ramli, A.M.A.; Harun, A.N.; Nawi, M.M.; Haron, N.A. Systematic review on the attributes of resident satisfaction measurement in the facility management context. *J. Adv. Res. Bus. Manag. Stud.* **2020**, *21*, 27–39. [CrossRef]
32. Van Mossel, H.J.; Jansen, S.J. Maintenance services in social housing: What do residents find important? *Struct. Surv.* **2010**, *28*, 215–229. [CrossRef]
33. Van Rysin, G.G. The impact of resident management on residents' satisfaction with public housing: A process analysis of quasi-experimental data. *Eval. Rev.* **1996**, *20*, 485–506. [CrossRef]
34. Au-Yong, C.P.; Azmi, N.F.; Mahassan, N.A. Maintenance of lift systems affecting resident satisfaction in low-cost high-rise residential buildings. *J. Facil. Manag.* **2018**, *16*, 17–25. [CrossRef]

35. Mokhsin, M.; Shahuddin, A.Z.; Zainol, A.S.; Som, M.H.M.; Hazemi, N.B. A prototype of high rise residential management systems in Malaysia: A case study for Seroja Apartment. *Int. J. Innov. Enterp. Syst.* **2020**, *4*, 1–11. [CrossRef]
36. EPRC. Hong Kong Housing Database. 2022. Available online: <http://easyaccess.lib.cuhk.edu.hk/limited/hkhousing.htm> (accessed on 2 February 2023).
37. Rosen, S. Hedonic prices and implicit markets: Product differentiation in pure competition. *J. Political Econ.* **1974**, *82*, 34–55. [CrossRef]
38. Yan, W. Factors affecting the accommodation price of shared rental platforms under the epidemic—Empirical analysis based on big data. In Proceedings of the 2020 International Conference on Big Data and Social Sciences (ICBDSS), Xi'an, China, 14–16 August 2020. [CrossRef]
39. Leung, K.M.; Yiu, C.Y. Rent determinants of sub-divided units in Hong Kong. *J. Hous. Built Environ.* **2019**, *34*, 133–151. [CrossRef]
40. Malpezzi, S. Hedonic pricing models: A selective and applied review. *Hous. Econ. Public Policy* **2003**, *1*, 67–89.
41. Tang, B.; Yiu, C.Y. Space and scale: A study of development intensity and housing price in Hong Kong. *Landsc. Urban Plan.* **2013**, *96*, 172–182. [CrossRef]
42. Chan, E.H.; Tang, B.S.; Wong, W.S. Density control and the quality of living space: A case study of private housing development in Hong Kong. *Habitat Int.* **2002**, *26*, 159–175. [CrossRef]
43. Yau, Y.; Ho DC, W. The effects of building management practices on residential property prices in Hong Kong. *J. Build. Apprais.* **2009**, *4*, 157–167. [CrossRef]
44. Ho, D.C.W.; Chau, K.W.; Cheung, A.K.C.; Yau, Y.; Wong, S.K.; Leung, H.F.; Lau, S.S.Y.; Wong, W.S. A survey of the health and safety conditions of apartment buildings in Hong Kong. *Build. Environ.* **2008**, *43*, 764–775. [CrossRef]
45. Cheung, K.S.; Wong, S.K.; Wu, H.; Yiu, C.Y. The land governance cost on co-ownership: A study of the cross-lease in New Zealand. *Land Use Policy* **2021**, *108*, 105561. [CrossRef]
46. Esri. “Topographic” [Basemap]. “World Topographic Map”. Available online: <https://www.arcgis.com/home/webmap/viewer.html?layers=b9b1b422198944fbbd5250b3241691b6> (accessed on 10 August 2023).

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Article

A Novel Data Analytics Methodology for Analyzing Real Estate Brokerage Markets with Case Study of Dubai

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Abstract: Despite the vast economic impact of real estate markets worldwide, research on real estate brokerage markets remains limited. Specifically, there are few studies that provide a systematic, integrated, and replicable analytical methodology to analyze and benchmark a given real estate brokerage market. To this end, this paper introduces a data analytics methodology for analyzing real estate brokerage markets, integrating various statistical and analytical methods to extract insights from market data, supporting real estate investment decisions. The applicability of the methodology is demonstrated with a case study analyzing data from the top 50 real estate brokerage firms in Dubai, UAE. As shown in the case study, applying this methodology to brokerage market data enables the visual benchmarking of firms, identification of similarities between them, profiling and comparison of clusters of firms, and exploration of the impacts of various categorical and numerical attributes on performance. A notable finding for the Dubai real estate brokerage market is that it takes a minimum of 700 days for a brokerage firm to mature and advance to the next level of business success.

Keywords: real estate brokerage firms; brokerage markets; statistical analysis; data analytics; multi-dimensional scaling (MDS)

1. Introduction

Real estate is one of the primary investment areas for both institutional and individual investors. According to the most recent statistics [1], the value of real estate in the world reached USD 379.7 trillion. China holds 26% of this value, Europe 43%, and the US 19%. The value of real estate in the GCC countries is around USD 1.36 trillion. It is forecasted that the size of the worldwide real estate market will increase at a compound annual growth rate (CAGR) of 5% [2]. This increase can be explained by the expansion of public-private partnerships, the increase in the global population, and the general willingness for household ownership. In the UAE, which is the focus country of this study, the total real estate market value is expected to approach USD 0.71 trillion in 2024 [3]. The increasing high demand in Dubai has expanded the total volume of real estate transactions and reached a new record of a 43.3% increase in the first 6 months of 2023 alone [4].

The focus market in this research, to demonstrate the applicability of the developed analytical benchmarking methodology, is Dubai, a city/Emirate within the United Arab Emirates (UAE). UAE is a Gulf country, and a union of seven “Emirates” (states/regions), whose estimated population is >9 million, including both citizens and non-citizen expatriate residents (<https://www.britannica.com/place/United-Arab-Emirates> accessed on 11 August 2023). While Abu Dhabi Emirate is the home to the capital city of Abu Dhabi, the Emirate/city of Dubai is the most populous, with an estimated population of >3.5 million (<https://www.dsc.gov.ae/en-us/Pages/default.aspx> accessed on 11 August 2023).

There are multiple unique aspects of the UAE, and particularly Dubai, that deserve special attention and economic/business research: first, Dubai has become a success story in

transforming an oil-dependent economy into a completely oil-independent and diversified economy. Dubai is a hub of commerce, finance, tourism, hospitality, and a multitude of other sectors. Second, UAE is one of the most attractive countries to work and live in the Middle East and also the larger geographical region, from West Africa to Southeast Asia. For example, for the 12th year in a row, a survey among the Arab youth ranked UAE as the top country in the world that they would like to live in (<https://arabyouthsurvey.com/en/findings/#my-global-citizenship-17> accessed on 11 August 2023). Third, a unique aspect of the UAE is that it is the top country in the world with respect to the percentage of expatriates living in the country as residents, with an estimated 88% of the population being expatriates (<https://www.globalmediainsight.com/blog/uae-population-statistics/> accessed on 11 August 2023). This implies a constant flow of international residents into and out of the UAE. Fourth, the UAE ranks among the better countries in the world to do business (<https://www.forbes.com/places/united-arab-emirates/> accessed on 11 August 2023), resulting in a further flow of people. Fifth, relating to the presented study, there is a vibrant and growing real estate sector in the UAE, and especially in Dubai, fueled by the tourism and hospitality sectors and expatriates living long term in the country. Due to the listed aspects, UAE, and especially Dubai, is a real estate market worth researching.

Real estate is considered a lower-risk investment alternative, beneficial for portfolio diversification, and protects investors against inflation [5]. In every real estate market, transactions are enabled and facilitated significantly through real estate brokerage firms, which constitute the real estate brokerage market. For example, in Dubai, the number of real estate brokers (agents), which was 5181 in the first half of 2018 [6], has, in about five and a half years, reached 15,367 by December 2023 [7]. Such a high increase, with a tripling of the number of brokers in about five years, also signals a possible over-saturation in the brokerage markets. Thus, it is crucial to investigate the brokerage markets to identify strategies for success in such a saturated market.

The vast amount of data pertinent to the real estate markets is systematically collected, harnessed, processed, and presented as information through business intelligence systems. This information is then used for decision making by investors, real estate developers, real estate brokerage firms, and finally regional, national, and international government and non-profit organizations. Government bodies also publish open data regarding the real estate markets and brokerage markets. For example, the list of data providers for the U.S.-based RERI (Real Estate Research Institute) include various real estate, finance, retail associations, advisors, and firms, as well as government organizations (<https://www.reri.org/dataproviders/index.cfm> accessed on 1 April 2024). Popular online services for accessing UAE real estate market data include DataDollar (<https://datadollar.ae> accessed 1 on April 2024), Wasila (<https://wasiladatabase.com/dubai-real-estate-database/> accessed on 1 April 2024), and Land Sterling (<https://landsterling.com/strategic-consultancy/data-services/> accessed on 1 April 2024). For example, the Dubai government openly publishes extensive data on both the real estate market and real estate brokerage market, both accessible to the public. The focus of this research is the latter, namely the brokerage market [7].

Despite new heights in the real estate market volume in recent decades, there are only limited data analytics studies that focus on the benchmarking of brokerage firms. Notable research on brokerage markets, including notable analytics research, can be found in References [8–16]. These and other research studies mostly apply econometrics techniques or simple summary statistics successfully to analyze various aspects of the real estate sector.

There are multiple data-driven studies that focus on real estate brokerage markets. Existing studies were found to apply either qualitative methods (as in Reference [13]), basic statistical summaries (as in Reference [14]), regression (as in References [11,15,16]), or other statistical methods (as in References [8,9]). However, none of the studies that were encountered apply more than two statistical and analytical methods within an integrated methodology. Furthermore, none of the encountered studies on the real estate brokerage markets were found to apply the machine learning (ML) method of multi-dimensional

scaling (MDS) or integrate ML with statistical tests of comparison. The benefit of developing a novel analytical methodology that integrates a multitude of methods, as in this paper, is that such an approach enables the derivation of novel insights that could not be obtained otherwise. Indeed, the current paper presents new types of insights that were not encountered in any of the earlier studies on the real estate brokerage markets.

Specifically, during the review of the literature, there was no study encountered that allowed the systematic answering of the following research questions:

- **RQ1:** How can brokerage firms be benchmarked visually with respect to various attributes?
- **RQ2:** Which brokerage firms are similar to each other and different than others?
- **RQ3:** How do the different clusters of brokerage firms differ from each other?
- **RQ4:** How do the values of the categorical attributes of brokerage firms affect their other attributes?
- **RQ5:** How do the values of the numerical attributes of brokerage firms affect their other attributes?

To this end, the focus of this paper is the development and introduction of a novel, custom-developed, and integrated data analytics methodology. The objective of the methodology is to analyze real estate brokerage markets so as to be able to answer all of the above five research questions within a unified framework.

To support the validity and value of the developed data analytics methodology, it is necessary to demonstrate -through at least one case study- how the methodology is implemented, and what insights it could generate. Thus, in this paper, where we introduce the methodology, we also apply the developed/introduced methodology. Specifically, we analyzed the real estate brokerage firms in Dubai, using public data published by Dubai Land Department (RERA, Real Estate Regulatory Agency) [7]. RERA is the government body in Dubai that is solely authorized to regulate, monitor, and govern the real estate sector within the Dubai emirate of UAE (United Arab Emirates). To analyze the data at hand, it was necessary to develop a customized data analytics methodology/workflow that uses various statistical and analytical methods. The developed methodology consists of comparison of means (Student's *t* test), visual analytics, hierarchical clustering, k-Means clustering, MDS (Multi-dimensional Scaling), outlier analysis, and linear regression. The methodology was developed using and targeting the analysis of data published by Dubai Land Department (RERA) in particular. Yet, the methodology can be extended to include other types of analysis, for data published for other cities/states/regions/countries around the world.

This Introduction section introduced the topic of study, research questions at hand, the data and methods used, the need for a new approach, and the scientific novelty of the custom-developed analytics methodology. Section 2 provides a summary of the relevant literature. Section 3 presents the custom-developed methodology as an analytics workflow and describes the specific statistical and analytical methods integrated into the methodology. Section 4 describes the data collected and shares the analysis and results obtained. Here, the methodology is applied with data collected from the selected real estate brokerage market, namely that of Dubai, UAE. Section 4 illustrates, one by one, how each of the five research questions shared in the Introduction can be answered through the methodology. Finally, Section 5 summarizes the study, with a discussion of possible threats to validity. The Supplementary Materials to the paper contains additional analysis and results, which have been excluded from the main body of the paper for the sake of succinctness.

2. Literature

For survival purposes, real estate brokerage firms need to stay current and innovate to adjust to changes in the economic and social environments [17]. Technological advancements are transforming the real estate brokerages sustaining the emergence of new approaches and strategies. The latter was facilitated by the transition of real estate data from the private domain, reserved for professionals, to the public domain [18]. Accordingly,

big data and data analytics have demonstrated their efficiency in improving decision-making in different domains with real estate becoming a significant area of application [19]. According to [18], data analytics is beneficial for real estate agents as it enhances property sales, shortens transaction time, and improves services from the supply and demand sides.

There are many studies that apply various data analytics methods for analyzing real estate markets.

In the era of the internet and digitization, real-time housing data, which is gathered by multiple listing services, is typically further enhanced with spatiotemporal geo-information data. Reference [20] used a dataset of more than three million observations from the German home market, to investigate and compare the prediction accuracy of multiple machine learning methods, such as stacked regression, XGboost, and random forest regressions. Reference [21] predicted several aspects of the real estate market using multilevel structured additive regression models. These models were especially used to identify the characteristics that have a statistically significant impact on real estate valuation. In another study that applied regression as the analytical technique, Reference [22] revealed that in Australia buildings with high energy ratings, denoting high level of environmental friendliness, were found to perform better financially overall.

Reference [23] presented a dynamic visual analytics solution, namely HomeSeeker, which serves a wide range of stakeholders involved in the local real estate market. The authors created visual analytics dashboards to help prospective homeowners conveniently view, assess, and evaluate real estate information. Additionally, HomeSeeker suggests a strategy to problem abstraction that promotes gradual education in the area real estate market, especially for consumers with less expertise.

Reference [24] developed an automated, machine-based approach method for determining the value of commercial real estate. The authors used a unique dataset on U.S. multifamily properties and apply advanced modeling techniques. Reference [25] applied grey relational analysis-analytical hierarchy process (GRA-AHP) to develop an advanced real estate investment decision-making model.

Since data from real estate markets can be highly complex, it may be difficult for both practitioners and researchers to overcome the complexities. To this end, Reference [26] provided a knowledge graph-based approach for knowledge extraction for the housing market. The authors' approach involves four main processes, namely entity linking, question answering, data gathering, and finally data cleaning, in order to handle the complexity. The system can make personalized recommendations based on keywords and historical market data. A user-based review highlighted the effectiveness of this method and its usefulness in real-world scenarios. Reference [27] focused on the efficient planning, supply, and administration of building life cycle documentation to develop novel best practices. The authors developed a framework for document classification and demonstrate their framework with an empirical study. The authors analyzed 8965 digital documents from 14 properties belonging to eight different entities, serving as an example of automated information extraction via artificial intelligence in real estate development.

Reference [28] provided a review of how big data is used for decision making in the real estate sector. Reference [29] used an entropy-based approach for ranking the importance of factors that influence residential real estate prices, using data from Auckland, New Zealand (NZ).

Big data and data analytics were also used to study the real estate market in specific conditions. Reference [30] investigated the factors that may impact the price revision of properties during COVID-19. To collect data about approximately 19,000 properties the authors used web-scraping, with subsequently 15 machine learning models being selected to analyze the scraped data. The results confirmed that the real estate market resisted the pandemic impact as the prices did not drop significantly as expected. Furthermore, the gradient boosting model was the most accurate and demonstrated that the main variable explaining price revision and prediction was the time a property was available on the market for sale.

Beyond predicting financial aspects related to real estate such as price and risk, machine learning (ML) frameworks and models were also used to identify the best location for a real estate investment. To this end, Reference [31] contrasted two approaches. Both approaches rely on decision trees, but the first is based on principal component analysis, and the second is artificial neural networks. [32] applied various machine learning techniques to predict sale-to-list ratio for the US real estate market. The study revealed, with 85% prediction accuracy, the strong influence of some temporal, pricing-related, and market-condition factors.

Data analytics was also used to facilitate buyers' and investors' comparison and selection of properties. One specific application of statistical/analytical methods is for forecasting prices and rents. An example of this line of research is Reference [33], where the authors used the econometrical error correction model (ECM) for forecasting house and unit price changes in the Greater Sydney Area.

Another line of research in data analytics for real estate markets is when sentiment analysis is at the core of analytics. One example is [34], where the authors model the impact of COVID-19 sentiment on the office real estate rents and occupancies in China.

The focus of the current research is the real estate brokerage markets within the real estate sector. To this end, notable studies on real estate brokerage markets are discussed next.

Reference [8] applied data analytics and statistical visualization for better decision-making in the real estate brokerage sector. The study examined data from 62 Nigerian PropTech firms using clustering and linear regression, offering insightful information to agents, managers, and clients. The research advanced knowledge of the Nigerian real estate brokerage industry while providing stakeholders with the facility of data-driven decision making.

Reference [9] identified economies of scope in residential real estate brokerage markets. Specifically, the authors found that it was on average more efficient when sales and listings are carried out by a single firm, rather than two separate firms. Reference [11] analyzed the relations between real estate brokers' attributes, agents' attributes, prices, and selling time. Similar to the results of [10], Reference [11] found that there are benefits in economies of scope.

Reference [10] focused on the comparison of the relative performances of franchised vs. independent real estate brokerage firms. The study revealed the significance of and the need to consider the self-selection behavior of the agents, in other words, which type of brokers the agents prefer to choose. Reference [12] analyzed the effect of brokerage firms on the residential real estate prices, revealing that homes sold through brokers realized higher prices.

As mentioned earlier, existing studies were found to apply either qualitative methods (as in Reference [13]), basic statistical summaries (as in Reference [14]), regression (as in References [11,15,16]), or another statistical method (as in References [8,9]). However, none of the studies that were encountered apply more than two statistical and analytical methods within an integrated methodology. No study on the real estate brokerage markets was found to apply the machine learning (ML) method of multi-dimensional scaling (MDS). Thanks to the novel custom-developed analytical methodology that integrates a multitude of methods, this paper enables the derivation of novel insights that could not be obtained in earlier literature.

3. Methods

The research contributions of the presented work are methodological and practical. The theoretical contribution is a novel custom-developed analytics methodology for analyzing brokerage firms in the real estate sector. The main practical contribution is the application of the developed methodology for a particular brokerage market, namely the Dubai brokerage market, yielding insights into that market. Figure 1 displays the analytics methodology as a workflow in Orange software (<https://orangedatamining.com> accessed on 1 April 2024), with a variety of different statistical and analytical methods systematically

applied. For example, scatter plots explain the relationships between two different variables and linear regression explains multiple variables affect multiple factors of response.

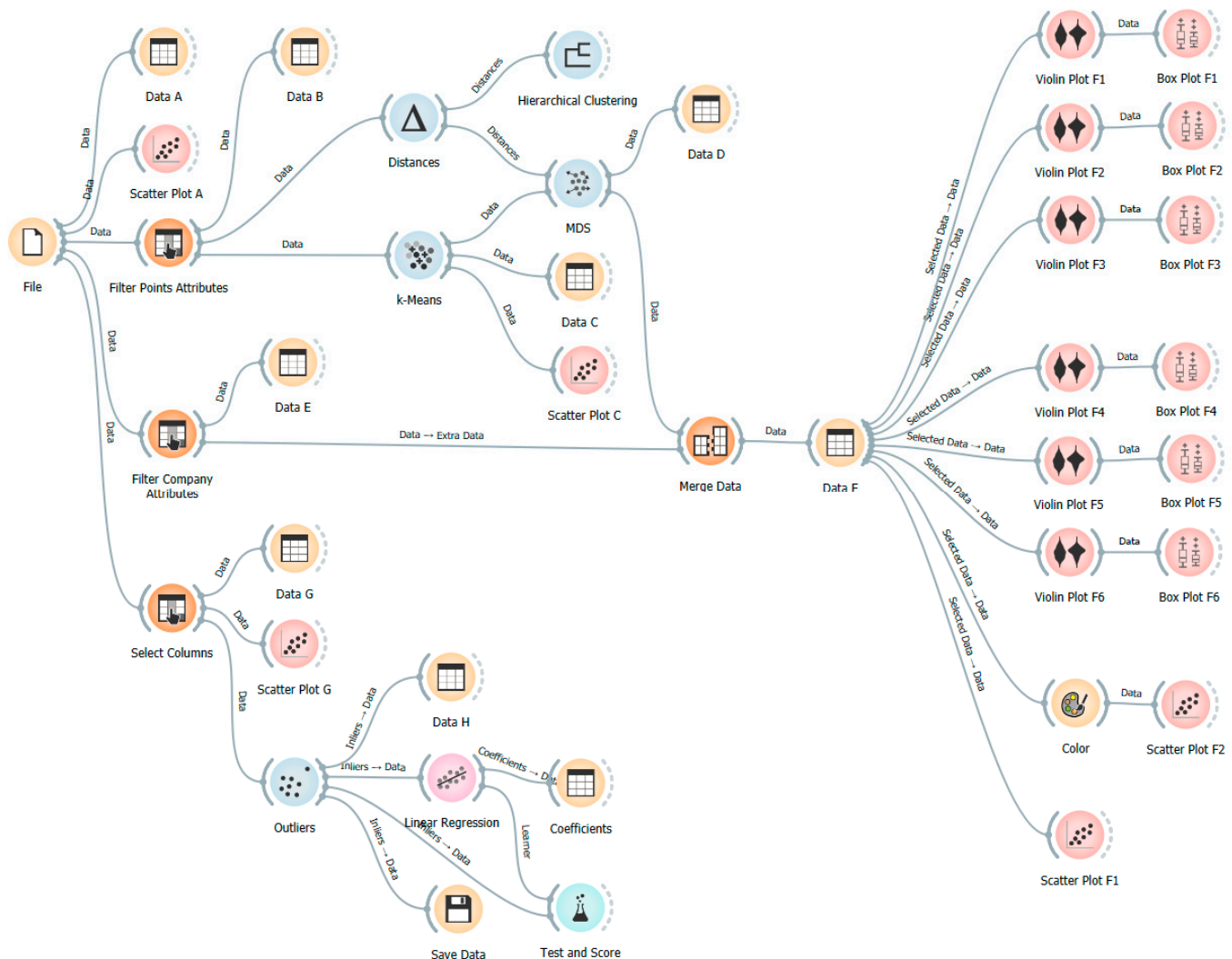


Figure 1. The data analytics methodology developed and applied in the study.

“Data analytics” is the analysis and modeling of data to discover insights. The term “custom-developed analytics methodology” refers to an analytics methodology that caters to a specific type of data, domain, or objective. Alternatively, such a methodology could appear as an “analysis pipeline” [35], “analytics workflow” or another similar term. Such a methodology, by definition, is not globally applicable to any dataset/domain/objective. Instead, it is tailor-designed to perform effectively and/or efficiently for the specific dataset/domain/objective it is intended for. Such a custom-developed analytics methodology is valuable especially when standard analytics workflows may not be sufficient in generating insights in the given context [36]. Research studies reporting custom-developed analytics methodologies can be found in practically all domains, including digital marketing [37], e-commerce [38], smart manufacturing [39,40], agriculture [41], renewable energy [42], marine sciences [43], and bioinformatics [35]. Therefore, it is reasonable to custom-develop novel analytics methodologies in the real estate domain, for benchmarking real estate brokerage firms.

In data analytics research that custom-develops novel methodologies, the term “method” or “technique” is typically used to refer to the specific statistics/analytics techniques, such as hierarchical clustering or scatter plot visualization, whereas the term “methodology” or “framework” is typically used to refer to the workflow that systematically integrates a

portfolio of techniques. In this sense, while the “methods” of statistics/analytics are well-established in the literature, the “methodology” in the paper is novel; because the existing methods/techniques have not been put together within an integrated whole as such and have thus not been applied as the customized whole.

The statistical and analytical methods/techniques integrated into the methodology are as follows:

1. A scatter plot visualization plots two variables on a two-dimensional Cartesian plane to observe the relationship between the two variables. Scatter plots are particularly beneficial to reveal patterns and correlations between the variables.
2. Hierarchical clustering is a cluster analysis technique that creates a hierarchical tree of clusters. At each level of the hierarchy, the distance between the observations within clusters is minimized, and then clusters are broken into smaller clusters [29].
3. k-Means clustering divides the observations in the dataset into k clusters, where each observation is successively assigned to the cluster whose centroid is at the smallest Euclidean distance [44].
4. MDS (multi-dimensional scaling) maps multidimensional data to a two-dimensional Cartesian plane such that the data points that have less distance are closer to each other. The objective of the selected MDS algorithm is to identify an accurate lower-dimensional representation of the—typically much—higher dimensional data while maintaining, as much as possible, the distances between the data points.
5. A strip plot maps the distribution of points in the subsets of a dataset, where each subset typically corresponds to data points having a particular value of a categorical attribute [45].
6. A violin plot is similar to strip plot, yet also includes two symmetric density plots that accompany the strip plot [46]. Furthermore, the points on the strip plot are typically jittered (distorted with small deviations) to distinguish them.
7. A box plot roughly portrays the distribution of points by drawing a rectangular box that shows the median, 25% and 75% quartiles, range, and outliers.
8. Comparison of means test determines whether there is a statistically significant difference between the means of two or more groups [47]. If the groups are normally distributed or are large in size, the Student’s t -test can be applied, with smaller p values suggesting that there is a statistically significant difference between the means of at least two groups.
9. Outlier analysis identifies outlier data points, which are data points that vary from and are significantly outside the other data points in the dataset. If the outliers are not appropriately handled, they might create bias in the statistical results [48].
10. Linear regression describes the connection between one or more independent variables and a dependent variable through a linear equation, where the dependent variable is expressed as a linear function of the dependent variable(s) and a random error term [49].

4. Analysis and Results

Our case study analysis, where we demonstrate the developed methodology, is focused on the Real Estate Brokerage Market in Dubai, United Arab Emirates (UAE).

4.1. Data

As the source dataset, we extracted data for the largest 50 licensed real estate brokers in Dubai [7] with the largest number of agents as of 10 May 2023. The data was obtained from the website of Dubai Land Authority (<https://dubailand.gov.ae/> accessed on 1 April 2024), which is the government entity in Dubai that regulates the real estate market. After collecting and cleaning the data, we developed a novel data analytics methodology that is customized for this specific dataset and datasets with similar attributes and structure. Then, we applied the methodology using Orange software to analyze the collected data for the selected market.

The Dubai housing market is continuing to grow. From 2022 to July 2024, the Federal Reserve of the United States has implemented a series of interest rate hikes, to mitigate against inflation (<https://www.federalreserve.gov/monetarypolicy/openmarket.htm> accessed on 11 August 2024). The hikes started on 17 March 2022, with an increase from 0.25% to 0.50%. Following multiple increases, finally, as of 31 July 2024, the Federal Funds interest rate was increased again from 5.25% to 5.50%. As of early 2023, Reference [50] revealed negative spillover effects of these interest rate hikes on the Dubai housing market, causing decreases in demand and prices in Dubai, as well as other countries. Yet, starting February 2023, the UAE house price annual price change has mostly increased, reaching from 6.34% in February 2023 to 16.18% in April 2024 (<https://www.globalpropertyguide.com/middle-east/united-arab-emirates/price-history> accessed on 11 August 2024). Sales transactions in Dubai showed 38% increase from 2022 to 2023. Furthermore, in Q1 of 2024, Dubai's residential sales transactions showed a 20% increase in volume as compared to Q1 of 2023 (<https://www.jll-mena.com/content/dam/jll-com/documents/pdf/research/emea/mena/jll-the-uae-real-estate-market-overview-q1-2024.pdf> accessed on 11 August 2024). In other words, while the series of interest rate hikes by the Federal Reserve initially had a negative spillover effect on Dubai till 2023, the Dubai housing market recovered and grew in volume in 2023 till 2024 Q1.

The data attributes are provided in Table 1. The primary target attribute is “RankingTotalPoint” which is numerical. The eight attributes that start with the text “Points” are points/scores corresponding to different dimensions of performance. The remaining are derived attributes, meaning that they were derived from the original dataset through calculations.

Table 1. Data attributes for the analyzed data [7].

Attribute	Data Type	Description
OfficeCode (Key Attribute)	Text	Custom created office code as ID attribute (to be used instead of OfficeNumber)
Name	Text	Full name of the office
TotalBrokersAllBranches	Numerical	Number of brokers in the whole firm, including all offices of that firm
NumberOfBrokers	Numerical	Number of brokers in this particular office (not the whole firm)
RankingTotalPoint	Numerical	Total points for an office, calculated as the sum of Points attributes (out of 100)
PointsNumberofTransactions	Numerical	Points for number of transactions
PointsTransactionTotalWorth	Numerical	Points for transactions total worth
PointsLegalNotice	Numerical	Points for legal notice
PointsComplianceWithLaws	Numerical	Points for compliance with laws
PointsRealEstateExperience	Numerical	Points for real estate experience
PointsNumberOfBranches	Numerical	Points for number of branches
PointsLocalization	Numerical	Points for localization
PointsInitiatives	Numerical	Points for initiatives
NumberOfAwards	Numerical	Number of awards that the office has received
HasEmailDomain	Binary	1 if the office has email domain of its own, 0 otherwise
IsMobileNumber	Binary	1 if the office has a mobile number listed as contact, 0 otherwise
LicenseIssueYear	Numeric	Year in which license was issued by the Dubai Land Department
DaysSinceLicense	Numeric	Number of days since license was issued by the Dubai Land Department

4.2. Benchmarking Brokers

The first research question that can be answered through data analytics is the following:

“**RQ1:** How can brokerage firms be benchmarked visually with respect to various attributes?”

Figure 2 is a scatter plot with variable “NumberOfBrokers” (Number of Brokers) on the *x*-axis and “RankingTotalPoint” (Ranking total point) on the *y*-axis. In addition, other

attributes are denoted with color (“DaysSinceLicense”) and size (“NumberOfAwards”). “OfficeCode”, the label, is the name of the real estate broker.

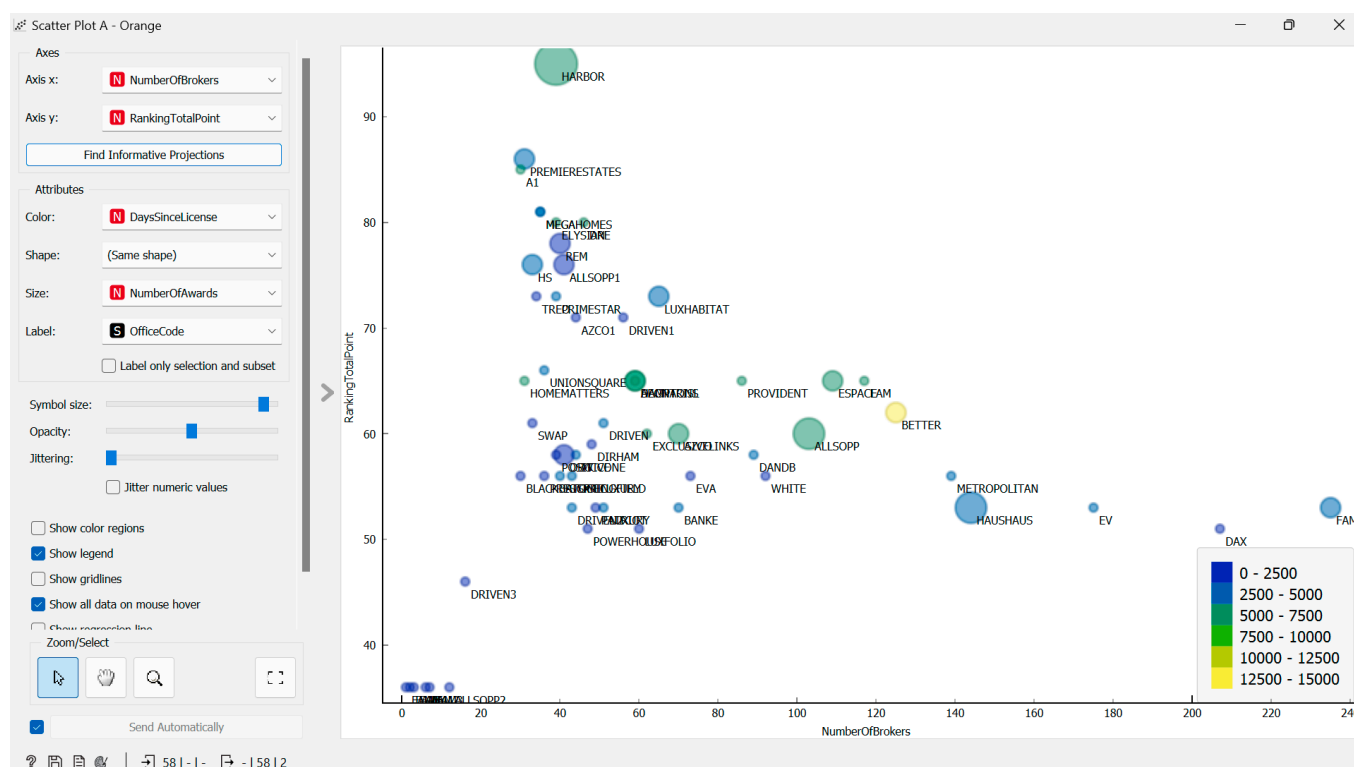


Figure 2. Scatter plot analysis of multiple attributes at once.

The scatter plot illustrates that there is no single consistent pattern, such as a positive or negative relationship between the two variables. However, this scatter plot can still yield a highly beneficial insight: A real estate buyer would prefer high values of “RankingTotalPoint” (y axis) and “NumberOfAwards” (size). It is possible to identify such brokers from this scatter plot as the larger circles on the upper region of the plot such as HARBOR, PREMIER ESTATES, REM, HS, ALLSP, and LUXHABITAT. Furthermore, analyzing the sector, one would especially be interested in identifying younger firms with fewer brokers as employees but with a high level of success. These firms are denoted by larger circles in the upper left region, as well as darker colors and towards the left side of the plot. All the firms mentioned in this paragraph qualify for these criteria, except for HARBOR, which is established well before the other mentioned.

4.3. Mapping Brokers

The second research question that can be answered through data analytics is the following:

“RQ2: Which brokerage firms are similar to each other and different than others?”

To answer this question, we apply hierarchical clustering, k-means clustering, and multidimensional scaling (MDS).

Figure 3 shows the application of hierarchical clustering with “OfficeCode”. The attributes used as dimensions are the eight numerical “Points” attributes. The hierarchical clustering algorithm, whose results are illustrated in the dendrogram of Figure 3, creates from 2 to 27 clusters, revealing varying levels of similarity. Some of the clusters consist of a single element. Even at the most detailed level, with 27 clusters, the number of firms can reach up to 7. For example, on the upper right of the figure, one can observe that the five brokers CA = (HAMPTONS, AEONTRISL, PROVIDENT, FAM, ESPACE) are grouped together, meaning that these firms are most similar with respect to the values of

attributes used in clustering. The largest cluster at this level consists of the seven firms CB = (PATRIOT, LUXURY, BANKE, DRIVEN2, HAUSBAUS, FAM1, EV).

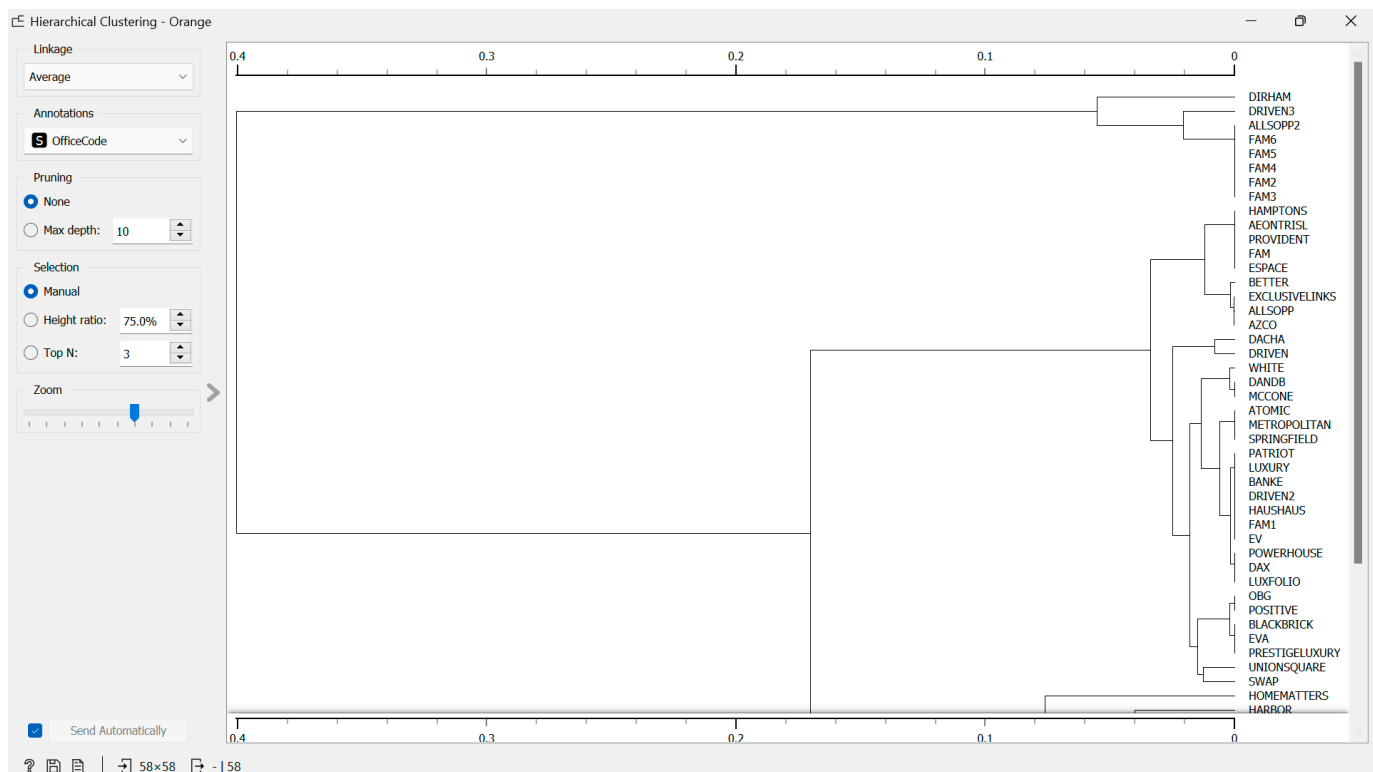


Figure 3. Hierarchical clustering results.

There are multiple implications of the results. For example, while other FAM branches (FAM2, . . . , FAM6) reside together in a different cluster, the FAM1 branch resides within a cluster consisting of firms under different ownership. The reasons for this divergence are worth investigating, especially given that RankingTotalPoint = 53 for FAM1, whereas it is 36 for other branches. The parent company FAM, which has even higher points, can have FAM1 managers work with other FAM branches to increase their performance.

The level of merging of clusters also is noteworthy. For example, cluster CA merges with a cluster of other firms CC = (BETTER, EXCLUSIVELINKS, ALLSOPP, AZCO) almost immediately, meaning that, before larger clusters are formed, the firms in clusters CA and CC are closer to each other, more than their similarity to other firms. Thus, these firms do better in similar dimensions and do worse also in other similar dimensions.

For a firm, it would be especially interesting to benchmark with a more successful firm that has significantly higher RankingTotalPoint value, yet in the same cluster. Because this means that the more successful company is doing better in similar dimensions of performance. A careful investigation of the source data revealed that the firms within cluster CA had exact same values for the eight dimensions of performance (PointsNumberOfTransactions, . . . , PointsInitiatives). The same situation was observed for cluster CB. For cluster CC, there was only a very slight difference, with BETTER doing only slightly better in the PointsNumberOfBranches dimension compared to the other three firms in that cluster, hence it being a cluster of its own at the most detailed level. However, when clusters are started to get merged, the situation changes. For example, when clusters CA and CC are merged, since the firms in CA all have RankingTotalPoint = 65, which is higher than the score for CC, it is reasonable for the firms in CC to look up to the firms in CA.

The next analysis is k-means clustering, whose results highly depend on the selection of the number of clusters. The best choice of k can be determined through the Silhouette scores [51], and the k value that maximizes the Silhouette score can be chosen. Figure 4

displays the Silhouette scores for different values for k . Silhouette score is highest for $k = 4$, thus we selected $k = 4$ as the number of clusters. Other parameters for pre-processing are provided in Figure 4.

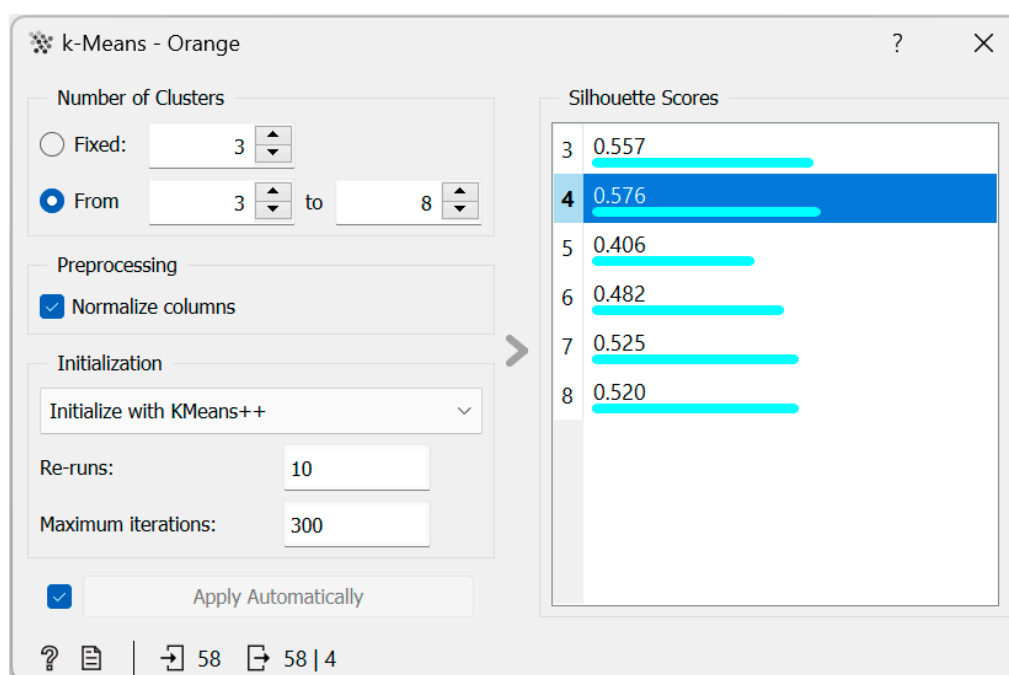


Figure 4. Parameters for k-Means clustering.

After applying k-means clustering, each observation is mapped to a cluster. A reasonable successive analysis is understanding how these observations in different clusters are related. To this end, we applied multi-dimensional scaling (MDS), which maps multi-dimensional data onto a two-dimensional Cartesian plane. In the MDS, “Show similar pairs” option is selected, which automatically turns the MDS results into a graph/network, enabling the analysis of graph analytics [52] techniques as future work.

Figure 5 shows a zoomed region within the results of MDS, with color regions displayed. Color denotes the cluster which the brokerage firm belongs to, with the tone of the color denoting the strength of belonging in the cluster, i.e., being close to the cluster centroid. There are four clusters, yet cluster C2 alone has most of the observations. Thus, we focus on cluster C2, which is denoted by red color. The firms close to each other, especially those that are connected on the MDS plot are similar and closer to each other in the higher dimensional plane. Within cluster C2, there are two major subclusters consisting of connected brokers. In graph analytics, these would be referred to as components, as the nodes in each of these components being reachable from (connected with) each other and yet disconnected from the rest of the graph/network.

The third research question, which is also related to the mapping of the brokerage firms, that can be answered through data analytics is the following:

“RQ3: How do the different clusters of brokerage firms differ from each other?”

To answer RQ3, we will apply strip plots, violin plots, box plots, and statistical hypothesis test for the comparison of means.

Earlier analysis revealed four clusters of firms. Through a violin plot and a statistical comparison test, these identified clusters can be characterized and analyzed deeper for insights.

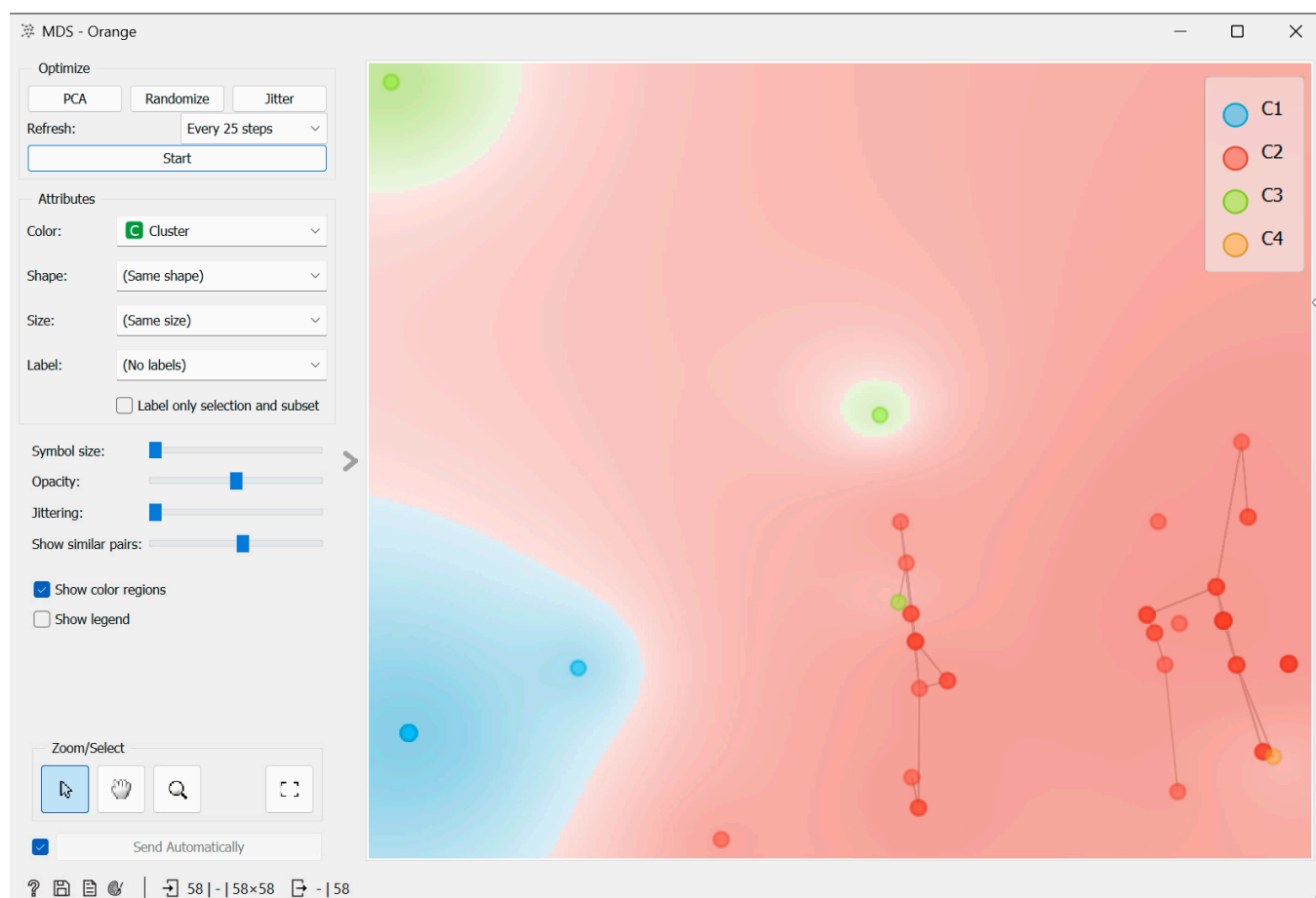


Figure 5. Results of multi-dimensional scaling (MDS).

Figure 6 shows office “DaysSinceLicense” on the Y axis while it shows the number of Cluster on the x axis. Cluster 4 shows an old firm, while cluster C2 and C3 show younger firms than cluster 4. Moreover, cluster 1 shows younger firms.

Figure 7 shows “NumberOfBrokers” on the Y axis while it shows the number of Cluster on the x axis. The violin plot shows that cluster C2 has the highest range, followed by cluster C4, while cluster C1 has the lowest. Furthermore, cluster C3 is slightly higher than cluster C1 yet still lower than cluster C2.

Figure 8 shows “RankingTotalPoint” on the Y axis while it shows the number of Cluster on the x axis. The violin plot shows that cluster 3 has the highest range followed by cluster 2 which is lower, while cluster 1 has the lowest of all clusters. Furthermore, cluster 4 is lower than cluster 2.

The results in Figures 6–8 can be combined as follows, to generate two novel insights for the market: Younger firms, which have less than 700 days or less since license issue (Figure 6) have much fewer number of brokers, being less than 20, and ranking lower (Figure 7), according to the scoring system of Dubai Land Authority.

In other words, to move from cluster C1 of young low-ranking firms to cluster C2 of higher-ranking firms, at least 700 days (approximately two years) are needed. This “700-day rule”, similar in essence to the “10,000-h rule” popularized by Malcolm Gladwell’s “Outliers” book [53], states the amount of time (in number of days) needed to mature and advance to the next level of business success in Dubai’s brokerage market.

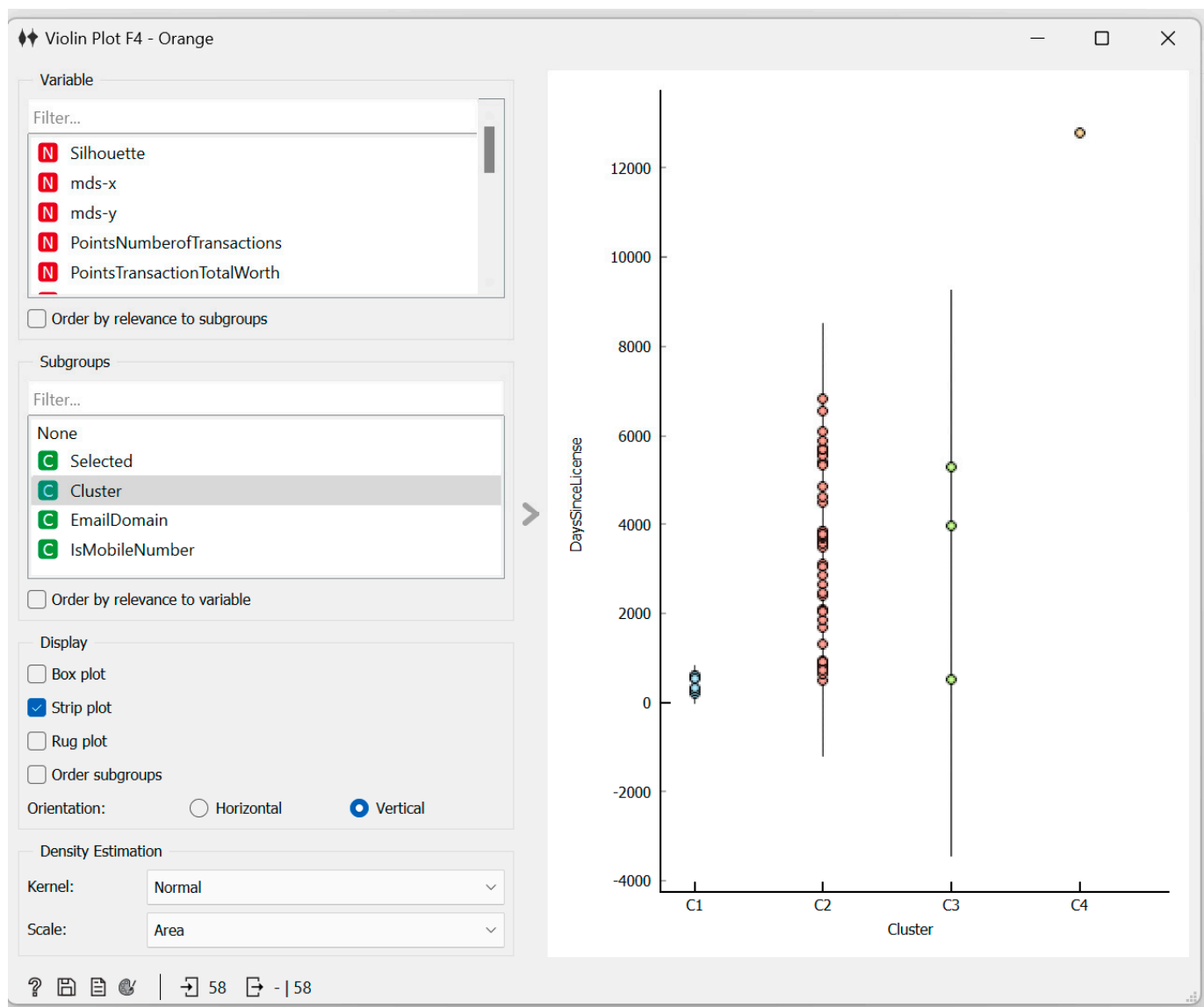


Figure 6. Strip plot for comparing clusters with respect to DaysSinceLicense.

4.4. Effects of Categorical Attributes

The fourth research question that can be answered through data analytics is the following:

“RQ4: How do the values of the categorical attributes of brokerage firms affect their other attributes?”

To answer RQ4, we will apply strip plots, violin plots, box plots, and statistical hypothesis test for the comparison of means.

Figure 9 shows a strip plot visualization and comparison of firms based on whether they have an email domain or not. The blue strip is for firms which do not have an email domain and the red plot is for those with an email domain. The Y axis shows “DaysSinceLicense” and each circle represents a brokerage firm. The value range for the red strip plot (firms with email domains) is much larger than the value range for the other group. Furthermore, there seems to be many observations within the red strip that have higher values than the observations in the blue strip. Our observations from Figure 9 call for the application of proper statistical test for the comparison of means of the two groups.

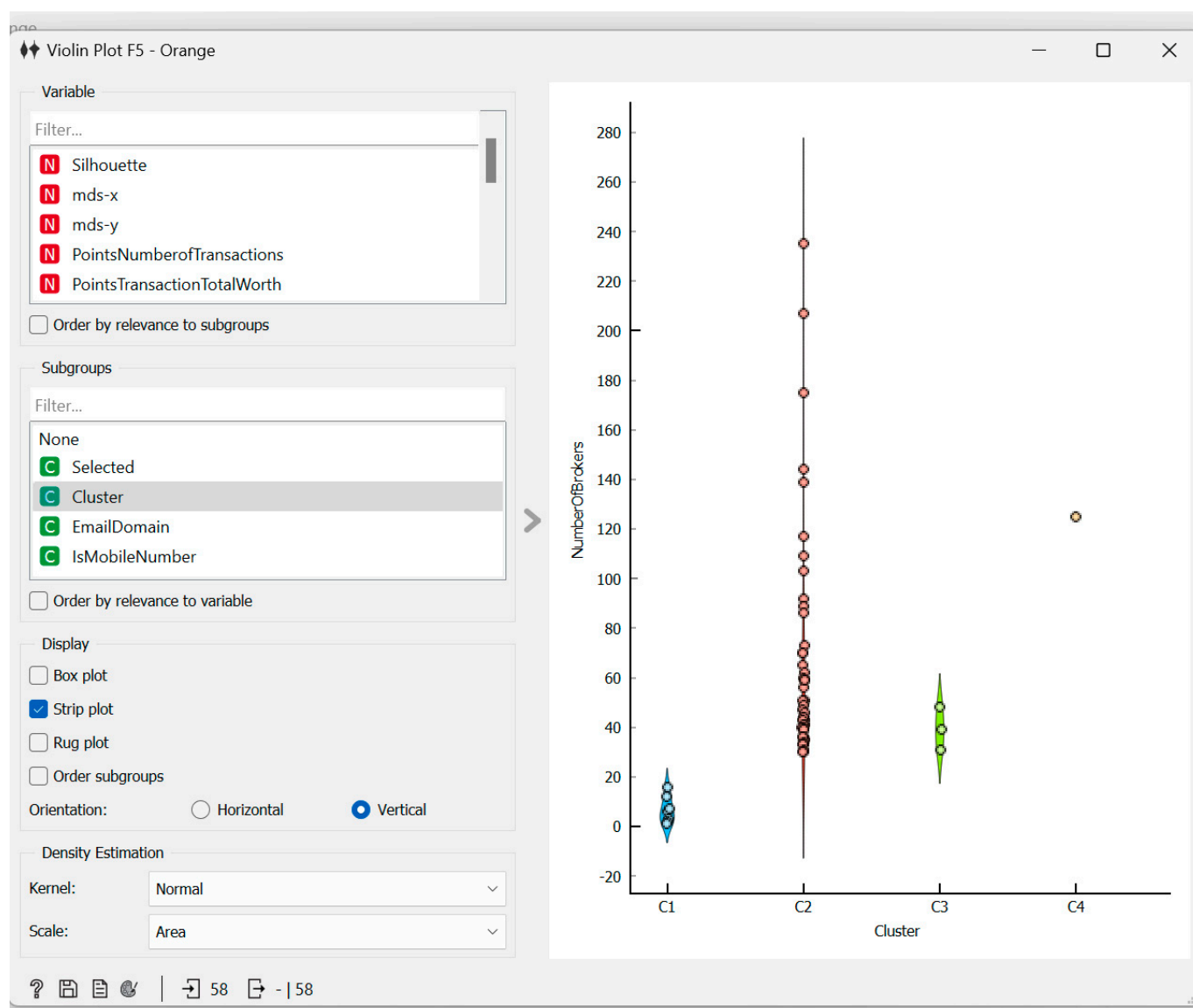


Figure 7. A violin plot for comparing clusters with respect to NumberOfBrokers.

From the boxplot in Figure 10, we can also observe that the range and interval in the firms who have no “EmailDomain” are narrower, while the range and interval on the firms who have an email domain is larger. Figure 10 also displays the results of student’s t test with a value of $p = 0.001$ obtained, suggesting strong statistical support for the differences in means. In other words, firms with an “EmailDomain” name have higher values of “DaySinceLicense”.

Similar analysis is then conducted for other dependent variables, namely “NumberOfBrokers” and “RankingTotalPoint”, whose results can be found in the Supplementary Materials [54].

4.5. Effects of Numerical Attributes

The fifth research question that can be answered through data analytics is the following: “**RQ5:** How do the values of the numerical attributes of brokerage firms affect their other attributes?”

To this end, scatter plot and regression analysis are applied to answer this question.

The next scatter plot analysis is aimed at advancing a better understanding of relation between “DayasSinceLicense”, “NumberOfBrokers”, “NumberOfAwards”, “EmailDo-

main”, and “IsMobileNumber”, as the independent factors versus “RankingTotalPoint” as the dependent variable response. To this end, the following steps are carried out:

- The mentioned five independent attributes and the dependent attribute are plotted in a scatter plot identify if any outliers exist.
- Outlier analysis is carried out and outlier data points are removed before the regression analysis.
- Regression analysis is carried out to fit an open formula that can represent the relation between independent factors and the dependent response.

Figure 11 shows a scatter plot of the selected attributes. We can observe a relationship between “RankingTotalPoints” and “DaysSinceLicense” being positive and somewhat linear. In Figure 11 we can observe that there is an outlier observation, represented by the yellow node on the top of the plot. Therefore, to be able to conduct a more reliable analysis, it is important to remove outliers.

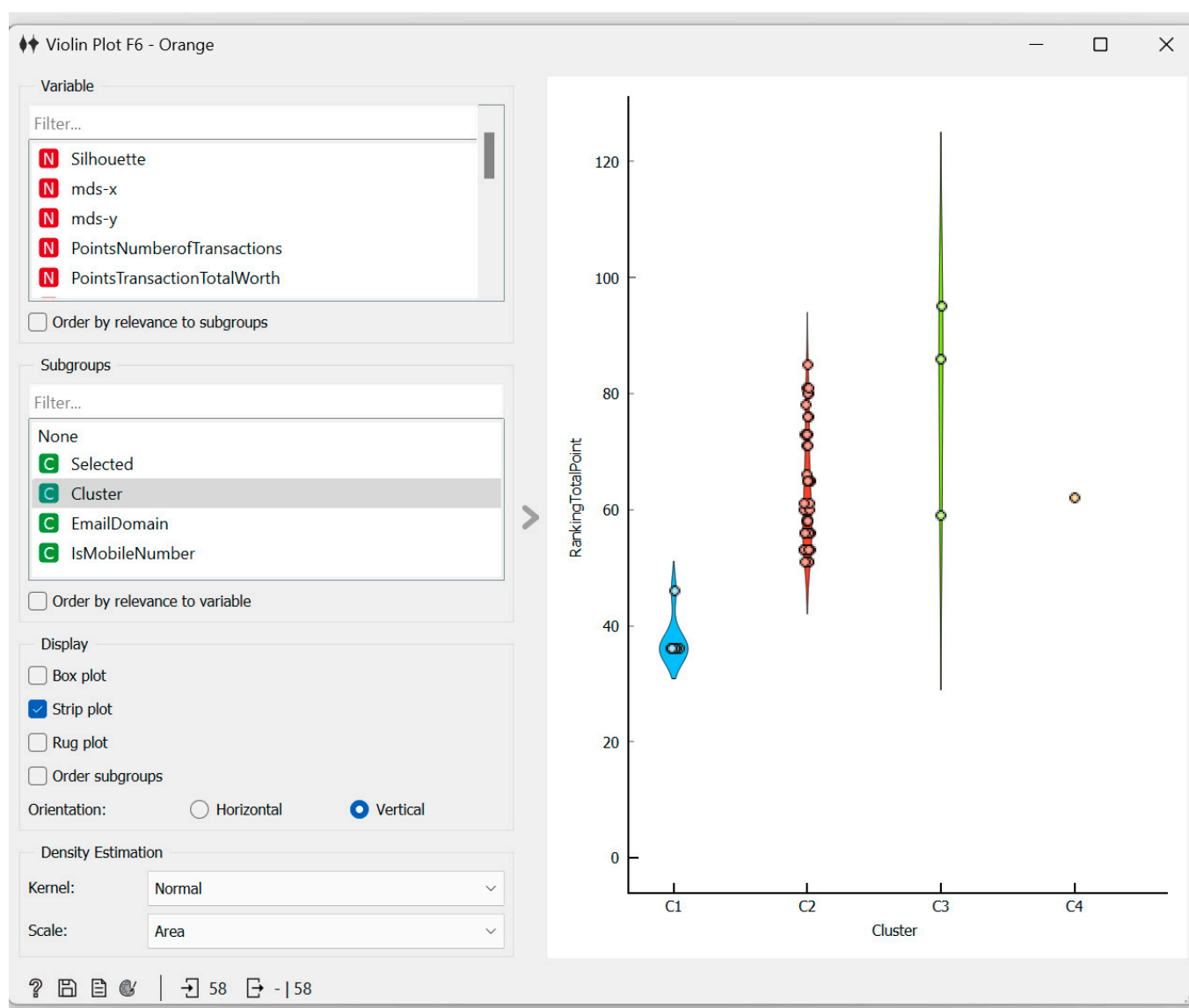


Figure 8. A violin plot for comparing clusters with respect to RankingTotalPoint.

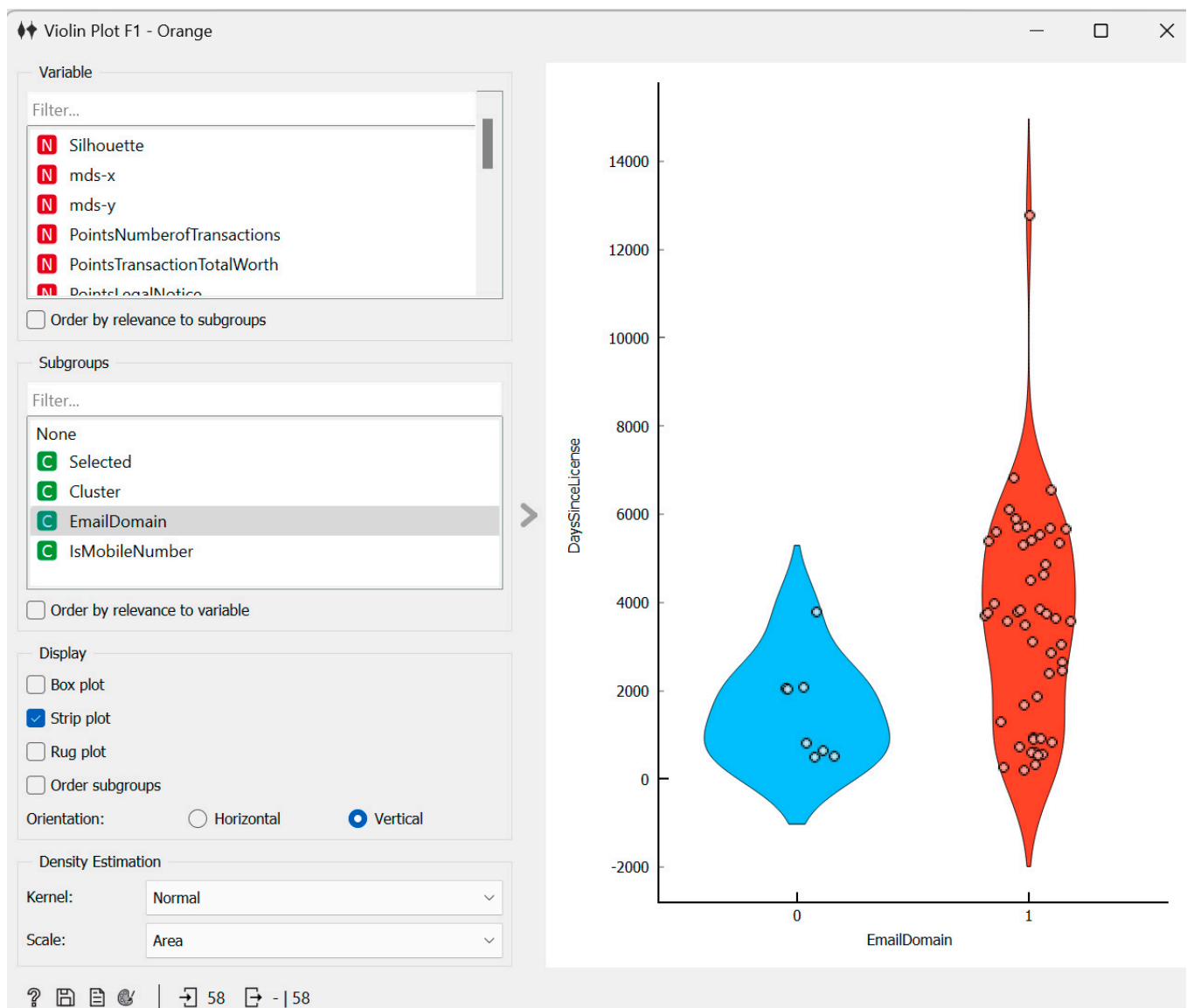


Figure 9. A violin plot visualization, where the x axis denotes whether firms have an email domain or not, and the y axis denotes the “DaysSinceLicense”.

Outlier analysis is carried out using the default “Local Outlier Factor” method, with 10% contamination, 20 neighbors, and the Minkowski metric. There were five outlier brokers that were identified, namely BETTER, DACHA, HAMPTONS, HOMEMATTERS, and A1. These brokers diverge from the rest of the market. The attribute values of these outlier brokers can be compared to the other inlier brokers to see why and how they diverge as outliers.

Linear regression conducted using “leave one out” option resulted in an R-squared value of 0.313, indicating that the total variation of the data explained using regression analysis is 31.3%. Although this is not nearly as high as one would hope to see, it can still be statistically significant. Further analysis using proper statistical tests is needed. The resulting regression equation is (1):

$$\text{RankingTotalPoint} = 51.0441 + 0.00439035 \times \text{DaysSinceLicense} - 0.0483027 \times \text{NumberOfBrokers} + 4.42648 \times \text{NumberOfAwards} + 4.86925 \times (\text{EmailDomain} = 0) - 4.86925 \times (\text{EmailDomain} = 1) + 1.66099 \times (\text{IsMobileNumber} = 0) - 1.66099 \times (\text{IsMobileNumber} = 1) \quad (1)$$

Brokerage firms can use this regression formula to judge where they should be on the average and benchmark themselves without the need to collect any data. If a broker's actual ranking total point is below what it is suggested by the regression function, then the brokerage firm can know that it should work harder towards the metrics.

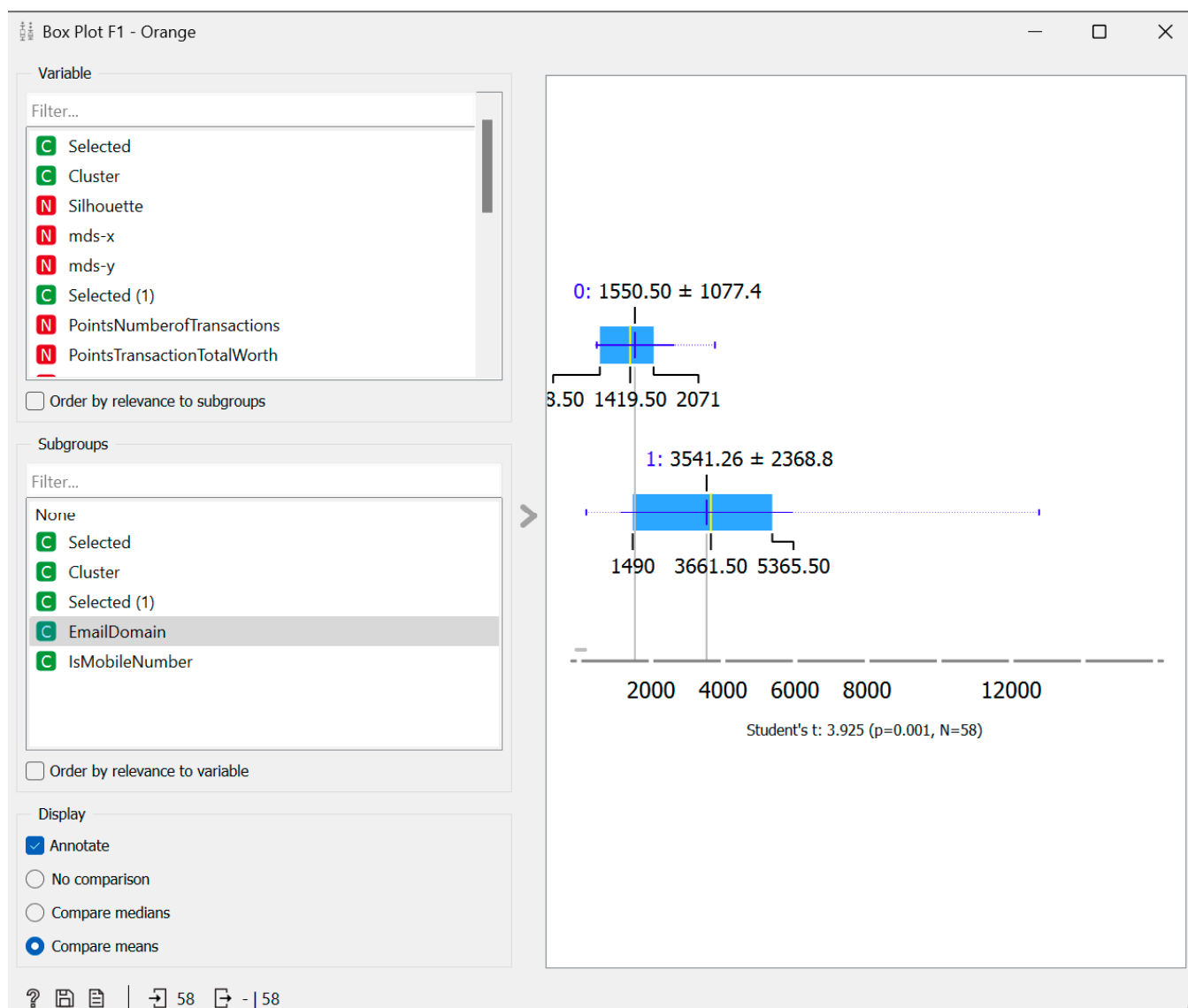


Figure 10. Box plot and statistical test for differences in means, as a complement to the analysis in Figure 9.

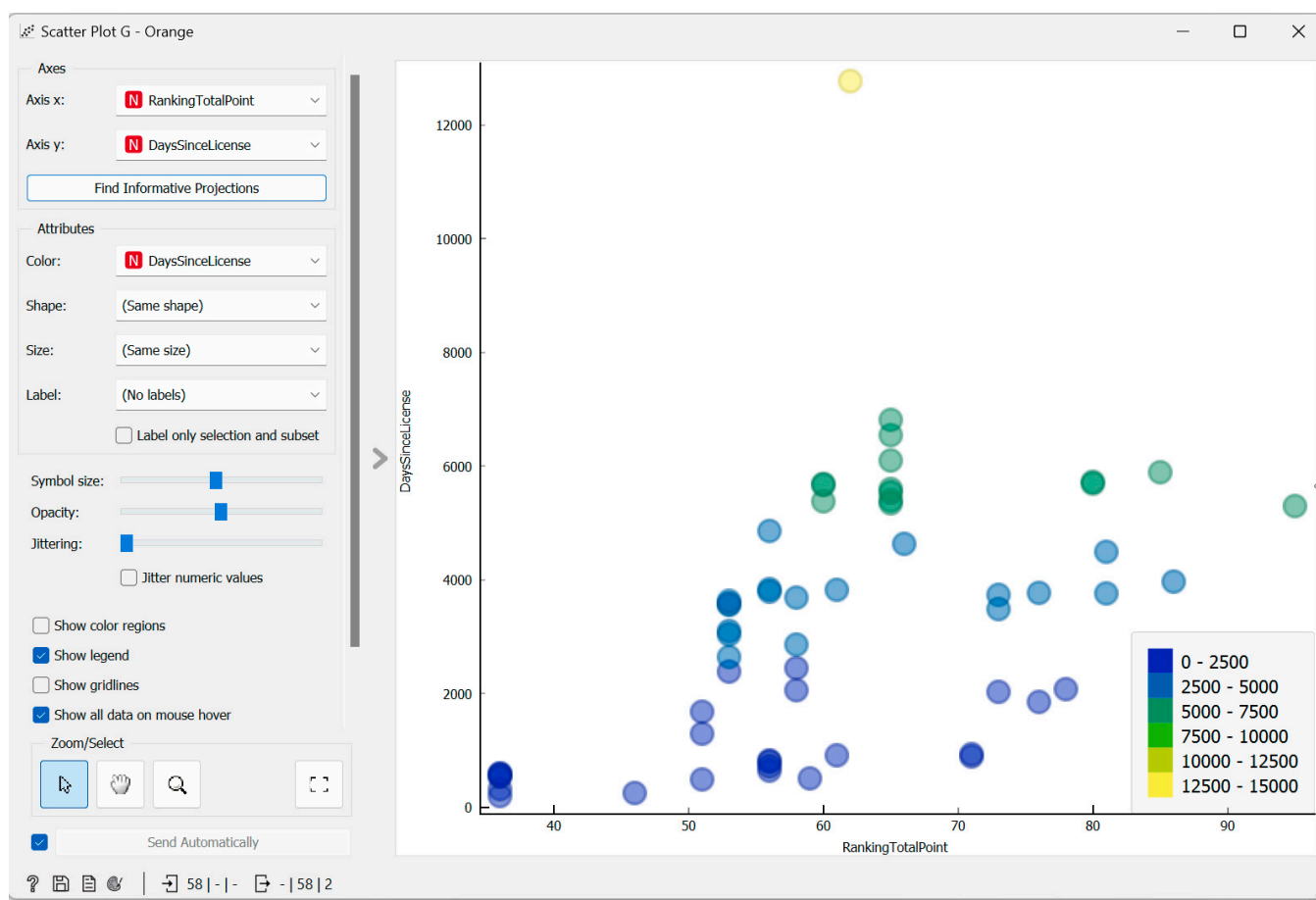


Figure 11. Scatter plot of select attributes before regression.

5. Conclusions

After applying various studies, we developed an analytics workflow with a clear understanding of interpreting brokerage firms in the real estate sector. To summarize our main breakthroughs, it was necessary to clean our dataset and identify some relationships between our dataset's attributes. Many patterns and trends were spotted after using our statistical methods that would help any reader or a real estate buyer to make decisions regarding choosing a broker. After developing our first scatter plot, we concluded that a real estate buyer would favor brokers with high-ranking points and with an also high number of awards. Moreover, a hierarchical clustering was made so we selected $k = 4$ as the number of clusters after going through our Silhouette scores. Furthermore, we used the multi-dimensional scaling (MDS) technique to represent complex, multi-dimensional data in a simplified two-dimensional Cartesian plane. This mapping method allows for a clearer visualization and easier interpretation of the data by reducing its dimensionality while preserving its inherent structure. In addition, we created more than one strip plot to show some comparisons that will help many real estate buyers to see the differences if different attributes were allocated. On top of that, we utilized the usage of boxplots to obtain different values of the p -value that will affect our statistical support. By using the Minkowski metric, we also used outlier analysis to see that we identified 5 outliers. It is worth noting that we used linear regression models and interpreted them by using test and score results.

The validity of our research could be affected by some threats, which can be addressed as the following:

- It is necessary to note that this dataset was analyzed in May 2023 since there would be future changes in the market since then that could affect the credibility of our research. For instance, some offices might have received awards in the past year.
- For some brokerage firms, some missing values that were not found in the original dataset such as an office phone number.
- It is essential to acknowledge that the following study was based on Dubai real estate brokerage market and the results may vary based on the selected city.
- There might be a chance that there are some real estate brokers who might not be included in our dataset which could also compromise the reliability of the research.

Future research on the topic can be towards the extension of the methodology to encompass other types of analysis and discover other insight types. Another line of possible future research is analyzing other brokerage markets and possibly analyzing multiple markets comparatively.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/buildings14103068/s1>. Figure S1. Box plot and statistical test for differences in means. Figure S2. Box plot and statistical test for differences in means. Figure S3. Violin plot visualization, where x axis denotes whether firms have email domain or not, and y axis denotes the “NumberOfBrokers”. Figure S4. Box plot and statistical test for differences in means, as a complement to the analysis in Figure S3. Figure S5. Violin plot visualization, where x axis denotes “RankingTotalPoint”, and y axis denotes whether firms have “EmailDomain” or not. Figure S6. Box plot and statistical test for differences in means, as a complement to the analysis in Figure S5.

Author Contributions: Conceptualization, G.E.; Data curation, A.S.A.A., M.M.A.-B.A.H., M.Z.S.A. and A.S.H.A.; Formal analysis, A.S.A.A., M.M.A.-B.A.H., M.Z.S.A., A.S.H.A. and G.E.; Investigation, A.S.A.A., M.M.A.-B.A.H., M.Z.S.A., A.S.H.A. and G.E.; Methodology, A.S.A.A., M.M.A.-B.A.H., M.Z.S.A., A.S.H.A. and G.E.; Project administration, G.E.; Resources, G.E.; Software, A.S.A.A., M.M.A.-B.A.H., M.Z.S.A. and A.S.H.A.; Supervision, G.E. and T.G.L.; Validation, G.E. and T.G.L.; Visualization, A.S.A.A., M.M.A.-B.A.H., M.Z.S.A. and A.S.H.A.; Writing—original draft, A.S.A.A., M.M.A.-B.A.H., Mohamm—ed Aleissae, A.S.H.A. and G.E.; Writing—review and editing, G.E. and T.G.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: The datasets presented in this article are not readily available because of copyright restrictions of Dubai Land Department (RERA). To access the current database and construct an up-to-date dataset, readers should visit RERA website.

Acknowledgments: We thank Dubai Land Department (RERA) for publicly sharing market data on their website.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Tostevin, P.; Rushton, C. Total Value of Global Real Estate: Property Remains the World’s Biggest Store of Wealth, Savills, Impacts the Future of Global Real Estate, 2023. Available online: <https://www.savills.com/impacts/market-trends/the-total-value-of-global-real-estate-property-remains-the-worlds-biggest-store-of-wealth.html#:~:text=The%20total%20value%20of%20the,a%20significant%20store%20of%20wealth> (accessed on 1 April 2024).
2. Grand View Research. Real Estate Market Size, Share & Trends Analysis: Report by Property (Residential, Commercial, Industrial, Land), by Type (Sales, Rental, Lease), by Region, and Segment Forecasts, 2022–2030, Report ID: GVR-2-68038-354-6, 2024. Available online: <https://www.grandviewresearch.com/industry-analysis/real-estate-market#> (accessed on 1 April 2024).
3. Statista, Market Insight—Financial—Real Estate Market—United Arab Emirates, 2024. Available online: <https://www.statista.com/outlook/fmo/real-estate/united-arab-emirates> (accessed on 1 April 2024).
4. Khan, T. CBRE—Report—Intelligent Investment—2023 UAE Real Estate Market Outlook Mid-Year Review, 2023. Available online: <https://www.cbre.ae/insights/reports/2023-uae-real-estate-market-outlook-mid-year-review> (accessed on 1 April 2024).
5. Zhang, W.; Li, B.; Roca, E. Moments and momentum in the returns of securitized real estate: A cross-country study of risk factors driving real estate investment trusts before and during COVID-19. *Heliyon* **2023**, *9*, e18476. [CrossRef] [PubMed]

6. Dubai Land Department. Dubai Real Estate Market Attracts 5933 Brokers & 2285 Registered Brokerage Offices, 2017. Available online: <https://dubailand.gov.ae/en/news-media/dubai-s-real-estate-market-attracts-5-933-brokers-2-285-registered-brokerage-offices#/> (accessed on 1 April 2024).
7. Dubai Land Department. Licensed Real Estate Brokers. 2023. Available online: <https://dubailand.gov.ae/en/eservices/licensed-real-estate-brokers/licensed-real-estate-brokers-list/#/> (accessed on 10 May 2023).
8. Obinna, W.K.; Udo, M.J. Improving online Real Estate Management System using data analytics. *J. Emerg. Technol.* **2022**, *2*, 66–75. [CrossRef]
9. Locke, S.L. Paying for a name? Comparing the performance of franchised real estate brokerage firms. *J. Real Estate Financ. Econ.* **2020**, *61*, 115–128. [CrossRef]
10. Lewis, D. Optimal Economies of Scope in the Residential Real Estate Brokerage Industry. *South. Univ. Coll. Bus. E-J.* **2022**, *7*, 1. Available online: <https://digitalcommons.subr.edu/cbej/vol7/iss1/1/> (accessed on 1 April 2024).
11. Turnbull, G.K.; Dombrow, J. Individual agents, firms, and the real estate brokerage process. *J. Real Estate Financ. Econ.* **2007**, *35*, 57–76. [CrossRef]
12. Stelk, S.; Zumpano, L.V. Can real estate brokers affect home prices under extreme market conditions? *Int. Real Estate Rev.* **2017**, *20*, 51–73. Available online: <https://ideas.repec.org/a/ire/issued/v20n012017p51-73.html> (accessed on 1 April 2024). [CrossRef]
13. Asensio-Soto, J.C.; Navarro Astor, E. Proptech: A qualitative analysis of online real estate brokerage agencies in Spain. *Intang. Cap.* **2022**, *18*, 489–505. [CrossRef]
14. Berggren, B.; Engström, R.; Kopsch, F.; Lind, H. The evolution of the real estate brokerage market: The case of Sweden. *Int. J. Eng. Technol. Sci. Innov.* **2019**, *4*, 16–32. Available online: <https://ijetsi.org/more2019.php?id=3> (accessed on 1 April 2024).
15. Rosenthal, S.S.; Strange, W.C.; Urrego, J.A. JUE insight: Are city centers losing their appeal? Commercial real estate, urban spatial structure, and COVID-19. *J. Urban Econ.* **2022**, *127*, 103381. [CrossRef]
16. Barwick, P.J.; Wong, M. Competition in the Real Estate Brokerage Industry: A Critical Review. The Brookings Institution Publication 2019. Available online: <https://www.brookings.edu/wp-content/uploads/2019/12/ES-12.12.19-Barwick-Wong.pdf> (accessed on 28 June 2024).
17. Kuc, B.R. Enhancing social responsibility and sustainability in real estate industry. *Turk. J. Comput. Math. Educ.* **2021**, *12*, 4999–5013.
18. Javadpour, L.; Khazaeli, M. Business Intelligence in the Real Estate Industry and Effect of Data Analytics Adoption. In Proceedings of the IIE Annual Conference, Nashville, TN, USA, 30 May–2 June 2015; Proceedings. Institute of Industrial and Systems Engineers (IIE): Peachtree Corners, GA, USA, 2015; p. 2212.
19. Singh, A.; Sharma, A.; Dubey, G. Big data analytics predicting real estate prices. *Int. J. Syst. Assur. Eng. Manag.* **2020**, *11*, 208–219. [CrossRef]
20. Cajias, M. Can a machine understand real estate pricing?—Evaluating machine learning approaches with big data. In Proceedings of the 26th Annual European Real Estate Society Conference, Cergy-Pontoise, France, 3–6 July 2019. [CrossRef]
21. Razen, A.; Brunauer, W.; Klein, N.; Kneib, T.; Lang, S.; Umlauf, N. Statistical Risk Analysis for Real Estate Collateral Valuation Using Bayesian Distributional and Quantile Regression. Working Papers in Economics and Statistics (No. 2014-12) 2014. Available online: <https://www.econstor.eu/handle/10419/101094> (accessed on 1 April 2024).
22. Lee, C.L.; Gumulya, N.; Bangura, M. The Role of Mandatory Building Efficiency Disclosure on Green Building Price Premium: Evidence from Australia. *Buildings* **2022**, *12*, 297. [CrossRef]
23. Li, M.; Bao, Z.; Sellis, T.; Yan, S.; Zhang, R. HomeSeeker: A visual analytics system of real estate data. *J. Vis. Lang. Comput.* **2018**, *45*, 1–16. [CrossRef]
24. Kok, N.; Koponen, E.L.; Martínez-Barbosa, C.A. Big data in real estate? From manual appraisal to automated valuation. *J. Portf. Manag.* **2017**, *43*, 202–211. [CrossRef]
25. Zhuang, M.; Pan, W.T.; Shi, Z.; Zhou, Y.; Zhong, Z. Application of Data Mining Technology in Evaluating Real Estate Investment Plan Based on GRA-AHP. *J. Phys. Conf. Ser.* **2019**, *1284*, 012037. [CrossRef]
26. Hu, Z.; Zhao, Z.; Rostami, M.; Ilievski, F.; Shbita, B. Demo: Knowledge Graph-Based Housing Market Analysis. In *Knowledge Graph Construction 2021 (KGCW 2021), Proceedings of the 2nd International Workshop on Knowledge Graph Construction Co-Located with 18th Extended Semantic Web Conference (ESWC 2021), Online, 2–6 June 2021*; 2021. Available online: <https://ceur-ws.org/Vol-2873/paper4.pdf> (accessed on 1 April 2024).
27. Bodenbender, M.; Kurzrock, B.M.; Müller, P.M. Broad application of artificial intelligence for document classification, information extraction and predictive analytics in real estate. *J. Gen. Manag.* **2019**, *44*, 170–179. [CrossRef]
28. Cheryshenko, M.S.; Pomernyyuk, Y.Y. Integration of big data in the decision-making process in the real estate sector. *IOP Conf. Ser. Earth Environ. Sci.* **2021**, *751*, 012096. [CrossRef]
29. Ge, X.J.; Du, Y. Main variables influencing residential property values using the entropy method—The case of Auckland. In Proceedings of the 5th International Structural Engineering and Construction Conference, Shunan, Japan, 2007. Available online: <https://www.asres2007.um.edu.mo/papers/041%20-%20PAPER.pdf> (accessed on 1 April 2024).
30. Grybauskas, A.; Pilinkienė, V.; Stundžienė, A. Predictive analytics using Big Data for the real estate market during the COVID-19 pandemic. *J. Big Data* **2021**, *8*, 105. [CrossRef]
31. Sandeep Kumar, E.; Talasila, V.; Rishe, N.; Suresh Kumar, T.V.; Iyengar, S.S. Location identification for real estate investment using data analytics. *Int. J. Data Sci. Anal.* **2019**, *8*, 299–323. [CrossRef]

32. Sobieraj, J.; Metelski, D. Machine Learning Insights: Exploring Key Factors Influencing Sale-to-List Ratio—Insights from SVM Classification and Recursive Feature Selection in the US Real Estate Market. *Buildings* **2024**, *14*, 1471. [CrossRef]
33. Shi, S.; Mangioni, V.; Ge, X.J.; Herath, S.; Rabhi, F.; Ouyse, R. House price forecasting from investment perspectives. *Land* **2021**, *10*, 1009. [CrossRef]
34. Wang, S.; Lee, C.L.; Song, Y. The COVID-19 Sentiment and Office Markets: Evidence from China. *Buildings* **2022**, *12*, 2100. [CrossRef]
35. Wratten, L.; Wilm, A.; Göke, J. Reproducible, scalable, and shareable analysis pipelines with bioinformatics workflow managers. *Nat. Methods* **2021**, *18*, 1161–1168. [CrossRef]
36. Edwards, J.S.; Rodriguez, E. Remedies against bias in analytics systems. *J. Bus. Anal.* **2019**, *2*, 74–87. [CrossRef]
37. Miklosik, A.; Kuchta, M.; Evans, N.; Zak, S. Towards the adoption of machine learning-based analytical tools in digital marketing. *IEEE Access* **2019**, *7*, 85705–85718. [CrossRef]
38. Al Akasheh, M.; Eleyan, N.; Ertek, G. A Predictive Data Analytics Methodology for Online Food Delivery. In Proceedings of the 2022 Ninth International Conference on Social Networks Analysis, Management and Security (SNAMS), Milan, Italy, 29 November–1 December 2022; pp. 1–7. [CrossRef]
39. Wanner, J.; Wissuchek, C.; Welsch, G.; Janiesch, C. A taxonomy and archetypes of business analytics in smart manufacturing. *ACM SIGMIS Database DATABASE Adv. Inf. Syst.* **2023**, *54*, 11–45. [CrossRef]
40. Kahveci, S.; Alkan, B.; Mus'ab, H.A.; Ahmad, B.; Harrison, R. An end-to-end big data analytics platform for IoT-enabled smart factories: A case study of battery module assembly system for electric vehicles. *J. Manuf. Syst.* **2022**, *63*, 214–223. [CrossRef]
41. Petrea, Ş.M.; Cristea, D.S.; Turek Rahoveanu, M.M.; Zamfir, C.G.; Turek Rahoveanu, A.; Zugravu, G.A.; Nancu, D. Perspectives of the moldavian agricultural sector by using a custom-developed analytical framework. *Sustainability* **2020**, *12*, 4671. [CrossRef]
42. Ertek, G.; Kailas, L. Analyzing a Decade of Wind Turbine Accident News with Topic Modeling. *Sustainability* **2021**, *13*, 12757. [CrossRef]
43. Schoening, T.; Köser, K.; Greinert, J. An acquisition, curation and management workflow for sustainable, terabyte-scale marine image analysis. *Sci. Data* **2018**, *5*, 180181. [CrossRef]
44. Ikotun, A.M.; Ezugwu, A.E.; Abualigah, L.; Abuhaija, B.; Heming, J. K-means clustering algorithms: A comprehensive review, variants analysis, and advances in the era of big data. *Inf. Sci.* **2023**, *622*, 178–210. [CrossRef]
45. Newburger, E.; Correll, M.; Elmqvist, N. Fitting bell curves to data distributions using visualization. *IEEE Trans. Vis. Comput. Graph.* **2022**, *29*, 5372–5383. [CrossRef] [PubMed]
46. Min, S.H.; Zhou, J. Smplot: An R package for easy and elegant data visualization. *Front. Genet.* **2021**, *12*, 802894. [CrossRef] [PubMed]
47. Casella, G.; Berger, R. *Statistical Inference*; CRC Press: Boca Raton, FL, USA, 2024.
48. Boukerche, A.; Zheng, L.; Alfandi, O. Outlier detection: Methods, models, and classification. *ACM Comput. Surv. (CSUR)* **2020**, *53*, 1–37. [CrossRef]
49. Montgomery, D.C.; Peck, E.A.; Vining, G.G. *Introduction to Linear Regression Analysis*; John Wiley & Sons: Hoboken, NJ, USA, 2021.
50. Rashad, A.S.; Farghally, M. The US monetary conditions and Dubai's real estate market: Twist or tango? *Int. J. Hous. Mark. Anal.* **2023**, *17*, 1225–1242. [CrossRef]
51. Shahapure, K.R.; Nicholas, C. Cluster quality analysis using silhouette score. In Proceedings of the 2020 IEEE 7th International Conference on Data science and Advanced Analytics (DSAA), Sydney, Australia, 6–9 October 2020; pp. 747–748. [CrossRef]
52. Brath, R.; Jonker, D. *Graph Analysis and Visualization: Discovering Business Opportunity in Linked Data*; Wiley: Hoboken, NJ, USA, 2015; ISBN 9781118845844. [CrossRef]
53. Gladwell, M. *Outliers: The Story of Success*; Back Bay Books: New York, NY, USA, 2011.
54. Al Abdulsalam, S.A.; Al Hashemi, M.M.A.; Aleissae, M.Z.S.; Almansoori, A.S.H.; Ertek, G.; Labben, T.G. Supplement to “A Novel Data Analytics Methodology for Analyzing Real Estate Brokerage Markets with Case Study of Dubai”. 2024. Available online: <https://ertekprojects.com/ftp/supp/27.pdf> (accessed on 28 June 2024).

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Article

Preparing Property Graduates for the Digital Age: Challenges and Strategies from the Perspective of Australian Property Educators

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Abstract: The work readiness of property graduates is the subject of global discourse and is an increasingly critical gap as employers demand professionals with competencies in their fundamental roles and digital technologies. Although these issues have been explored from the perspectives of students, graduates, and employers, the insights of property academics remain unexplored. As such, this study delved into the challenges encountered by property academics in Australia concerning the training of property graduates for the digital age, as well as the efficacy of strategies used to achieve this. The opinions of 22 property academics were gathered through an online questionnaire survey and analysed through mean scores, relative importance index (RII), and exploratory factor analysis (EFA). The profile of respondents suggests that approximately half of them have no more than five years of industry experience, and only 54.5% currently engage with the industry. The most significant challenges include limited funding to procure bespoke software and insufficient time to achieve digital competency. Furthermore, academics cited limited support from the universities as a key challenge, but rated curriculum rigidity as non-pertinent. Regarding strategies, retraining academics for digital proficiency, increased technical support from universities, adopting active learning, and revising curricula to incorporate digital technology are critical. Collaboration with industry partners and increased funding for software procurement also emerged as key external factors. Variations in these perceptions also suggest that older academics are less receptive towards retraining, academics with more industry experience believe that a restructuring of the curricula is required, and smaller institutions require more funding and industry support. The core themes of the proposed strategies also indicate that holistic curricula integration is required to incorporate the perspectives of all stakeholders. Practically, these findings underscore the pivotal role of academics in bridging the skills gap and the interconnected roles of graduates, universities, and industry partners.

Keywords: property academics; PropTech; property graduates; work readiness; challenges; strategies; Australia

1. Introduction

The property sector has long been a critical driver of economic growth due to its intricate links to the broader economy, as well as the dual function of the asset class as a provider of shelter and enabler of economic activity [1,2]. This dynamic sector's success depends on several stakeholders, institutional frameworks, and informal norms [3]. In particular, the three-way relationship between education providers, graduates, and

employers is fundamental. Education providers aim to equip graduates with the skills required by prospective employers, which constantly need to be updated to match client demands and the evolving technological landscape [4,5].

Despite the relevance of the property sector to the success of the broader economy, the extant literature has documented significant gaps between the training offered by education providers and the skills demanded by the industry [5–7]. Several studies have highlighted the need for more robust collaboration between major property sector stakeholders to ensure its ongoing success and retain its position as a pillar of the economy [7–10]. Employers now expect more rounded graduates with a better appreciation of industry standards and many interpersonal skills, a significant variation from past decades when the biggest concern was academic excellence [11]. This divide between academia and the industry has been reported across many countries, indicating the significance of the issue on a global scale: in the USA [12,13], in the UK [4,14], in Australia [5,15–17], in China [18], and in Nigeria [19].

The property sector is Australia's most significant industry, contributing 13% to the economy and providing more jobs than the mining and manufacturing industries combined, having a total of 1.4 million jobs in 2022 [20]. Notwithstanding the high level of student satisfaction with the quality of property education in Australia [15,21], there are also critical expectation gaps in the skills required by employers [5,13,22,23]. According to Boyd [22], the changing demands of stakeholders in the property industry have contributed to a significant gap that education providers need to address. Warren and Heng [13] questioned how well higher education providers prepare graduates in facilities management (FM) courses across the UK, the USA, and Australia. Baxter [23] called for greater attention to detail in property education to ensure graduates' preparedness for the industry's dynamic demands. A recent study by Abidoye et al. [5] affirms that these expectation gaps are still relevant in the Australian property industry, further indicating that more deliberate actions are required to better equip property graduates for the dynamic demands of the modern client.

As the property industry struggles to address these generic expectation gaps, an even wider disparity has become apparent in recent years due to technological advancements in the digital age [5,24]. Baum [10] referred to the use of digital technologies in the property industry as *PropTech*, a term that has become increasingly relevant due to recent technological developments and a general shift towards data-oriented decision making and automation [25,26]. In one of the earliest papers on the growing divide between academia and practice, Boyd [22] reported changes to client preferences and further cautioned against the potential for property graduates to become redundant should education providers fail to adapt to these new demands. These gaps are a result of decades of change, culminating in a more sophisticated property market linked to the finance sector and involving more stakeholders [27].

These shortcomings call for all stakeholders to take proactive measures to better prepare property graduates for the digital age [6,9,24,26]. Notably, most previous studies have focused on the perspectives of property graduates [5,19], current students [28,29], or employers [7,30]. Despite being primarily responsible for designing a curriculum and delivering lessons to students, property academics have been the subject of very little research interest in equipping property graduates for the digital age. Callanan and McCarthy [9] posited that many graduate programs are designed based on faculty availability. To that end, the competency levels of property academics may be the most relevant driver of change to prepare property graduates for the digital age. Some extreme projections suggest that traditional roles in valuation and construction could be phased out within decades due to more efficient digital tools [31]. Consequently, there is a genuine risk that property graduates with limited exposure to digital tools may struggle to secure jobs in a market that no longer values their skills [5]. This sentiment is a common theme in the extant literature; future property professionals must understand the technological advancements

transforming the industry and be able to apply these technologies to enhance efficiency and value to meet dynamic client needs [26].

The aim of this research was to address the significant gaps between the training offered by education providers and the skills demanded by the property industry, with a specific focus on preparing property graduates for the digital age in Australia. Recognising the pivotal role of property academics in curriculum design and delivery, this study explored their perspectives on the challenges they face and the efficacy of proposed strategies to bridge the divide between property education and industry expectations. Unlike previous studies that were mainly conducted from the viewpoint of property graduates and employers, this study explored the opinions of property academics. Moreover, this study considered the views of academics in all recognised subsectors of the property industry and was not limited to just one discipline like the bulk of previous studies. As such, the findings of this study highlight critical perspectives on the shortcomings of current approaches and frameworks, as well as potential dimensions of focus for various stakeholders and decision makers to improve property graduates' preparedness for the future of the property profession. Additionally, the underlying themes and interrelationships underscore the need for a holistic approach that incorporates the perspectives of academics, graduates, and employers to design and deliver property education.

The rest of the paper is structured as follows: The next section presents a review of relevant studies covering key themes related to the preparedness of the property industry for the digital age, the necessity for technological training, and the role of property educators in equipping property graduates. This is followed by the methodology in Section 3, where we explain the research process and methods. Section 4 presents the results and discussion, with conclusions being detailed in Section 5.

2. Literature Review

The property industry is a complex and intricate system of subjects and disciplines without a clearly defined body of knowledge [9,32]. The success of the property industry is dependent on the ongoing relationship between several stakeholders: education providers to equip students with the relevant skills, graduates to apply the requisite skills to meet client demands, employers to provide jobs and further training for graduates, and policymakers to provide a framework within which the needs of all stakeholders are represented [6,33,34]. Aliu and Aigbavboa [11] reported that the dynamism of present-day clients' needs requires education providers to constantly upgrade the curricula and teaching methods to keep up with trends and continuously produce graduates who can seamlessly transition as technology evolves. The skillset required of a property professional has transformed over recent decades due to digitisation, internationalisation, and the shift from traditional property services to quasi-financial services [35].

2.1. How Prepared Is the Property Industry for the Digital Age?

Technology has transformed decision making, value assessment, client preferences, construction, management, and every other facet of the property market [10,26]. According to Starr et al. [26], the digital transformation of the built environment is driven by the need for industry standards to be more efficient, adaptable, and flexible. Further, the emergence and proliferation of digital tools have resulted in irreversible changes to traditional practices and increased the competition for property professionals [25]. Baum [10] espoused the disruptive potential of PropTech. Similarly, Cornish et al. [36] emphasised the benefits of embracing technology in service delivery and client interaction to boost efficiency. Although the ongoing digital transformation represents an opportunity to streamline services and productivity, the property sector has generally been slow to adopt these innovations [24].

These technological advances have implications for all subsectors of the property industry. The process of property valuation has progressively shifted from manual to automated approaches [25,27,37]. In particular, automated valuation models (AVMs) are

increasingly limiting the need for trained professionals to determine the value of properties for mortgage and sale purposes, a dynamic that is slowly transforming the practice into more of a science than an art [34,37]. In Australia, industry leaders such as CoreLogic, APM Price Finder, and Monitor now adopt AVMs as standard practice [17]. Similarly, blockchain technology has facilitated the creation of decentralised networks of banks and valuers to facilitate the speedy listing, verification, and sharing of valuations [26]. In the construction subsector, technology has revolutionised building information modelling (BIM), alternative delivery systems, and collaborative partnerships [8]. There are also significant gaps in the training of quantity surveying graduates due to rapidly changing trends and client demands [38,39]. The real estate agency has evolved to incorporate online listing platforms such as *Domain* and *Flatmates* and virtual reality (VR) technologies for remote property inspections.

The work readiness of graduates conceptualises their proficiency in the skills required by employers to fulfil roles towards client needs [40]. In the digital age, a graduate without adequate competence in the digital tools adopted in the industry cannot be deemed work-ready [40,41]. With the property industry being generally regarded as a slow-moving asset class with conservative stakeholders, the rate of adopting technological tools has lagged compared with the rest of the market [24,42]. As economies become more digitised and data become more readily available, there are calls for all property market stakeholders to evolve their practices and competencies [24,34,36]. However, Parker [15] highlighted a worrying trend of higher education institutions in Australia employing the cheapest available resources to deliver their property courses as more experienced academics retire, citing the casualisation of teaching as a particular issue of note.

2.2. The Need for Technological Training

Property education is complex due to the nature of the asset class, the number of stakeholders involved, and the difficulty in clearly defining a body of knowledge [9]. Recent improvements in data processing and the ongoing integration of PropTech in the property industry have also contributed to a paradigm shift that is increasingly making traditional skills redundant [10,24,26]. To address the challenges of the digital age, modern property professionals must understand the intricacies of the property market and possess an appreciable competence in technological tools and skills [33]. Not only will this digital skillset maintain their professional relevance, but a lack of it will inevitably force them out of a market that places a premium on the speed and efficiency of newer methods over the laborious processes of yesteryear [10,25,33]. Future property professionals must evolve with industry demands to retain a role as critical stakeholders providing valuable services in this age of automation [17].

Even before the uptick in adopting technological tools in the property industry, the existing literature reported gaps between the expectations of employers and the training provided for graduates by higher education institutions [4,9,13,43]. Moreover, graduate employers consistently comment on the extended periods of integration they have to offer to new graduates due to the lack of practical knowledge [44]. These gaps largely remain unaddressed [5,7]. In addition to these generic challenges, the digital age and increased technological needs have exacerbated the gaps between academic training and industry readiness [24,26,36]. According to Hefferan and Ross [27], the sophistication of the property market, technological advancements, and specialised client needs have increased the demand for property professionals in Australia. Decades of change driven by technological advances have also shifted the skillset required to service property clients [35].

With more firms and industry providers adopting technological tools to automate core tasks and keep up in the digital age, education providers must redesign curricula to reflect dynamic client needs [5,19,34]. Additionally, these advancements highlight the potential risk of redundancy to future property professionals. Without the needed competence in technological tools, property graduates could become relics in an increasingly digital

market that no longer requires traditional skills better handled by these digital tools [31,45]. These changing dynamics require all stakeholders to adapt, especially education providers, who must take a more proactive role in shaping programmes to better prepare graduates for an evolving industry [35]. According to Starr et al. [26], significant upgrades to the current knowledge base must be made to keep up with the rapidly changing digital age. The role of education providers and academics as stakeholders in bridging these gaps cannot be overstated. Academics are equally responsible for equipping graduates with the skills to make them work-ready and delivering an adequately competent workforce to prospective employers.

2.3. Equipping Property Graduates: The Role of Property Academics

All stakeholders have a role to play in securing the future of property education in Australia: the government to make resources available, policymakers to provide a framework within which the transition can occur, the industry to further the training of the graduates, and the students to upskill and ensure their job readiness [34,40,46]. However, much of the success will rely on property academics, given their intermediary role of equipping graduates with in-demand skills for industry roles. According to Borg and Scott-Young [47], the educator's role includes the delivery of literacy skills embedded with practical industry knowledge, career coaching, and industry engagement. Beyond the acceptance that universities have a crucial role in ensuring the successful transition of property graduates into the industry, very little has been reported on the exact role of academics in driving this change [46,48].

The issue of expectation gaps in Australian property education has been explored from the perspective of different stakeholders, including policymakers [46], graduates [16,17], and employers [5,47]. Despite being responsible for delivering these skills to future property professionals, property academics have been the subject of limited research interest.

Several strategies have been proposed to foster stronger ties between academia and practice. Guest speakers familiar with industry practices could help facilitate graduates' exposure to essential technological skills before joining the industry [49]. Weinstein and Worzala [6] suggested mentorship programs as an avenue to facilitate practical training for property graduates during and beyond their time as students. Similarly, active learning focuses on transmitting knowledge to students through project-based activities, a strategy that improves the cognitive capacities of graduates by simulating the conditions under which most will ultimately work [50]. Borg and Scott-Young [47] reported the following themes as the main strategies proposed by employers to better prepare property graduates for the industry: industry engagement, embedded practice, literacy lessons, and career coaching.

Mainly, other stakeholders, such as graduates and employers, have proposed these strategies. No previous study in the existing literature has investigated the pressing need to equip property graduates for the digital age from the perspective of academics and the challenges they face as they strive to close these expectation gaps. Thus, this study assessed the challenges property academics face in Australia as they try to equip property graduates with the necessary skills to succeed in the digital age as well as strategies to aid these proactive attempts.

3. Materials and Methods

This study adopted a quantitative exploratory research design to assess the perspectives of Australian property academics on the challenges they face in equipping property graduates for the digital age, and the study has proposed strategies to improve these attempts. Figure 1 summarises the research process implemented to explore these concepts.



Figure 1. Research process on property academics' challenges and strategies.

3.1. Data Description

These opinions were gathered through an online questionnaire survey designed and administered on the Qualtrics platform. The online survey approach allowed for data collection across geographical borders in addition to ensuring the anonymity and confidentiality of responses [51]. The eligibility criteria for respondents were limited to active property academics currently teaching property-related courses at Australian universities accredited by the Australian Property Institute (API).

As the principal organisational body for Australia's property industry, API represents academics and industry practitioners across the entire sector and retains a database of 110 active property academics who meet the eligibility criteria. Thus, prospective respondents were contacted through the API by sending an initial recruitment email and a follow-up reminder email after a month to boost participation in the study [52]. The online questionnaire survey was open for two months, after which 22 complete responses were received, representing a response rate of 20%.

According to Akintoye and Fitzgerald [53], the established level of response rates in similar survey-based studies ranges from 20% to 30%. Further, previous studies in the property sector conducted through professional bodies reported comparatively lower response rates, notably 2.9% in Poon and Brownlow [7] and 3% in Warren-Myers and Cradduck [54]. The sample size in this study also compares favourably with previous studies assessing technological competencies, education, and practice among property professionals and stakeholders—21 [54] and 18 [55]. Although the small sample size limits the generalisability of these findings, this study provides indications of the wider perceptions of property academics towards the challenges of and strategies for preparing graduates for the digital age. Additionally, the spread of respondents across states and institutions in Australia strengthens the diverse perspectives discussed in this paper.

The first section of the questionnaire queried background information on the respondents' age, gender, educational qualification, academic and industry experience, as well as academic designation and industry certification, if any. Details on their affiliate institutions were also gathered, including locations, programs offered, courses, accreditation, and yearly enrolment estimates. Next, respondents were presented with a list of challenges and strategies developed based on the current literature and asked to rate these measurement items on a 5-point Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). Table 1 presents a profile of the respondents in this study.

Table 1. Profile of respondents (property academics).

Variables		Frequency (n = 22)	Percentage (%)
Age	25–34 years	2	9.1
	35–44 years	6	27.3
	45–54 years	7	31.8
	55–64 years	6	27.3
	Above 65 years	1	4.5
Gender	Male	15	68.2
	Female	6	27.3
	Prefer not to answer	1	4.5
Education	Bachelor's	1	4.5
	Master's	1	4.5
	PhD	20	90.9
Academic experience	0–5 years	2	9.1
	6–10 years	5	22.7
	11–15 years	6	27.3
	16–20 years	5	22.7
	Above 20 years	4	18.2

Table 1. Cont.

Variables		Frequency (n = 22)	Percentage (%)
Academic Designation	Professor	2	9.1
	Associate Professor	3	13.6
	Senior Lecturer	13	59.1
	Lecturer	4	18.2
Industry Certification	Certified Fund Manager	1	4.5
	Development Practitioner	1	4.5
	Practising Valuer (CPV)	6	27.3
	Practising Valuer (plant and machinery)	1	4.5
	None	13	59.1
Location (State)	New South Wales (NSW)	6	27.3
	Queensland (QLD)	4	18.2
	South Australia (SA)	1	4.5
	Victoria (VIC)	9	36.4
	Western Australia (WA)	2	9.1

3.2. Analysis Techniques

Data analyses were undertaken using the Statistical Package for Social Sciences (SPSS) software version 28, mainly through the following statistical techniques: descriptive statistics, mean scores, relative importance index (RII), and exploratory factor analysis (EFA). Following preliminary screening and data cleaning, Cronbach's alpha was computed to measure the internal consistency of the 5-point Likert scales used in the questionnaire. This test returned a reliable alpha of 0.802, well above the recommended 0.7 threshold [56,57].

3.2.1. Relative Importance Index (RII)

Given the limited literature comprehensively assessing the challenges and strategies of property academics in equipping property graduates for the evolving technological industry, these perceptions were ranked through RII. These opinions were collated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) to ascertain how critical and promising the challenges and strategies were, respectively. Through the established RII method developed by Kometa et al. [58], the frequencies of these responses were aggregated and transformed to facilitate a more robust ranking. The index was computed using Equation (1).

$$\text{Relative Importance Index} = \frac{\sum w}{A * N} \quad (1)$$

where

w = the weighting of each factor, ranging from 1 (strongly disagree) to 5 (strongly agree);

A = the highest weight (5);

N = the sample size (22).

To interpret the computed indices, the values range from 0 to 1 in ascending order of perceived importance by the respondents [58,59]. Adapted from Akadiri [60], these index scores were categorised into five distinct categories for easy interpretation: $0 \leq \text{RI} < 0.2$ = "Unimportant"; $0.2 \leq \text{RI} < 0.4$ = "Low"; $0.4 \leq \text{RI} < 0.6$ = "Medium"; $0.6 \leq \text{RI} < 0.8$ = "High"; and $0.8 \leq \text{RI} \leq 1$ = "Critical".

3.2.2. Exploratory Factor Analysis (EFA)

Distinct themes in the challenges and proposed strategies were drawn out through an EFA, which is ideal in the absence of an established theory of behaviour [61,62]. Following the recommendations of Fabrigar and Wegener [62], the following checklist was followed to generate the themes and patterns: data suitability, rotational method, factor extraction, factor retention, and labelling. To ensure the data's suitability for an EFA, correlation

matrices were generated. These values fell within the acceptable range of 0.40 to 0.70, indicating strong relationships between the construct and their suitability for EFA [62,63]. Factor extraction was specified using the direct oblimin rotation method, which is ideal because of the correlation between measurement items [63].

Kaiser's criteria, the scree plot, and the pattern matrix were subsequently adopted for factor extraction and retention [64]. Based on Kaiser's criteria, which specify the retention of factor clusters with an eigenvalue greater than 1, four clusters were retained from the challenges and three were retained from the strategies. Considering that the proposed strategies must directly address existing challenges, further examination of the relationship between these clusters also provides useful insights into the overarching need to reduce expectation gaps between academia and the industry. Tables 2 and 3 detail the initial eigenvalues, total variance explained, and rotation sums of squared loadings. In the EFA, high total variance explained values indicate more comprehensive insights into the relationships and patterns [56]. The merged scree plots are also presented in Figure 2, showing factor clusters with an eigenvalue higher than 1 before the breakpoint. Thus, clusters that tailed off after the breakpoint were rejected based on Kaiser's criteria [56].

Table 2. EFA of challenges (eigenvalues and total variance explained).

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings
	<i>Total</i>	<i>% of Variance</i>	<i>Cumulative %</i>	<i>Total</i>
1	3.048	30.479	30.479	2.419
2	1.943	19.431	49.910	1.696
3	1.326	13.265	63.175	2.017
4	1.256	12.560	75.735	2.116
5	0.884	8.836	84.571	
6	0.540	5.397	89.968	
7	0.420	4.205	94.173	
8	0.333	3.329	97.502	
9	0.178	1.784	99.286	
10	0.071	0.714	100	

Table 3. EFA of strategies (eigenvalues and total variance explained).

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings
	<i>Total</i>	<i>% of Variance</i>	<i>Cumulative %</i>	<i>Total</i>
1	2.136	30.513	30.513	2.136
2	1.423	20.334	50.847	1.423
3	1.234	17.636	68.482	1.234
4	0.913	13.047	81.529	
5	0.630	8.996	90.525	
6	0.379	5.413	95.938	
7	0.284	4.062	100	

Finally, the factor loadings of the various clusters were observed and analysed to define the themes and underlying relationships in the challenges and strategies related to equipping property graduates for the digital age from the perspective of property academics in Australia. The pattern matrices were preferred for this stage of factor retention and labelling as it aligns with the initial choice of the direct oblimin rotation method [63]. By suppressing coefficients less than 0.30, higher factor loadings were prioritised to better reflect the underlying themes [62]. Further, this prevented cross-loading to limit ambiguity in the results and capture the essence of the coefficients [62,63].

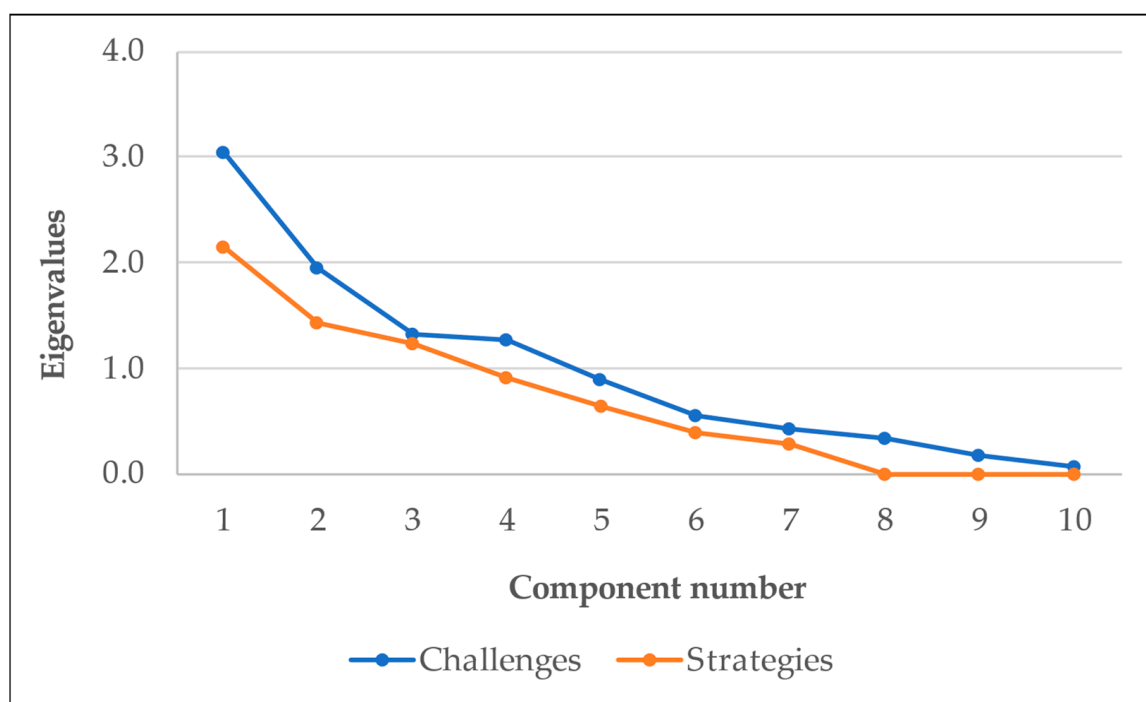


Figure 2. Scree plot (challenges and strategies).

4. Results and Discussion

4.1. Industry Engagement among Property Academics

The starting point of these discussions considered the level of industry engagement among property academics in Australia given the well-documented instances of a disconnect [25,26]. Industry engagement among academics reflects not only a current understanding of what the industry requires but also the basis for proactive changes to keep graduates up to date [26,65]. Critically, industry engagement among academics is a fundamental strategy for bridging the expectation gaps, especially as they become more glaring in the digital age [26,47].

As reported in Table 4, approximately half of the surveyed respondents in this study have five years or less of industry experience, and 54.5% currently have some form of ongoing industry engagement. The existing literature reports no definitive ideal level of industry experience, but there are several indications that higher and more active engagement with the industry correlates with more proactive training of graduates [66]. As recommended by Van De Ven and Johnson [67], open lines of communication and engagement among the key stakeholders of the property sector are critical for a smoother transition into the technological age, particularly as graduates come under increasing pressure to acquire new skills and hit the ground running in their industry roles [5,9,39].

Table 4. Industry engagement among property academics in Australia.

Variables		Frequency (n = 22)	Percentage (%)
Industry experience	No industry experience	2	9.1
	1–5 years	9	40.9
	6–10 years	1	4.5
	11–15 years	5	22.7
	16–20 years	3	13.6
	Above 20 years	2	9.1
Current industry engagement	Yes	12	54.5
	No	10	45.5

4.2. Challenges in Equipping Property Graduates for the Digital Age

4.2.1. Challenges Property Academics Encounter in Equipping Property Graduates

Despite the ongoing calls for industry engagement and the widening expectation gap, little work has been performed on the unique challenges faced by property academics in their efforts to better equip graduates for the digital age. In the age of PropTech, there are several operational, regulatory, and social barriers inhibiting the rapid adoption of digital technologies in the property industry [10]. The existing literature has highlighted a few notable challenges impeding the process of incorporating digital technologies in course delivery [5,68].

Much has been reported on the expectation gaps between the industry and academia, but it has mostly been through the perspective of other stakeholders such as students, graduates, and employers [5,40,50]. Although academics play a critical role in designing curricula and equipping graduates with the required skills, there is no definitive framework to assess the obstacles faced by academics. In this study, the following challenges were considered in the context of their significance towards property academics in the digital age: limited funding to procure software; insufficient time to upskill; limited technical support from the universities; insufficient knowledge of new tools; no access to the required tools; insufficient time to incorporate technological tools in the curricula; difficulty in modifying the curricula; no industry demand for technological skills; and rigid structure of property programs. Thus, these challenges were ranked through an RII to establish how significant each of them is from the perspective of property academics in Australia. As shown in Figure 3, the 10 challenges considered the range from “Medium” ($0.4 \leq \text{RII} < 0.6$) to “High” ($0.6 \leq \text{RII} < 0.8$) in terms of importance.

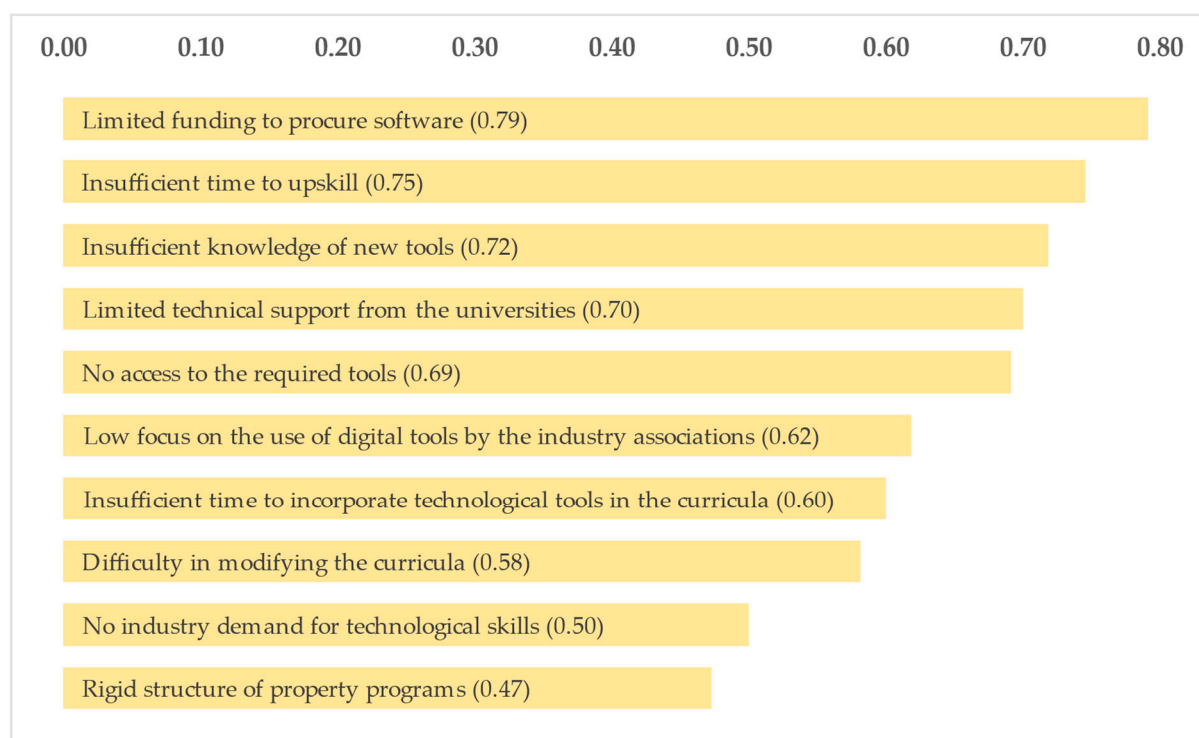


Figure 3. Relative importance index ranking of challenges.

Starting with the least pertinent, academics rated the rigid structure of university curriculums ($\text{RII} = 0.47$) and difficulties in modifying the curricula ($\text{RII} = 0.58$) as quite low, with it being a “Medium”. The curricula for training property graduates need to be diverse and up to date with the skill requirements of the industry and employers [6,49,69]. Warren and Heng [13] concur that existing curricula should be a point of focus in bridging

the expectation gaps. Notably, insufficient time to incorporate technological tools in the curriculum had a “High” level of importance (RII = 0.60). These differing perspectives suggest that although the curricula may not be rigid enough to impede training for the digital age, academics have little time to incorporate them. The rapid evolution of standard practice in the property industry to keep up with technology in the digital age may mean that standard education approaches cannot keep up with the ever-changing industry [68]. This finding is consistent with the prevailing notion that PropTech is transforming all aspects of the property industry [5,24] but challenges suggestions that the fundamental issue is the rigid structure of property programs [4,39].

Given that the challenge “no industry demand for technological skills” was only “Medium” (RII = 0.50), this evinces that property academics recognise a growing demand for these skills [5,36]. This aligns with Baum’s [10] assertion on the growth of PropTech in the property industry and the global shift towards digital technologies. However, the most prominent challenges stem from limited funding to secure bespoke software (RII = 0.79), insufficient time to upskill (RII = 0.75), insufficient knowledge of the new tools (RII = 0.72), and limited technological support from the universities (RII = 0.70). Low access to the required tools (RII = 0.69) confirms limited funding to secure these software and digital tools, which inhibits the efforts of academic departments to offer advanced training opportunities [70].

Limited funding to secure and incorporate these tools in education attempts essentially shifts the burden of training to employers, further reducing the appeal of employing fresh graduates [5,9,13,69]. Although unexpected, the limited technical support from the universities requires renewed efforts from all stakeholders to put property academics in a better position to train property graduates for the digital age. Similarly, a low focus on the use of digital tools by industry and regulatory associations (RII = 0.62) suggests that a shift in focus is required to provide the required training to future property graduates.

4.2.2. Underlying Themes in the Challenges Property Academics Encounter (EFA)

Based on the initial challenges surmised based on the extant literature and previous studies from the perspectives of other stakeholders, four underlying themes were generated through an EFA to explain the relevance of these challenges from the unique standpoint of property academics. Collectively, these four-factor clusters explain 75.735% of the total variance. Table 5 summarises the results of the EFA conducted, the labelled factor clusters, and the associated factor loadings.

Table 5. Themes in the challenges academics encounter.

Factor Cluster	Challenges	Factor Loading
Resource Constraints	Insufficient time to incorporate technological tools in the curriculum	0.876
	Insufficient knowledge of new tools	0.794
	Limited funding to procure software	0.644
External Industry and Regulatory Framework	Low focus on digital tools by industry associations	0.833
	No industry demand for technological skills	0.779
	No access to the required tools	0.504
Curricula rigidity	Rigid structure of property programs	−0.946
	Difficulty in modifying the curricula	−0.903
Technical support and upskilling limitations	Limited technical support from the universities	−0.916
	Insufficient time to upskill	−0.584

Labelled “resource constraints”, three challenges loaded onto the first cluster, which also accounted for 30.479% of the total variance explained. Insufficient time to incorporate technological skills into the curricula, insufficient knowledge of these tools, and limited funding to procure bespoke software are all linked to this initial cluster, representing some of the most prominent challenges [9,69,70]. This factor suggests that limited access to the resources required to integrate technology is a critical and ongoing challenge. Overall, the results indicate that property academics may not have enough time to incorporate new technological tools, lack the requisite level of proficiency in these tools, and face budgetary constraints when trying to procure bespoke software and technological tools [68,70].

The second cluster (external industry and regulatory framework) explained 19.431% of the total variance and comprised the following three challenges: low focus on digital tools by industry associations, no industry demand for technological skills, and no access to the required tools. Primarily, these challenges relate to wider factors beyond the control of property academics, mainly the industry and regulatory landscapes. According to Wilkinson et al. [25], industry and regulatory associations need to proactively drive changes in focus and training to keep property professionals relevant in the digital age. The emergence and integration of PropTech are integral external drivers that further enforce the need for university training to adapt to changing industry demand [24,71]. These challenges underscore the importance of industry associations and regulatory bodies driving changes to incorporate technological skills into property education. Additionally, professional institutes play a critical role to graduates and early career practitioners through career advancement opportunities [72], which must reflect the digital skills currently in demand.

The third-factor cluster (curricula rigidity) explained 13.265% of the total variance and comprised the following challenges: the rigid structure of property programs and difficulty in modifying the curricula. As previously established in the ranking of challenges, property academics do not view curricula rigidity as a paramount challenge. Instead, time to incorporate the changes and new tools represents the more pressing need [5,40,69].

Lastly, the “technical support and upskilling limitations” cluster reflects difficulties related to the support and training opportunities property academics receive from their institutions. This factor cluster accounted for 12.56% of the total variance. This variable suggests that universities may not provide adequate technical support to faculty members, including assistance with technology integration, troubleshooting, and access to resources [68]. Insufficient time to upskill further suggests strong links to a lack of technical support. In the absence of sufficient technical support, academics may be less willing to take on the extra burden of technological training and upskilling in digital competencies.

4.3. Strategies to Equip Property Graduates for the Digital Age

4.3.1. Ranking of Proposed Strategies

In recognition of the widening expectation gaps created by the adoption of digital tools in practice, several initiatives have been explored to equip future property graduates with these skills and competencies. With employers emphasising these novel skill sets, property graduates must necessarily have an appreciable understanding of the fundamental property skills and digital advancements currently used to facilitate tasks in the industry [40,41]. This study explored seven proposed strategies: retraining of property academics to gain digital proficiency; increased technical support from the universities; active learning (project-based course delivery); revision of the property curriculum to incorporate digital technology; increased support from industry partners; increased demand for technology by the industry/regulatory bodies; and uncreased funding from universities to procure software. Analysed through an RII, these strategies are presented in Figure 4.

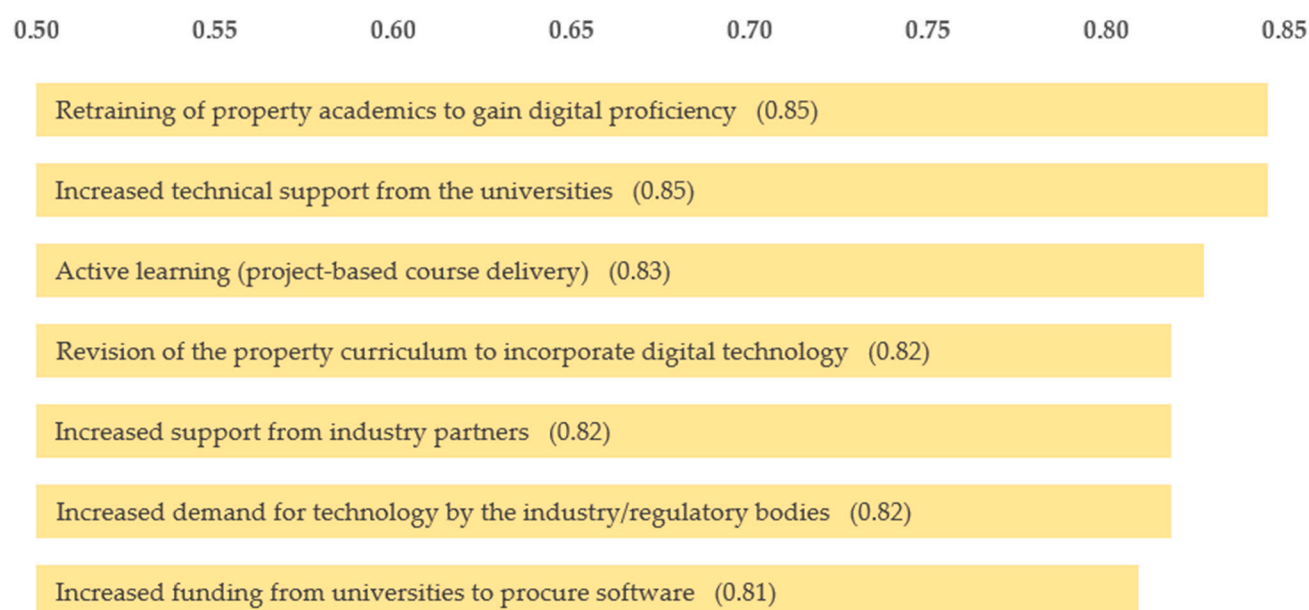


Figure 4. Relative importance index ranking of strategies.

Initial screening of the index ranking suggests that property academics rate the efficacy of these proposed initiatives highly, as all seven were rated “Critical” ($0.8 \leq \text{RI} \leq 1$). Retraining of property academics to gain digital proficiency ($\text{RII} = 0.85$) and increased technical support from the universities ($\text{RII} = 0.85$) were rated most highly. This strategy requires the provision of training and professional development opportunities to enhance the digital proficiency of property academics and keep them up to date with industry requirements. This is a commonly suggested initiative to improve the work readiness of graduates [28,73] but has rarely been explored for academics. In the same vein, increased technical support from the universities would facilitate the incorporation and integration of these digital tools, providing a basis for more innovative course delivery [68].

Active learning or project-based course delivery ($\text{RII} = 0.83$) and revision of the property curriculum to incorporate digital technology ($\text{RII} = 0.82$) also rank highly in popular proposed strategies to equip property graduates for the digital age. Active learning is a teaching approach that encourages students to actively engage with digital technologies while working on real-world projects [50,74,75]. Significant strides have already been made in this respect, but further efforts are required to incorporate novel digital technologies while working on real-world projects [36,74,75]. Rather than encouraging academics to make these changes at the classroom level, an overhaul of the academic curricula is required to consistently ensure the delivery of technological competencies to equip future property graduates with the skills required in the digital age [39,74].

The final set of strategies relates largely to external influences by industry and regulatory partners: increased support from industry partners ($\text{RII} = 0.82$), increased demand for technology by the industry/regulatory bodies ($\text{RII} = 0.82$), and increased funding from universities to procure software ($\text{RII} = 0.81$). Ongoing collaboration with industry partners is required not only to provide networking opportunities but also digital competencies for property academics [5,74]. This increased collaboration would also provide access to latest software and would provide proficient professionals that could interact with students in the form of guest lectures and workshops [17,36,74]. Industry and regulatory bodies also have a crucial role to play by encouraging collaboration and providing further opportunities for training as new skills become standard practice [25]. Despite the widely publicised funding constraints of universities [70], strategic allocation of these funds to training programs for academics and access to bespoke software would be an effective route for securing the future of property graduates as work-ready industry practitioners [76,77].

4.3.2. Underlying Themes in the Proposed Strategies (EFA)

Following a ranking of the strategies to identify their perceived efficacy among property academics, three-factor clusters were generated through an EFA to highlight the underlying themes in these strategies. Approximately 68.482% of the total variance was explained by these factor clusters, which are presented and labelled in Table 6.

Table 6. Themes in the proposed strategies to equip property graduates for the digital age.

Factor Cluster	Strategies	Factor Loading
Holistic Curriculum Integration	Active learning (project-based course delivery)	0.811
	Increased support from industry partners	0.791
	Increased demand for technology by the industry/regulatory bodies	0.623
	Revision of the property curriculum to incorporate digital technology	0.466
Capacity Building and Resource Acquisition	Increased funding from universities to procure software	0.867
	Retraining of property academics to gain digital proficiency	0.759
Infrastructure and Technical Support	Increased technical support from the universities	0.918

The first cluster, “Holistic Curriculum Integration”, underscores the need for an integrated approach to training graduates and reflects the key roles of several stakeholders such as academics, industry partners, regulatory bodies, and academic institutions, as well as the nature of course design and delivery [7–10]. Four strategies were loaded onto this cluster, representing different phases of property graduates’ training. Regarding course design and structure, increased support from industry partners [8,70] and increased demand for technology by these bodies [4,27,45] are crucial in establishing the need for property education to evolve. Given the underlying responsibility of the employer to their clients, this increased demand for digital competency can drive change in other stakeholders, such as property academics [26,45]. Essentially, a shift in priorities by prospective employers in the industry would signal necessary shifts for both graduates and employers.

Active learning, particularly through project-based course delivery, emphasises practical application and hands-on experience [50,74,75]. This approach cultivates critical thinking and problem-solving skills, allowing students to directly engage with digital tools. Collaborating with industry partners establishes a vital link between academia and the practical demands of the property industry [50,74,75]. It ensures that academic content aligns with current industry needs, exposing students to real-world challenges and the latest technologies. Moreover, revising the property curriculum to incorporate digital technology is crucial for a comprehensive update. This strategy involves a systematic overhaul, embedding digital proficiency throughout the curriculum in terms of content, assessments, and teaching methods [5,19,34]. The practical implications of Cluster 1 underscore the importance of a holistic approach to curriculum development that considers industry partnerships, technology demands, and innovative teaching methods. This approach ensures graduates are not only technically proficient but also well prepared to apply their skills effectively in the dynamic digital landscape of the property industry, fostering a smoother transition from academia to the professional world.

Cluster 2, denoted as “Capacity Building and Resource Acquisition”, concentrates on the need for increased funding from universities and the retraining of property academics to achieve digital proficiency. The strategy of increased funding addresses the financial dimension of acquiring essential software, acknowledging the pivotal role technology plays in property education [70,78]. Adequate financial support facilitates the procurement of

cutting-edge software, ensuring students have access to the latest tools and fostering a technologically advanced learning environment. Simultaneously, the retraining of property academics recognises the importance of educators possessing the necessary digital skills to effectively teach and mentor students [46,48]. Faculty retraining contributes to the seamless integration of digital technologies into the curriculum, enabling educators to deliver more effective and up-to-date instruction. This, in turn, positively impacts the overall learning experience and serves as a model for students navigating the complexities of the digital age [47,50]. The practical implications of Cluster 2 emphasise the critical need for a balanced approach that addresses both financial resources and human capital to build and sustain the capacity for effective property education in the digital era. It further highlights the importance of continuous investment for ongoing software updates, acquisitions, and faculty development, ensuring a robust and forward-looking educational environment.

Only one strategy was loaded onto the third cluster, underpinning the need for technical support from the universities. Although this is a statistically significant cluster, it offers very little practical thematic relationships. Nonetheless, the strategy to ensure technical support for property academics was discussed in the context of its relative importance to other strategies and academics' diverse opinions on its efficacy.

4.3.3. Property Academics' Diverse Opinions on the Proposed Strategies

Although all of the proposed strategies were ranked very highly by property academics, more in-depth analyses highlighted varied perspectives for different groups. These viewpoints also show which strategies specific groups of academics deem most prevalent depending on their academic or industry experience and institutional features. Particularly, opinions differed on the potency of the following proposed strategies: increased funding to procure software, revision of property academic curricula, retraining academics, and increased support from industry partners.

Collectively, increased funding to procure bespoke software was rated as critical by property academics. While this finding implies that all institutions require additional funding [70], it overlooks the current state of software availability and access in different institutions. As shown in Figure 5, the size of the respective institutions (based on yearly enrolment) reveals significant disparities in attitudes towards this strategy.

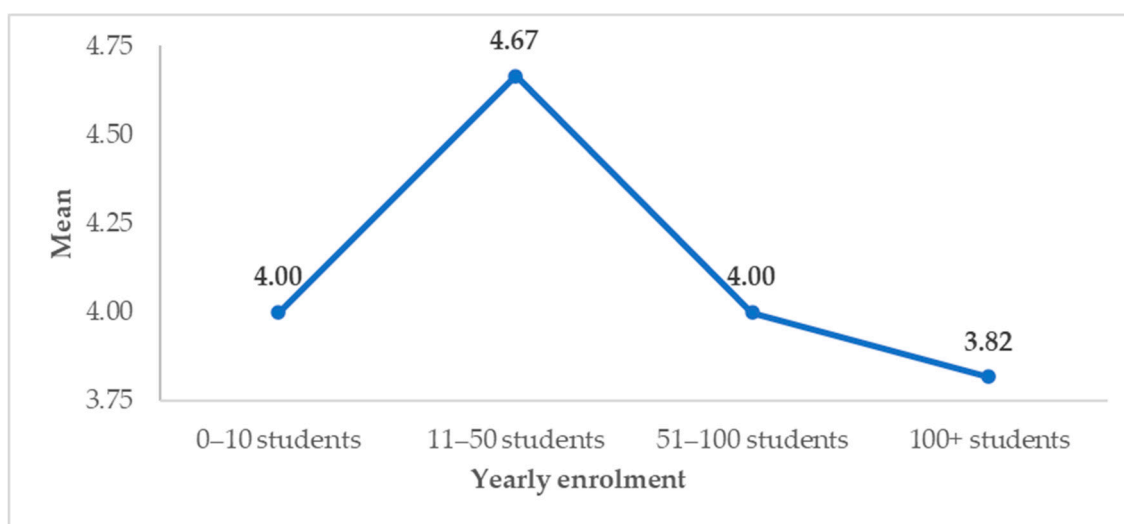


Figure 5. Opinions on increased funding to procure software based on yearly enrolment.

The existing technological resources of bigger universities could inhibit the perceived need for additional funding, a stark contrast to smaller institutions with no current access and limited funding. It is plausible that smaller institutions cannot afford the high cost of bespoke software and tools due to their limited budgets, thus increasing their perceived

need for budgetary support [78]. Because universities' funding and excellence are positively correlated [79], increased efforts and systems are required to improve the accessibility of these smaller institutions to the software and tools required to train property graduates for the digital age [78]. In part, the size of higher education institutes is a relevant factor for continued success due to economies of scale and a wider scope of focus [78]. Even in the absence of public funding, Benito et al. [79] and Rossi [78] showed that alternative networking strategies with industry associations can boost the institution's ability to attract funds towards the research and training of graduates. This is further validated in Figure 6, which indicates that smaller institutions rate higher industry support as a more effective strategy.

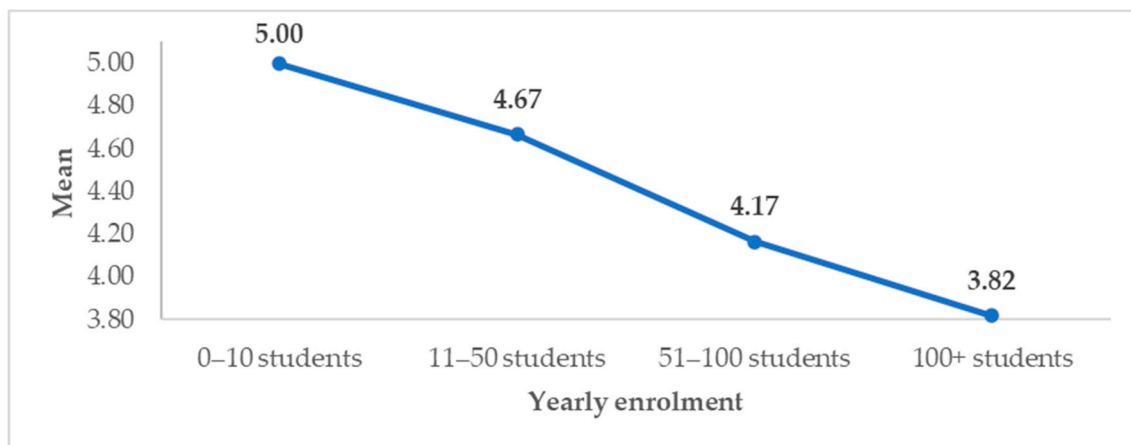


Figure 6. Opinions on increased support from industry partners based on yearly enrolment.

The emergence of PropTech has incentivised the property industry to adapt, prompting continuous dialogue about the necessity of revising academic curricula [5,24,71]. In response to the evolving landscape, there is a growing consensus on the need to modernise curricula by integrating emerging industry practices, harnessing technology, and fostering project-based learning [4,36,40]. Figure 7 depicts a positive relationship between industry experience and the perceived need to restructure academic curricula to better reflect industry requirements.

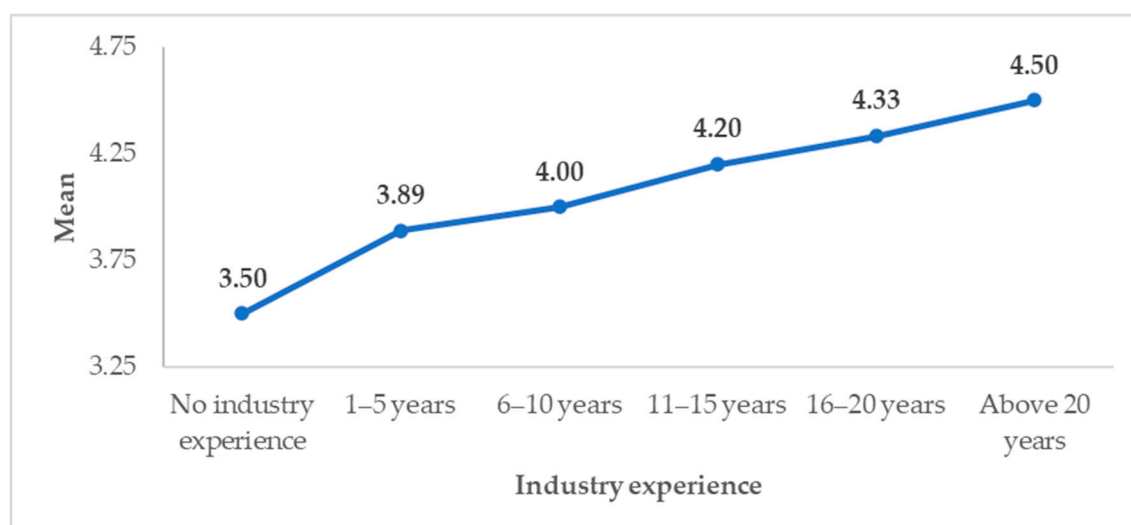


Figure 7. Opinions on revising academic curricula based on industry experience.

This relationship suggests stronger opinions towards this strategy based on the level of industry exposure. Essentially, the need to restructure current academic curricula is more apparent with industry experience. Lipinski and Kosicek [80] advocated as much by positing that education providers with more industry experience have a better appreciation of industry expectations, which facilitates their preferred training methods. The need for more industry insights calls for higher education providers to incorporate the perspectives of industry veterans and maintain ongoing interactions with industry professionals [36,66,80].

Retraining property academics to gain digital proficiency is another critical initiative towards improving the work readiness of future property graduates. Although the benefits of digitally competent academics are apparent, perceptions towards this strategy differ among younger and older property academics. As illustrated in Figure 8, there is an inverse relationship between age and the perceived effectiveness of this strategy. Speculatively, this reluctance to retrain may point towards intergenerational differences in attitudes towards technology and hesitancy to alter established methods [81,82]. As such, professional development programs for property academics necessarily need to be tailored towards different age groups to address specific concerns and provide flexibility to groups with varying levels of digital proficiency.

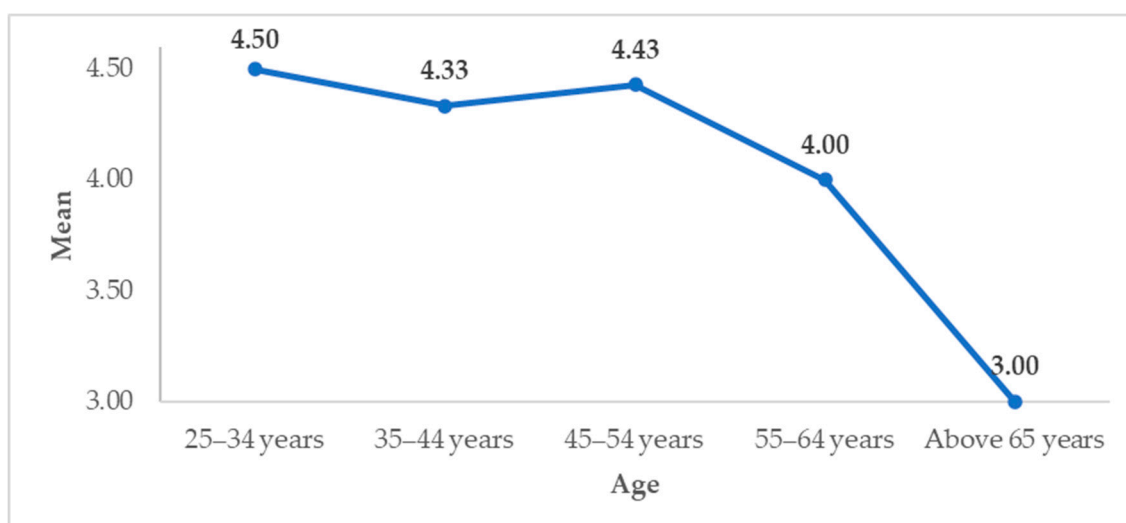


Figure 8. Opinions on retraining academics based on age.

5. Conclusions

This study explored the challenges that property academics face in preparing graduates for the digital age and the efficacy of proposed strategies in addressing the widening gap between the skills taught by property programs and those in demand by employers. The need for graduates to be work-ready is a long-standing issue of contention but has become more apparent over the past few decades with the rise of PropTech and the rapid adoption of digital tools to streamline tasks across various professions. These expectation gaps have been explored from the perspective of a few stakeholders, mainly current students, graduates, and employers. The perspectives of property academics, who play a dual role in training graduates and designing programs to meet industry standards, have been largely overlooked in the extant literature.

These opinions were gathered through an online questionnaire survey designed and administered on the Qualtrics platform to property academics in Australia. Subsequently, a total of 22 valid responses were analysed through RII and EFA using the SPSS software version 28. RII facilitated a ranking of the challenges and strategies, while underlying themes and patterns were identified through EFA.

Approximately half of the surveyed respondents had five years or less of industry experience, with 54.5% currently engaging with the industry. Considering that higher

industry engagement has been proposed as a strategy to improve work readiness, increased engagement levels should be encouraged to enhance the digital proficiency of academics and, consequently, future property graduates.

The most notable challenges faced by property academics when training property graduates for the digital age include limited funding to secure bespoke software, limited technical support from universities, and insufficient knowledge of new tools. To bridge these gaps, academic institutions must allocate resources strategically, invest in technical support infrastructure, and provide ongoing training for faculty. Curriculum revision should prioritise digital skills, and collaboration with industry partners should be leveraged to access resources. Ultimately, addressing these challenges is essential to ensure that property graduates are well equipped to navigate the digital landscape of the property industry, enhancing their employability and readiness for the evolving demands of the field.

Overall, property academics' perspectives suggest that retraining academics to gain digital proficiency, increased technical support from universities, and project-based course delivery could be the most effective strategies. These strategies signal the importance of faculty development and continuous learning, emphasising the need for property academics to remain up to date with digital advancements. Universities should prioritise allocating resources for faculty training and technical support services, recognising that these strategic investments enhance teaching quality and student engagement. Similarly, education providers could leverage the support of industry partners to improve proficiency in and access to digital tools.

Although these strategies all have merit, the findings also highlight distinct preferences and needs within the property academic community. Older property academics tend to be less inclined toward retraining, and property academics with more industry experience have stronger opinions towards curriculum restructuring. Moreover, smaller institutions, often constrained by limited resources, expressed a greater need for increased funding and industry collaboration to effectively implement these strategies. To address the challenges identified in this study, additional solutions could be explored to further enhance the preparedness of property graduates for the digital age. Beyond the strategies already discussed, one potential solution is the establishment of interdisciplinary collaborations among universities. Encouraging collaboration between property programs and departments specialising in technology-related disciplines could facilitate the integration of cutting-edge digital skills into property education. This approach could lead to the development of joint courses or interdisciplinary projects that expose property students to a broader range of digital tools and technologies.

Regarding strategies to bridge these expectation gaps, the need for a holistic approach that incorporates the perspectives of education providers, employers, and students is vital. Collaborating with employers helps align educational objectives with industry needs to incorporate practical and industry-relevant content into coursework. Students, as end-users, offer valuable insights into the relevance of digital tools and the practicality of acquired skills, bridging the gap between theory and application. Establishing a continuous feedback loop involving all stakeholders fosters ongoing improvement, ensuring academics stay abreast of industry trends and evolving student expectations. This collaborative approach facilitates targeted professional development opportunities, such as workshops and industry-academic collaborations, enabling academics to enhance their digital proficiency and stay responsive to the dynamic demands of the property industry in the digital era.

This study provides much-needed insights into the perspectives of one of the main stakeholders with a crucial role in training future property graduates for the digital age: property academics. However, the sample size limitation must be acknowledged. Although this study's sample size is consistent with similar research, it may not fully represent the diverse perspectives of property academics. Future research could benefit from larger sample sizes to provide a more comprehensive overview, which would facilitate more refined analyses to identify the specific needs of academics in different disciplines. Following this study's consideration of property academics' perspectives, future studies could also explore

the diverse perspectives of different stakeholders in a single framework such as a focus group. In particular, the perspectives of stakeholders such as employers and graduates are critical in an attempt to develop a holistic framework to consistently provide the required level of training. While academics play a central role, neglecting the viewpoints of industry professionals and students may result in an incomplete understanding of the challenges and opportunities in preparing property graduates for the digital age. As the digital landscape continues to evolve, ongoing research is also essential to assess the effectiveness of proposed strategies and adapt them to the ever-changing demands of the property industry in the digital age. Notwithstanding these limitations, what these findings make clear is that the transition into the digital age requires proactive and consistent efforts from all stakeholders, including property academics, who are responsible to both the property graduates and the property industry.

Author Contributions: Conceptualisation, R.B.A., A.A.A. and C.M.A.; methodology, A.A.A., C.M.A. and A.K.A.; software, A.A.A., C.M.A. and A.K.A.; validation, R.B.A., M.B. and T.B.O.; formal analysis, A.A.A. and C.M.A.; investigation, A.A.A., C.M.A. and A.K.A.; resources, R.B.A.; data curation, R.B.A., A.A.A., C.M.A. and A.K.A.; writing—original draft preparation, A.A.A. and C.M.A.; writing—review and editing, R.B.A., M.B. and T.B.O.; visualisation, A.A.A. and C.M.A.; supervision, R.B.A.; project administration, R.B.A.; funding acquisition, R.B.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the UNSW Faculty of Arts, Design and Architecture Research Support Scheme, Grant Number PS68403.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy.

Acknowledgments: The authors appreciate all the property educators who responded to the questionnaire survey. The constructive comments of the anonymous reviewers are much appreciated. This paper is part of a research project which focuses on equipping property graduates for the digital age, from which other papers will be published with a different objective/scope but sharing the same background.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Baum, A. *Commercial Real Estate Investment*, 2nd ed.; Routledge: London, UK, 2009.
2. Boyd, T. *Stakeholder Impact on Property Education Programs*; Queensland University of Technology: Brisbane, Australia, 2000.
3. Özogul, S.; Tasan-Kok, T. One and the Same? A Systematic Literature Review of Residential Property Investor Types. *J. Plan. Lit.* **2020**, *35*, 475–494. [CrossRef]
4. Amidu, A.R.; Ogbesoyen, O.; Agboola, A.O. Exploring Gaps between Real Estate Curriculum and Industry Needs: A Mapping Exercise. *Pac. Rim Prop. Res. J.* **2018**, *24*, 265–283. [CrossRef]
5. Abidoye, R.; Lim, B.T.H.; Lin, Y.C.; Ma, J. Equipping Property Graduates for the Digital Age. *Sustainability* **2022**, *14*, 640. [CrossRef]
6. Weinstein, M.; Worzala, E. Graduate Real Estate Programs: An Analysis of the Past and Present and Trends for the Future. *J. Real Estate Lit.* **2008**, *16*, 387–413. [CrossRef]
7. Poon, J.; Brownlow, M. Competency Expectations for Property Professionals in Australia. *J. Prop. Invest. Financ.* **2014**, *32*, 256–281. [CrossRef]
8. Arain, F. Applied Education Program Enhancing Employability of Graduates in Construction Industry. *Int. J. Constr. Proj. Manag.* **2020**, *12*, 147–156.
9. Callanan, J.; McCarthy, I. Property Education in New Zealand: Industry Requirements and Student Perceptions. *J. Real Estate Pract. Educ.* **2003**, *6*, 23–32. [CrossRef]
10. Baum, A. *PropTech 3.0: The Future of Real Estate*; Saïd Business School, University of Oxford: Oxford, UK, 2017.
11. Aliu, J.; Aigbavboa, C. Key Generic Skills for Employability of Built Environment Graduates. *Int. J. Constr. Manag.* **2021**, *23*, 542–552. [CrossRef]
12. Shi-Ming, Y. New Paradigms in Real Estate Education. *Pac. Rim Prop. Res. J.* **2001**, *7*, 79–88. [CrossRef]
13. Warren, C.M.J.; Heng, S.H.K. FM Education Are We Meeting Industry Needs. In Proceedings of the Pacific Rim Real Estate Society Conference, Melbourne, Australia, 24–27 January 2005.
14. Poon, J. Postgraduate Student Satisfaction in the UK. *Prop. Manag.* **2019**, *37*, 115–135. [CrossRef]
15. Parker, D. The Future of Property Education in Australia. *J. Prop. Invest. Financ.* **2021**, *39*, 9–14. [CrossRef]

16. Prikshat, V.; Montague, A.; Connell, J.; Burgess, J. Australian Graduates' Work Readiness—Deficiencies, Causes and Potential Solutions. *High. Educ. Ski. Work-Based Learn.* **2020**, *10*, 369–386. [CrossRef]
17. Halvitigala, D.; Wilkinson, S.; Antoniadis, H. Meeting Changing Industry Expectations from Australian Property Valuation Graduates. In Proceedings of the AUBEA 2017: Australasian Universities Building Education Association Conference, Melbourne, Australia, 3–5 July 2017; pp. 129–138.
18. Xiao, Y.; Chan, N. The Dilemma and Future of Property Valuation Education in China. *Pac. Rim Prop. Res. J.* **2016**, *22*, 145–165. [CrossRef]
19. Ayodele, T.O.; Oladokun, T.T.; Kajimo-Shakantu, K. Employability Skills of Real Estate Graduates in Nigeria: A Skill Gap Analysis. *J. Facil. Manag.* **2020**, *18*, 297–323. [CrossRef]
20. Property Council of Australia Our Economic and Job Contribution. Available online: <https://www.propertycouncil.com.au/> (accessed on 16 August 2022).
21. Newell, G. The Quality of Property Education in Australia. *Pac. Rim Prop. Res. J.* **2003**, *9*, 361–378. [CrossRef]
22. Boyd, T. Stakeholder Impact on Property Education Programs. In Proceedings of the 11th Pacific Rim Real Estate Conference (PRRES), Brisbane, Australia, 23–27 January 2005; pp. 1–15.
23. Baxter, J.S. Re-Engineering a Valuation Degree: How Did We Get Here and Where Do We Go? *J. Prop. Invest. Financ.* **2007**, *25*, 444–467. [CrossRef]
24. Baum, A. *PropTech 2020: The Future of Real Estate*; Saïd Business School, University of Oxford: Oxford, UK, 2020.
25. Wilkinson, S.; Halvitigala, D.; Antoniadis, H. *The Future of the Valuation Profession*; University of Technology: Sydney, Australia; RMIT University: Melbourne, Australia, 2017.
26. Starr, C.W.; Saginor, J.; Worzala, E. The Rise of PropTech: Emerging Industrial Technologies and Their Impact on Real Estate. *J. Prop. Invest. Financ.* **2021**, *39*, 157–169. [CrossRef]
27. Hefferan, M.J.; Ross, S. Forces for Change in Property Education and Research in Australia. *Prop. Manag.* **2010**, *28*, 370–381. [CrossRef]
28. Succi, C.; Canovi, M. Soft Skills to Enhance Graduate Employability: Comparing Students and Employers' Perceptions. *Stud. High. Educ.* **2020**, *45*, 1834–1847. [CrossRef]
29. Poon, J. A Study of Real Estate Student Satisfaction in Australia. *Pac. Rim Prop. Res. J.* **2015**, *21*, 215–233. [CrossRef]
30. Gibler, K.; Black, R.; Moon, K. Time, Place, Space, Technology and Corporate Real Estate Strategy. *J. Real Estate Res.* **2002**, *24*, 235–262. [CrossRef]
31. Seagraves, P. Real Estate Insights: Is the AI revolution a real estate boon or bane? *J. Prop. Invest. Financ.* **2023**. ahead-of-print. [CrossRef]
32. Black, R.T.; Rabianski, J.S. Defining the Real Estate Body of Knowledge: A Survey Approach. *J. Real Estate Pract. Educ.* **2003**, *6*, 33–54. [CrossRef]
33. Żróbek, S.; Kucharska-Stasiak, E.; Renigier-Biłozor, M. Today's Market Needs Modernized Property Appraisers. *Real Estate Manag. Valuat.* **2020**, *28*, 93–103. [CrossRef]
34. Wilkinson, S.; Halvitigala, D.; Antoniadis, H. Educators, Professional Bodies and the Future of the Valuation Profession. *Prop. Manag.* **2018**, *36*, 389–399. [CrossRef]
35. D'Arcy, É.; Taltavull, P. Real Estate Education in Europe: Some Perspectives on a Decade of Rapid Change. *J. Eur. Real Estate Res.* **2009**, *2*, 69–78. [CrossRef]
36. Cornish, S.; Reed, R.; Wilkinson, S. Incorporating New Technology into the Delivery of Property Education. *Pac. Rim Prop. Res. J.* **2009**, *15*, 303–320. [CrossRef]
37. Grover, R. Mass Valuations. *J. Prop. Invest. Financ.* **2016**, *34*, 191–204. [CrossRef]
38. Yogeshwaran, G.; Perera, B.A.K.S.; Ariyachandra, M.R. Competencies Expected of Graduate Quantity Surveyors Working in Developing Countries. *J. Financ. Manag. Prop. Constr.* **2018**, *23*, 202–220. [CrossRef]
39. Bisola Odubiyi, T.; Aghimien, D.; Aigbavboa, C.; Thwala, W. Bridging the Gap between Academic and Practice Quantity Surveying in Nigerian Construction Industry. In Proceedings of the 2019 MOC Summit, Banff, AB, Canada, 21–24 May 2019.
40. Borg, J.; Scott-Young, C.M.; Turner, M. Smarter Education: Leveraging Stakeholder Inputs to Develop Work Ready Curricula. In *Smart Innovation, Systems and Technologies*; Howlett, R.J., Jain, L.C., Eds.; Springer: Singapore, 2019; Volume 144.
41. Dhakal, S.; Prikshat, V.; Nankervis, A.; Burgess, J. Conceptualising Graduate Work-Readiness: Theories, Concepts and Implications for Practice and Research. In *The Transition from Graduation to Work*; Dundon, T., Wilkinson, A., Eds.; Springer: Singapore, 2018; pp. 15–29.
42. Braesemann, F.; Baum, A.; Fabian Braesemann, C. *PropTech: Turning Real Estate into a Data-Driven Market?* Saïd Business School, University of Oxford: Oxford, UK, 2020.
43. Elliott, P.; Warren, C.M.J. The Valuation Profession in Australia: Profile, Analysis and Future Directions. In Proceedings of the 11th Annual Conference of the Pacific Rim Real Estate Society (PRRES), Melbourne, Australia, 23–27 January 2005.
44. Boyd, T. Bridging the Gap: A Graduate Training Program for the Property. In Proceedings of the 13th PRRES Conference, Fremantle, Australia, 21–24 January 2007.
45. Abidoye, R.; Ayub, B.; Ullah, F. Systematic Literature Review to Identify the Critical Success Factors of the Build-to-Rent Housing Model. *Buildings* **2022**, *12*, 171. [CrossRef]

46. Molla, T.; Cuthbert, D. The Issue of Research Graduate Employability in Australia: An Analysis of the Policy Framing (1999–2013). *Aust. Educ. Res.* **2015**, *42*, 237–256. [CrossRef]
47. Borg, J.; Scott-Young, C.M. Employers' Perspectives on Work Readiness in Construction: Are Project Management Graduates Hitting the Ground Running? *Int. J. Manag. Proj. Bus.* **2020**, *13*, 1363–1379. [CrossRef]
48. Savage, S.; Davis, R.; Miller, E.; Queensland University of Technology; Australian Learning & Teaching Council. *Professional Education in Built Environment and Design: Final Report*; Queensland University of Technology: Brisbane, Australia, 2010; ISBN 9781741072907.
49. Galuppo, L.A.; Worzala, E. *A Study into the Important Elements of a Masters Degree in Real Estate*; Taylor & Francis, Ltd.: Abingdon, UK, 2004; Volume 7.
50. Boyd, S. Learning Outcomes and Opportunities in Property Education through Constructive Alignment. In Proceedings of the 21st Pacific-Rim Real Estate Society Conference, Kuala Lumpur, Malaysia, 18–21 January 2015.
51. Neuman, W.L. *Social Research Methods: Qualitative and Quantitative Approaches*, 7th ed.; Pearson: London, UK, 2014.
52. Ott, R.L.; Longnecker, M.T. *An Introduction to Statistical Methods and Data Analysis*; Duxbury: Pacific Grove, CA, USA, 2015.
53. Akintoye, A.; Fitzgerald, E. A Survey of Current Cost Estimating Practices in the UK. *Constr. Manag. Econ.* **2000**, *18*, 161–172. [CrossRef]
54. Warren-Myers, G.; Cradduck, L. Physical and Climate Change-Related Risk Identification in Valuation Practice: An Australian Perspective. *J. Prop. Invest. Financ.* **2022**, *40*, 14–37. [CrossRef]
55. Steinmetz, C.; Thompson, S.; Marshall, N. Surveying International University Students: The Case of the 5% Response Rate. *Issues Educ. Res.* **2020**, *30*, 1105–1125.
56. Hair, J.F.; Black, W.C.; Babin, B.J.; Anderson, R.E. *Multivariate Data Analysis*; Pearson: London, UK, 2010.
57. Attaran, S.; Celik, B.G. Students' Environmental Responsibility and Their Willingness to Pay for Green Buildings. *Int. J. Sustain. High. Educ.* **2015**, *16*, 327–340. [CrossRef]
58. Kometa, S.T.; Olomolaiye, P.O.; Harris, F.C. Attributes of UK Construction Clients Influencing Project Consultants' Performance. *Constr. Manag. Econ.* **1994**, *12*, 433–443. [CrossRef]
59. Abidoye, R.B.; Ge, J.; Ahiadu, A.A.; Adilieme, C.M.; Swanzey-Impraim, S. Perceptions of Young Adults on the Critical Success Factors of the Build-to-Rent Housing Model in Sydney, Australia. *Buildings* **2023**, *13*, 1892. [CrossRef]
60. Akadiri, O.P. Development of a Multi-Criteria Approach for the Selection of Sustainable Materials for Building Projects. Ph.D. Thesis, The University of Wolverhampton, Wolverhampton, UK, 2011.
61. Taherdoost, H.; Sahibuddin, S.; Jalaliyoon, N. Exploratory Factor Analysis; Concepts and Theory. *Adv. Appl. Pure Math.* **2022**, *27*, 375–382.
62. Fabrigar, L.R.; Wegener, D.T. *Exploratory Factor Analysis*; Oxford University Press: Oxford, UK, 2011.
63. Costello, A.B.; Osborne, J. Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most from Your Analysis. *Res. Eval. Pract. Assess. Res. Eval.* **2005**, *10*, 7. [CrossRef]
64. Williams, B.; Onsman, A.; Brown, T.; Andrys Onsman, P.; Ted Brown, P. Exploratory Factor Analysis: A Five-Step Guide for Novices. *J. Emerg. Prim. Health Care JEPHC* **2010**, *8*, 990399. [CrossRef]
65. Amarathunga, B.; Wijethunga, S. Sri Lankan Management Undergraduates' Employability Capital towards Work Readiness: Undergraduates' Perspective. In Proceedings of the 18th International Conference on Business Management, Colombo, Sri Lanka, 10 December 2021.
66. Patrick, E.; Heazlett, D.; Anderson, J.; Hartley, V. *Key for Successful Industry-Education Engagement*; Mercer Consulting: Sydney, Australia, 2019.
67. Van De Ven, A.H.; Johnson, P.E. Knowledge for Theory and Practice. *Acad. Manag. Rev.* **2006**, *31*, 802–821. [CrossRef]
68. Wong, J.M.W.; Wong, F.K.W.; Hui, E.C.M. A Study to Improve Higher Education for Surveying Professionals in Hong Kong. *J. Educ. Built Environ.* **2007**, *2*, 76–89. [CrossRef]
69. Manning, C.; Epley, D. Do Real Estate Faculty Teach the Skills and Competencies Needed by Corporate Real Estate Executives? *J. Real Estate Pract. Educ.* **2006**, *9*, 37–59. [CrossRef]
70. Rodríguez-Abitia, G.; Martínez-Pérez, S.; Ramirez-Montoya, M.S.; Lopez-Caudana, E. Digital Gap in Universities and Challenges for Quality Education: A Diagnostic Study in Mexico and Spain. *Sustainability* **2020**, *12*, 9069. [CrossRef]
71. Siniak, N.; Kauko, T.; Shavrov, S.; Marina, N. The Impact of PropTech on Real Estate Industry Growth. *IOP Conf. Ser. Mater. Sci. Eng.* **2020**, *869*, 062041. [CrossRef]
72. Warren, C.; Wilkinson, S. The Relevance of Professional Institutions to Students and Early Career Practitioners in the Property and Construction Industries within Australia. In Proceedings of the CIB International Conference on Building Education and Research: Building Resilience, Heritance Kandalama, Sri Lanka, 11–15 February 2008; pp. 354–363.
73. Hoxley, M.; Poon, J.; Fuchs, W. Differing Perceptions of Graduates from Undergraduate and Postgraduate Courses. *J. Eur. Real Estate Res.* **2011**, *4*, 243–258. [CrossRef]
74. Poon, J. An Examination of a Blended Learning Approach in the Teaching of Economics to Property and Construction Students. *Prop. Manag.* **2013**, *31*, 39–54. [CrossRef]
75. Olbina, S. Improving the Delivery System for Teaching the Project Planning and Feasibility/Site Development Course to Building Construction Undergraduate Students and Real Estate Graduate Students. *Int. J. Constr. Educ. Res.* **2008**, *4*, 46–64. [CrossRef]

76. Rogers, M.; Tyler, L. Learning in a Digital Age. In *Studying for Your Early Years Degree: Skills and Knowledge for Becoming an Effective Early Years Practitioner*; Critical Publishing Ltd.: St. Albans, UK, 2017; pp. 94–103.
77. Bridgstock, R. Graduate Employability 2.0: Capabilities and Networks for Learning, Innovation and Career Development in the Digital Age. In *Proceedings of the Australian Conference on Science and Mathematics Education*; The University of Queensland: Brisbane City, Australia, September 2016; ISBN 9780987183453. Available online: <https://openjournals.library.sydney.edu.au/IISME/article/view/12155> (accessed on 8 October 2023).
78. Rossi, F. Universities' Access to Research Funds: Do Institutional Features and Strategies Matter? *Tert. Educ. Manag.* **2009**, *15*, 113–135. [CrossRef]
79. Benito, M.; Gil, P.; Romera, R. Funding, Is It Key for Standing out in the University Rankings? *Scientometrics* **2019**, *121*, 771–792. [CrossRef]
80. Lipinski, J.; Kosicek, P.M. *Leveraging Industry Experience to Enhance a Professor's Ability to Teach Applications of Theory*; Indiana University of Pennsylvania: Indiana, PA, USA, 2016.
81. Zhang, M. Older people's attitudes towards emerging technologies: A systematic literature review. *Public Underst. Sci.* **2023**, *32*, 948–968. [CrossRef]
82. Liu, Q.; Geertshuis, S.; Grainger, R. Understanding Academics' Adoption of Learning Technologies: A Systematic Review. *Comput. Educ.* **2020**, *151*, 103857. [CrossRef]

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ISBN 978-3-7258-4325-1