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Regional Development

Opportunities and Constraints

Edited by
Katarína Vitálišová, Anna Vaňová and Jan Nevima

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Editors

Katarína Vitálišová
Matej Bel University
Banská Bystrica
Slovakia

Anna Vaňová
Matej Bel University
Banská Bystrica
Slovakia

Jan Nevima
Silesian University in Opava
Karvina
Czech Republic

Editorial Office
MDPI AG
Grosspeteranlage 5
4052 Basel, Switzerland

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About the Editors

Katarína Vitálišová

Dr. Katarína Vitálišová is an associate professor at the Department of Public Economics and Regional Development of Faculty of Economics, Matej Bel University, Slovakia. Her research is oriented toward the issue of public and local governance, building and maintaining relationships and partnerships between stakeholders, strategic planning of the spatial development and implementation of new approaches, including creative and smart cities, and place marketing and is represented by more than 160 publications. She is a member of several international expert networks in the field of regional and local development, management, and marketing places (ORCID ID: 0000-0002-5830-4862).

Anna Vaňová

Prof. Anna Vaňová is a professor at the Department of Public Economics and Regional Development of Faculty of Economics, Matej Bel University, Slovakia. She orients her research on the issue of strategic planning and implementation of new approaches (smart, resilient, slow, green, etc.) in spatial development. She is also a specialist in the field of place marketing, place branding, public and non-profit marketing, and open government. She is a member of several international expert networks, research projects, and projects for practice and an author and co-author of more than 180 publications (ORCID ID: 0000-0002-0035-9326).

Jan Nevima

Dr. Jan Nevima is an associate professor in the field of International Trade and a doctor in the field of Economics at the School of Business Administration in Karvina, Silesian University, Opava, and at the Department of Economics and Public Administration. He is the author or co-author of professional articles published in domestic and foreign magazines and anthologies and presented at conferences. He was a co-investigator of the Czech-Slovak intergovernmental scientific and technical cooperation and the Czech Science Foundation project. He was an expert for the preparation and implementation of CZ PRES 2022 in cooperation with the Office of the Czech Republic Government, and he also cooperates with the Ministry of Foreign Affairs. He is the investigator of the Technological Agency of the Czech Republic project in the area of increasing the resilience of cities and municipalities (ORCID ID: 0000-0002-4788-9009).

Preface

The Special Issue on "Regional development: Opportunities and Constraints" contains eleven papers dealing with the various aspects of local and regional development. First part of the papers delves into the complexities of the European Union policy and their effect on the regional sustainable and economic development, including the specific focus on the EU funds and their absorption. Another part of the papers investigates the specifics of various stakeholders' engagement (universities, industrial zones) in fostering innovation and thus the process of regional development. Specific attention is also paid to the research of the strategic development of regions and cities (Tajo Salor, Vukovar) from the territorial identity and revitalization point of view. The last group of papers is devoted to the deeper spatial econometric analysis of the selected regions in Asia.

The diversity of the papers confirms the interdisciplinarity of the issue as well as the uniqueness of the author's understanding of the issue with regard to the specifics of the investigated territories. The high-quality content of the papers contributes to enhancing the theory and practice of the regional development.

Katarína Vitálišová, Anna Vaňová, and Jan Nevima
Editors

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Article

Issues of EU Member Nations' Shared Sovereignty, Institutions, and Economic Development

Ismatilla Mardanov

Department of Management, Southeast Missouri State University, Cape Girardeau, MO 63701, USA; imardanov@semo.edu

Abstract: To investigate the effects of the European Union's (EU) member nations' shared sovereignty on economic growth. The member nations have lost substantial political and economic independence (sovereignty) and democracy. Therefore, their governments cannot facilitate rapid economic growth in their countries, affecting the EU as a whole. Data from the World Bank, institutional research entities, and the EU were utilized. The dependent variable is economic growth, and the independent and moderating variables are mainly institutions and the European Sovereignty Index. Shared sovereignty and its specific categories and foreign direct investment (FDI) outflows negatively impact economic development in the EU. Shared sovereignty negatively moderates the relationship between political rights and economic development and between FDI outflows and economic development. Democracy in member nations is formal rather than real. The present study focused on the EU's problems rather than its achievements and empirically investigated the direct and moderating effects of national sovereignty and member-country institutions on member-country economic growth. This focus and the nature of the investigation constitute the originality of the present study and reduce the gap in the literature about the effects of sovereignty, institutions, and capital spillovers (FDI outflows) on economic growth in Europe. The value of the study is in its findings, which should trigger holistic research efforts on the pros and cons of the EU for Europe, democracy, the economy, and the world.

Keywords: the European Union; shared sovereignty; democracy; FDI; economic growth

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1. Introduction

The concept of a United States of Europe is not a recent one, as it has been mentioned by prominent figures throughout history such as Napoleon Bonaparte, Victor Hugo, Giuseppe Garibaldi, and John Stewart Mill. Winston Churchill expressed his concerns about Europe in 1946 and suggested the formation of a Council of Europe as the first step towards creating a regional structure known as the United States of Europe (USE).

There is substantial research on the positive outcomes of EU membership, including the rise of Europe and the advantages of the European Union (Dzemydaite 2021; Pastor et al. 2018; Greenaway et al. 2000; Lock 2009; Daniel and Shiamptanis 2008; Acemoglu et al. 2005). The European Union has had a positive impact on new member nations, with per capita GDP increasing in all of them (Baneliene 2013) and more significantly in some, such as Slovenia. However, some older member countries, such as Greece, had negative GDP growth rates about a decade after the last global financial crisis. At the same time, non-member European countries, such as Switzerland and Norway, achieved significantly higher growth rates. This was due to the EU's economic specialization policies (Dzemydaite 2021), whereby Greece's specialization was in agriculture and tourism. Over the past ten years, pre-pandemic, Europe's economic growth rate was between one and two percent, which was comparable to the former Soviet Union's economic growth rates set by their centralized planning system.

The present study aims to analyze the issues and problems of the European Union and explore methods to address them. Therefore, it does not focus on the positive aspects of the EU, which is a unique structural phenomenon.

The European Union is a unique political entity that is neither a confederation nor a federation but is moving toward becoming a federation (Hazak 2012). Its governing system is based on the Lisbon Treaty, and its structural formation can be considered experimental. The European Parliament's representation is based on population size, with larger countries having more representatives and more influence on the legislative process and outcomes. Meanwhile, the European Council is composed of country executive branch leaders. However, unlike the American Senate, the EU has no upper legislative chamber with equal representation of member states, resulting in smaller countries having less influence despite delegating a significant part of their sovereignty to the EU. This discrepancy is undermining member-state democracies and diminishing their rights.

Germany has advocated for a single constitution for the EU (Thym 2009), which could create a more legitimate union with a more effective and efficient government. However, the idea of referenda was blocked by voters in France and the Netherlands. The EU's institutional setup and legitimacy among its citizens have been questioned in the literature (Dimitrova 2010), with some attributing the problems to national polities (Schmidt 2006). The EU's super governance, inappropriately shared sovereignty, national polities, and cultural differences could be factors contributing to the low economic growth rates of the EU for many years. In the second decade of the Eurozone, several countries experienced significant financial difficulties (Kuforiji 2016). Additionally, the structural setup of some peripheral countries' economies under the division of labor in the EU was a primary cause of the deep economic crises in those countries.

The gap between research and practice is evident in the EU, where research has been reluctant to analyze the issues and problems of this conglomerate that tightly controls member states' political, economic, and social systems. The objectives of this study are to analyze the pros and cons of member nations delegating their political and economic sovereignty and the effects of shared sovereignty (De Burca 2003) on economic development. Sovereignty can serve as an instrumental or moderating variable that strengthens or weakens the relationship between economic and political institutions and economic development. This study will also question the EU's feasibility and legitimacy (Cohen 2012), and the erosion of democracy in member nations.

In his article for the Harvard Business Review, Bill Lee (2013) said, "How long can this go on?" He continued: "According to a recent article in *The Wall Street Journal*, the 17-nation Eurozone remains the 'weakest link' in our global economy after years of economic stagnation. It is mired in high unemployment, plagued with stalled or contracting economies, and paralyzed by political dysfunction. Similarly, *The Economist* lambasts eerily complacent EU leaders for sleepwalking through an economic wasteland." The excessive delegation of political and economic sovereignty to the European Parliament and the EU's executive bodies has contributed significantly to member states' economic and social problems, according to Grosse (2016).

In free societies, people recognize that their country belongs to them and they elect politicians to develop their economy and improve their lives. However, this belongingness is under question in the member nations of the EU, where there is unequal representation in the European Parliament from member nations and the EU's executive bodies.

2. The Theoretical Framework

2.1. Shared Sovereignty and Economic Development

The European Economic Community (EEC) was established in 1957 with the aim of achieving economic integration through a single market and customs union, and to create a centralized foreign trade policy to withstand global competition. While forming alliances, partnerships, and communities among countries is a natural and justified step, joining such communities requires sharing national sovereignty with a common body that makes decisions for the people of member nations. As the community evolves into a union, such as the European Union, member nations lose an essential part of their sovereignty.

This is particularly true when they enter a common currency zone as they surrender the overwhelming share of their national sovereignty.

The present study supports the classical theory of state sovereignty based on Westphalian or Vattelian sovereignty, which is also the foundation of the Montevideo Convention (1933) on the Rights and Duties of States. External, Westphalian, or Vattelian sovereignty refers to a state's autonomy or self-determination regarding external players. On the other hand, internal or domestic sovereignty is defined by an institutional and constitutional system that ensures the effective exercise of power according to the sovereign's will (Krasner 1999).

The Montevideo Convention officially defined external sovereignty. According to Article 1, a state as a person of international law must possess the following qualifications: a permanent population, a defined territory, a government, and the capacity to enter into relations with other states. The internal aspect of sovereignty is defined in Article 3, which states that a state has the right to defend its integrity and independence, provide for its conservation and prosperity, organize itself as it sees fit, legislate upon its interests, administer its services, and define the jurisdiction and competence of its courts. The exercise of these rights is limited only by the exercise of the rights of other states according to international law. However, the convention does not envision the formation of unions such as the European Union.

Initially, sovereignty was associated with the indivisibility and inalienability of ultimate power (Hinsley 1986), which was the state. Francis Hinsley (1986, p. 223) stated that " ... in modern times—the rise of legislatures, the introduction of representation, the extension of suffrages and the insertion of constitutional features into the basis, the composition and the procedures of government—necessitated the notion that sovereignty resided in the body-politic as a means of preserving the precondition of effective action in and for the community, the sovereignty of the state."

In other words, sovereignty exists for the government/state and the community so that it can address problems using the government as the ultimate instrument. Furthermore, Francis Hinsley says that the sovereign state must have coercive authority to make political and legal systems function. The member states of the EU have no real democracy: political processes are formal and inconsequential. A winning political party or block follows the directives of the European Commission because member states share their external and internal sovereignty with the European Union.

Neil MacCormick (1993) argues that since no nation-state in the EU is in "a position such that all the power exercised internally in it, whether politically or legally, derives from purely internal sources," none can be regarded any longer as a sovereign state. He asked "whether or not there are any Sovereign States here, now, anymore?" He said: "I am going to answer that negatively" (MacCormick 1993). Later he powerfully affirmed his stance on sovereignty in the European Union: "absolute or unitary sovereignty is absent from the legal and political setting of the European Community—neither politically nor legally is any member state in possession of ultimate power over its internal affairs" (MacCormick 1999). A European Court of Justice ruling in 1963 claimed that the arrangement "creates a new legal order ... for the benefit of which the States have limited their sovereign rights, albeit within limited fields" (Judgment of the Court 1963). Loughin (2016) suggested that because the EU arrangement is permanent, and it is no longer within the political authority of a member state to exercise the procedure for withdrawal from treaty arrangements, no issue of ultimate authority—and no question of sovereignty—is involved.

The view of infringement of the UK's sovereignty due to the Maastricht Treaty of 1993 was predominant until 2018, when the UK decided to exit the EU. MacCormick (1993) wrote: "There is a widespread, but perhaps misguided, belief that there are a lot of sovereign states in the world, that this is a good thing, that the United Kingdom is one, and that it will be a bad thing if the UK ceases to be so. It is also a majority view that if the United Kingdom has a constitution at all, its central pillar is the principle of the sovereignty of Parliament. No sovereignty, no constitution; no constitution, no UK."

The primary view of the EU in the sovereignty research field is that European integration excessively limited the member states' Westphalian (or Vattelian) sovereignty, or even deprived them of it (Krasner 1999). Due to integration, the national sovereignty of member states has become a pooled resource or common sovereignty (Czaputowicz 2013, 2015). In this context, the paradox is that national elections are inconsequential formalities because the winning party and new government cannot address the nation's problems without the EU's approval.

2.2. Institutions and Economic Development

In the EU's Eurozone, no political party can promise voters economic development programs or projects. The European Central Bank rejects any national projects if it decides that those programs are not a priority for the EU. Additionally, the absence of national currency is a massive distortion of the economic sovereignty of member nations. The European Commission would blame the national governments for being selfish. The European Central Bank blames member country governments for making "wrong political decisions with the aim of re-election and maintaining the political power" (Tkáčová et al. 2018). Officials in the European Commission state that democratic outcomes (elections, referenda, etc.) must not be allowed to challenge the economic policy of the Eurozone, which creates tensions in the member countries (Markantonatou et al. 2018). Without economic sovereignty, political sovereignty does not exist. In all of the member nations, party-based democracy is in crisis (Bickerton et al. 2022). The European Sovereignty Index (Puglierin and Zerka 2022) confirms the limited institutional sovereignty of member nations.

While the economic institutions of EU member nations are rated high in the economic freedom index, overall economic integration and many specific centralized economic decisions did not contribute significantly to their prosperity. Per capita GDP in the first ten years has increased by only ten percent in member nations that entered the EU from 1973 to 2004; the effects of deep integration into the EU were positive but not overwhelming for some countries, and not so favorable for other member countries in terms of per capita GDP increase and labor productivity (Campos et al. 2019). Europe has a relatively stable financial system, and the literature confirms a long-term equilibrium relationship between banking development, stock market development, and economic development (Wu et al. 2009). However, that stability could have been more consistent over the decades, and the current institutional system of the EU may not help dynamic economic development as desired. The quality of institutions matters (Zeqiraj et al. 2022), and the EU has high-quality institutions. However, much progress remains to be made before they support true democracy, political freedom of member nation citizens, and economic competitiveness. Europe is losing trade and investment competition to China and the United States because of weakened national democratic institutions before the EU's governing bodies. The EU is implementing cohesion policies (Farole et al. 2011). The most recent policy includes the years 2021 to 2027. The EU Cohesion Policy strengthens the European Union's economic, social, and territorial cohesion. It aims to correct imbalances between countries and regions. It delivers on the Union's political priorities, especially those pertaining to green and digital transitions (European Commission 2023). The EU's Cohesion Policy is implemented through interventions.

There are three trends in the implementation of cohesion policies: technology, geographical integration, and institutional differences in the EU. Institutions are the key force according to the scholars analyzing this trend, because institutions shape the ability of an economy to use and develop its resources (Farole et al. 2011).

3. Hypotheses

The European Council on Foreign Relations (Puglierin and Zerka 2022) asserts that European sovereignty does not involve building fences or withdrawing from the world stage, nor should it be viewed as opposing national sovereignty. Rather, it involves en-

hancing the EU's ability to manage the intricate interdependencies that are characteristic of today's world. The Council insists that Europe should not be bullied by others. The sovereignty index produced by the European Council on Foreign Relations indicates that the sovereignty scores of countries are relatively low, indicating that they have shared a significant portion of their sovereignty with the EU's governing bodies and NATO.

Shared sovereignty can lead to conflicts associated with multilevel governance and a prolonged crisis of party-based democracy (Bickerton et al. 2022). Donohoe (2013) hopes that once the Troika departs, a member country will regain its economic sovereignty.

The state, as a political power, is always a viable positive and coercive force when it possesses economic power, institutions, and instruments. Delegating economic power to external bodies implies self-disabling and reduces the state's and the country's people's responsibility. Furthermore, voluntarily relinquishing sovereignty implies that the state fears that it cannot survive alone and must join neighboring states. Weak nations believe that having a larger partner is always safer. Weak states seek to join supranational unions because their political forces are so weak that they lack the confidence in their own abilities and competence to lead the country and withstand global pressures. Indeed, groups of weak countries within unions may survive together better than individual countries. However, non-member European nations did not face the same survival challenges as EU members since the EU's inception. Furthermore, member nations of a union may develop more quickly if that union is established correctly.

There are two categories of countries that are interested in founding a union. The first is represented by strong countries that want to involve many weaker countries into unions to make them an isolated marketplace for their goods. The second category is represented by weak nations that would be comfortable outsourcing their leadership responsibilities to the external unelected bodies, such as unions, and become passive actors. These weak political actors are unable to design the country's future or plan anything that could rebuild the country into another powerful nation. Additionally, the state is not sure that it will be able to protect itself from outside enemies and seeks to join a military alliance. The state ignores the principle of inseparability of economic and political power (Mayer and Phillips 2017).

The EU is the best example, the member nations of which delegated those inseparable powers to the EU and unsuccessfully tried to be politically independent of the Union. The establishment of the European Parliament cut member nations' political and economic sovereignty significantly and weakened member nations' political independence.

The European Parliament centralized much of the legislative functions of national governments. Heinz-Jürgen Axt (2011) stated that many scholars and policy makers argue that the EU is characterized by a democratic deficit. Andreas Føllesdal and Simon Hix (2005) have referred to the "standard version" of the democratic deficit. Heinz-Jürgen Axt (2011) writes about Simon Hix's points the following.

> It is assumed that executive powers are strengthened and legislative powers are weakened. The institutional setting of the EU has increased the influence of the European Commission and the Council whereas the national parliaments have lost the power to control the executive institutions. National parliaments are no longer in a position to monitor and control decision making in the EU effectively. Ministers who are part of the national executive power structures dominate decision making at EU level. And the European Council is not subject to democratic control. Simon Hix has presented this argument in the following statement: "Governments can ignore their parliaments when making decisions in Brussels or can be out-voted in the Council."

Hypothesis 1. *Shared sovereignty will be negatively associated with the member country's economic development.*

Hypothesis 2. Shared *sovereignty will moderate the relationship between member country political institutions and economic development.*

Economic sovereignty is hampered when a country lacks the power to make independent financial and trade decisions, particularly when it does not have its own currency. The sovereignty and conflict literature focuses on the more political aspects of this subject (Brack et al. 2021) through the theories of federalism, non-functionalism, intergovernmentalism, and post-functionalism. The economic root of political integration in Europe is to be investigated more from the point of cost-benefit analysis for every member nation. Economic integration cannot be achieved without political decisions. The political decision is to economically integrate into a union. When this integration happens, policy makers' power in member nations drastically diminishes and they start thinking and speaking about restricted economic and political sovereignty, and researchers discuss shared or pooled sovereignty (Keohane 2002). The single foreign trade policy restricts member nations' opportunities to explore new markets and take advantage of effective and efficient trade relations and capital investment in all countries in which the member country has interests. The common market and union compose a very restricted community and policies are not made in the interests of all the member nations because the unelected executive body will make subjective decisions under the influence of the lead countries.

There are lead members in every union. They have stronger economic and veto power (may be informal) to restrict member nations from adopting economic programs that are good for the people of those nations. There is always blame for not thinking of all the members of the union and being selfish and assertive. In the end, the protesting country will not be able to achieve anything significant to develop its economy and improve the lives of its citizens at higher rates or avoid disruptions in this development. Member nations cannot freely attract foreign investment or invest their capital anywhere else, purchase foreign-made products or export their products anywhere else without considering the interests of the Union.

A single currency could help achieve the goal of creating a single country. However, that country does not exist yet. Therefore, not having their own currency, member countries of the EU cannot use all the possible features of local money that an independent country can. They cannot do emission, which sometimes helps mitigate crisis situations. Debt financing programs to handle crises bury the country in external debt (the EU and its Central Bank are still external entities for member nations); the conditions of repayment are very harsh.

No amount of borrowed money can help if the country does not make holistic decisions for itself. The country's credit rating decreases, investment inflows dry up, and foreign trade will be under the control of the EU. When a government's formal political power is separated from its economic power it has no power at all; it does not make economic decisions for its own country because the political power has no economic instruments, and the country has no economic institutions that the union has.

Hypothesis 3. *A member nation's shared sovereignty will negatively moderate the relationship between foreign direct investment inflows and outflows and the nation's economic development.*

4. Methods

4.1. Data Sources and Measures

The present study utilizes quantitative data on member nations' macroeconomic parameters (GDP growth rates in 2015 and 2019, %; per capita GDP in 2015 and 2019, $) of all of the 27 member countries (the UK is excluded) of the EU from publicly available sources of The World Bank (2019a, 2019b), the Freedom House (The Political Freedom Index (2019): see the weblink with this name in the references), (The Fraser Institute (2019): see the weblink with this name in the references), (The Heritage Foundation (2019): see the weblink with this name in the references), the European Council of Foreign Relations (European Sovereignty Index: see the weblink with this name in the references), and various academic and internet sources.

The political freedom index is a survey of public opinion that the Freedom House collects annually. The survey is conducted on a 100-point scale, 100 being free and 0 is not free. This scale is divided into two subscales: political rights (possible 60 points) and civil liberties (possible 40 points). The economic freedom index in both institutions (the Fraser Institute and the Heritage Foundation) is generated by surveying the public in all involved countries on a 100-point scale, with 100 points being free and 0 being not free. The subindices have the same 100-point scale. The European Sovereignty Index (2019) uses primary sources (input from our 27 national associate researchers) and secondary sources (such as public opinion data, official statistics, and other rankings). The scale is 0–10, 10 being an excellent sovereignty score and 0 being no sovereignty. The state of the sovereignty data belongs to a fixed time, the beginning of 2019. All economic data belong to the end of 2019. The institutional data belong to the beginning of 2019. All data are numerical and compatible with statistical analyses. All data are one-directional and positive.

Economic development: GDP growth rates measure economic development in the EU member nations.

Political institutions: the political freedom aggregate index, political rights, and civil liberties measure the political institutions of the member nations of the EU. The economic development data was chosen for the most stable period, 2015–2019, unaffected by recessions and turbulence in the world economy.

Economic institutions: the economic freedom index and its subindices in the Fraser Institutions and the Heritage Foundation's surveys measure the economic institutions of a member nation.

Sovereignty: the European Sovereignty Index measures the sovereignty of the EU member nations.

Foreign economic relations: inbound and outbound foreign direct investment and foreign trade (imports and exports) measure foreign economic relations. The FDI is measured by its share in the GDP as well as in US dollars. Imports and exports are measured in US$.

4.2. Dependent, Independent, and Moderating Variables

The dependent variable is GDP growth rates in a five-year range, 2015–2019, for the member nations of the EU. Independent variables are the sovereignty index, the political freedom index, and the economic freedom index, and their subindices, country cultural dimensions, foreign direct investment, and foreign trade (imports and exports). The moderating variable is the sovereignty index.

4.3. The Model and Data Processing Techniques

The purpose of my study is to reveal the causal relationships between independent and dependent variables using the instrumental variable estimation and direct and moderating (interaction) effects of independent variables in multiple regression. The model (Figure 1) involves the effects of political and economic institutions on economic development under the effects of sovereignty indices as instrumental variables. If sovereignty indices are weak instruments, then simple moderation can reveal the effects of the current conditions of shared sovereignty on institutions, foreign direct investments, and foreign trade. In the instrumental variable estimation (Angrist and Krueger 2001), sovereignty was not a strong instrument in determining causal relations between economic development and political and economic institutions and foreign economic relations (foreign direct investment and trade). Therefore, the direct impact of independent variables on the dependent variable and the moderating effects of sovereignty on the relationship between economic development and institutions and foreign economic relations will be examined in correlation analyses and OLS (Stigler 1981) estimations.

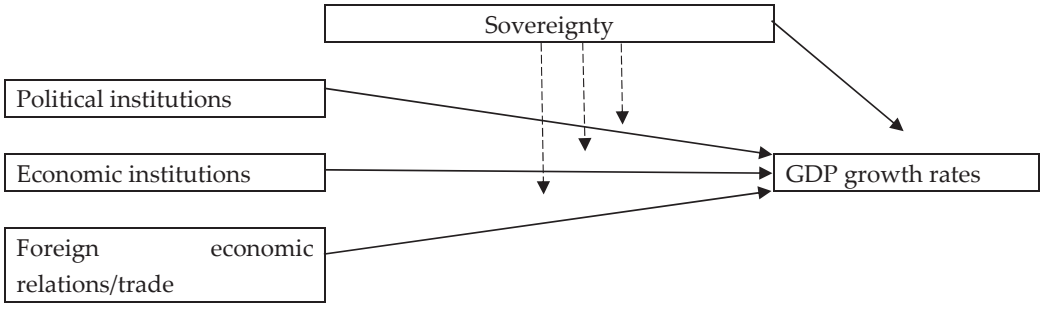

Figure 1. Direct and moderating effects of country factors on economic development. ——→ Direct effects - - - - - - - - → Moderating effects.

I used the following multiple regression equation (Fisher 1938) for hypothesis testing.

$$Y = b_0 + b_1X_1 + b_2 X_2 + \ldots + b_nX_n + c.$$

I utilized the following model for testing moderating effects (Kenny and Judd 1984) of the third variable.

$$Y = i + aX + bM + cXM + e.$$

Chi-square goodness of fit test for data independence. All data are categorical quantitative ordinal or numerical.

5. Analysis and Results

Analyses involve member states' sovereignty, institutions, intranational economic relations, and economic development relationships within the EU. The European sovereignty index has several subindices, namely, economic, defense, climate, health, technological, and migration sovereignties. Sovereignty correlates with several country variables. Most importantly, sovereignty correlates negatively and significantly with key economic development indicators, namely with annual GDP growth rates, annual GDP per capita growth rates, five-year GDP growth rates, five-year GDP per capita growth rates, the size of government, government spending, transfers and subsidies, and total marginal tax/tax burden. The negative relationships among key variables indicate that shared sovereignty does not facilitate desired economic development in member nations (Table 1).

Table 1. Correlations among the sovereignty index, institutional, economic, and cultural factors in member countries.

	sog [1]	gsp	ts	tmt	pd	gdpgr	gdppcgr	gdpgr5	gdppcgr5
National sovereignty score	−0.62 **	−0.61 **	−0.62 **	−0.63 **	−0.46 *	−0.62 **	−0.75 **	−0.53 **	−0.63 **
	taxb	govs	pr	cl	lspr	ji	ppr	rtb	br
National sovereignty score	−0.78 **	−0.50 **	0.59 **	0.58 **	0.66 **	0.75 **	0.59 **	0.40 *	0.69 **
	indul	gdppc	imp	exp	tb	gdp	govi	bf	inf
National sovereignty score	0.61 **	0.59 **	0.63 **	0.63 **	0.50 **	0.59	0.80 **	0.74 **	0.38 *
	finf	cpi	je	propr	sb	ind			
National sovereignty score	0.41 *	0.82 **	0.78 **	0.73 **	0.49 **	0.42 **			

[1] Please see the description of abbreviations in Tables 1–3 below. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 2. Correlations among the economic sovereignty index, institutional, economic, and cultural factors in member nations.

Economic sovereignty score	sog	gc	tmt	pd	ua	gdpgr	fdii	taxb	fdiin
	−0.47 *	−0.68 **	−0.46 *	−0.50 **	−0.48 **	−0.38 *	−0.43 *	−0.64 **	−0.40 *
Economic sovereignty score	gdppc5	demi	pr	cl	gi	lspr	ji	ppr	reg
	−0.48 *	0.40 *	0.46 *	0.46 *	0.43 *	0.70 **	0.73 **	0.67 **	0.44 *
Economic sovereignty score	br	ind	indul	gdppc	exp	imp	tb	gdp	ecf
	0.70 **	0.56 **	0.67 **	0.70 **	0.55 **	0.55 **	0.44 *	0.45 *	0.55 **
Economic sovereignty score	propr	je	govi	bf	inf	cpi			
	0.78 **	0.74 **	0.82 **	0.67 **	0.54 **	0.82 **			

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 3. Correlations among the economic development indicators, shared sovereignty, institutional, economic, and cultural factors in member countries.

GDP growth rates in 2019 compared to 2015	sov	sovc	sovd	sovh	pr	sg	ts	tmt	ppr
	−0.53 **	−0.40 *	−0.62	−0.51 **	−0.40 *	0.65 **	0.85 **	0.57 **	0.41 *
GDP growth rates in 2019 compared to 2015	cc	gdpgra	gdppcgr	fdii	exp	gdp	taxb	govs	gdppc5
	0.41 *	0.89 **	0.61 **	0.43 *	−0.39 *	−0.45 *	0.59 **	0.68 **	0.67
Per capita GDP growth rates in 2019 compared to 2015	sov	sovc	sove	sovh	sovt	pr	cl	sog	gc
	−0.63 **	−0.66 **	−0.48 *	0.69 **	−0.49 **	−0.43 *	−0.47 *	0.75 **	0.48 *
Per capita GDP growth rates in 2019 compared to 2015	ts	tmt	lspr	ji	ppr	cc	lmr	pd	indul
	0.68 **	0.70 **	−0.41 *	−0.47 *	−0.40	0.47 *	0.44 *	0.37 *	−0.71
Per capita GDP growth rates in 2019 compared to 2015	gdpgr	gdppc	gdp5	propr	je	govi	taxb	govs	bf
	0.68 **	−0.53 **	0.67 **	−0.41 *	−0.46	−0.53	0.85 **	0.70 **	−0.42
Per capita GDP growth rates in 2019 compared to 2015	cpi								
	−0.56 **								

* $p < 0.05$; ** $p < 0.001$.

Description of abbreviations used in Tables 1–3.

sog	size of government
gsp	government spending (Fraser Institution)
ts	transfers and subsidies
tmt	total marginal tax
pd	power distance
gdpgr	GDP growth rates (2019/2018)
gdppcgr	GDP per capita growth rate (2019/2018)
gdpgr5	GDP growth rates (2019/2015)
gdppcgr5	GDP per capita growth rates (2019/2015)
taxb	tax burden
govs	government spending (Heritage Foundation)
pr	political rights
cl	civil liberties
lspr	legal system and property rights
ji	judicial integrity
ppr	protection of property rights
rtb	regulatory trade barriers
br	business regulation
indul	indulgence
gdppc	GDP per capita
imp	imports
exp	exports
tb	trade balance
gdp	GDP current US$
govi	government integrity (Fraser Institution)
bf	business freedom
inf	investment freedom
finf	financial freedom
cpi	corruption perceptions index
je	judicial effectiveness
propr	property rights (Fraser Institution)
sb	ease of starting business
ind	individualism
gc	government consumption
ua	uncertainty avoidance
fdii	FDI inflows, % in GDP
fdiin	FDI inflows, current US$
demi	democracy index
gi	government integrity (Heritage Foundation)
reg	regulations
ecf	economic freedom (Heritage Foundation)
sov	sovereignty
sovc	climate sovereignty
sovh	health sovereignty
sovt	technological sovereignty
cc	capital controls
lmr	labor market regulations

Economic sovereignty had significant negative correlations with the size of government, government consumption, top marginal tax, power distance, uncertainty avoidance, annual GDP growth rates, FDI inflows (% in GDP), FDI inflows (current US$), and GDP per capita in 2019 compared to 2015. Economic sovereignty did not have any correlation with the five-year GDP growth rates (Table 2). The EU's social/entitlement programs and supported lifestyles contribute to the EU citizens' indulgence.

Not only does overall shared sovereignty have negative correlations with key member state variables, but also its subcategories have such correlations with the GDP growth rates in 2019 against 2015 and other country variables (Table 3) such as GDP per capita growth rates in 2019 against 2015. This evidence indicates that state sovereignty is shared excessively with the EU so that it has negative relations with economic development. Only

the sovereignty subindex migration had no significant correlation with either 2019 GDP growth rates against 2015 or 2019 GDP growth rates per capita against 2015.

The analysis for moderation indicates that *shared sovereignty* moderates the relationship between *economic development* and member country *political institutions*. The interaction effects of political rights and sovereignty were statistically significant at $p < 0.05$ and negative (Table 4), indicating that the shared sovereignty's negative impact on economic development becomes stronger with diminishing political rights. As seen in Tables 5 and 6, shared sovereignty has a significant negative impact on the economic development of member states. The effect size measured by semi-partial correlations is medium (r = 0.30 indicates a medium effect).

Table 4. Moderating effects of shared national sovereignty on the relationship between economic development and political institutions (Dependent variable: GDP growth rates in 2019 against 2015).

Independent Variables	B	Standard Error	Beta	t	Sig.	Zero-Order	Correlations	
							Partial	Semipartial
(Constant)	−254.93	137.18		−1.86	0.076			
Political rights	40.94	19.71	3.29	2.08	0.049	−0.529	0.388	0.332
Shared sovereignty	67.90	32.63	9.23	2.08	0.049	−0.403	0.397	0.322
Political rights*Sovereignty	−10.20	4.67	−12.02	−2.18	0.039	−0.551	−0.414	−0.349
F = 5.42 *; R^2 = 0.644								

* $p \leq 0.05$.

Table 5. Direct effects of political institutions and shared sovereignty on economic development.

Independent Variables	B	Standard Error	Beta	t	Sig.	F	Sig.	R^2
Political rights	−1.77	2.64	−0.142	−0.067	0.511	0.497	0.016	0.293
Shared sovereignty	−3.28	1.56	−0.456	−0.21	0.046			

Dependent variable: GDP growth rates in 2019 against 2015.

Table 6. Direct effects of sovereignty on economic development.

Independent Variables	B	Standard Error	Beta	t	Sig.	F	Sig.	R^2
(Constant)	34.45	6.81		5.06	0.001	9.70	0.005	0.280
Shared sovereignty	−3.89	1.25	−0.529	−3.12	0.005			

Dependent variable: GDP growth rates in 2019 compared to 2015.

Direct effects of other shared sovereignty categories on economic development suggest that key categories (climate change, national defense, and healthcare) are significant and negative (Table 7). Membership in NATO takes away the majority of sovereignty in national defense. Moderating effects of sovereignty also were discovered in the relationship between FDI inflows and economic development (Table 8). The positive B-coefficient for the interaction predictor indicates that economic development will be weaker if sovereignty decreases and FDI outflows from member states increase. The effect sizes of the predictors range from medium to large (r = 0.30 or higher but lower than 0.50 indicates medium effect: r = 0.481 is close to the large effect).

Table 7. Direct effects of specific sovereignty indices on economic development (Dependent variable: GDP growth rates in 2019 compared to 2015) (N = 27).

Independent Variables	B	Standard Error	Beta	t	Sig.	F	Sig.	R^2
(Constant)	25.16	8.26		3.05	0.006			
Shared national sovereignty in:						7.53	0.001	0.693
climate change	−3.89	1.35	−0.62	−2.89	0.009			
national defense	−1.93	0.67	−0.47	−2.90	0.009			
the economy	2.19	1.18	0.044	1.85	0.079			
healthcare	−2.85	1.39	−0.58	−2.05	0.053			
migration	2.36	1.73	0.21	1.37	0.187			
technology	2.10	1.23	0.41	1.71	0.103			

Table 8. Moderating effects of shared national sovereignty on the relationship between economic development and FDI outflows (Dependent variable: GDP growth rates in 2019 against 2015).

Independent Variables	B	Standard Error	Beta	t	Sig.	Zero-Order	Correlations	
							Partial	Semipartial
(Constant)	25.84	6.49		3.98	0.001			
Sovereignty index	−2.52	1.16	−0.34	−2.16	0.041	−4.92	−0.411	−0.314
FDI outflows, % in GDP	−0.17	0.06	−0.99	−2.82	0.010	0.170	−0.506	−0.409
Sovereignty index * FDI outflows	0.05	0.02	1.18	3.31	0.019	0.42	0.568	0.481

F = 8.10 at $p = 0.001$; $R^2 = 0.514$.

Direct effects of FDI inflows on economic development are positive and significant, while FDI outflows have a significant negative impact on the economic development of member states (Table 9).

Table 9. Direct effects of FDI inflows and outflows (% in GDP) on economic development (Dependent variable: GDP growth rates in 2019 compared to 2015).

Independent Variables	B	Standard Error	Beta	t	Sig.	F	Sig.	R^2
(Constant)	11.83	1.02		11.66	0.001			
FDI outflows	−0.21	0.061	−1.21	−3.40	0.002	9.83	0.001	0.450
FDI inflows	0.29	0.067	1.52	4.29	0.001			

6. Discussion

6.1. Findings

Hypothesis 1, stating that shared sovereignty will be negatively associated with the member country's economic development is supported because the aggregate sovereignty index and its main subindices (climate, defense, and health) are significantly and negatively correlated and associated (in the OLS estimation) with economic development of member nations. Shared sovereignty negatively moderates the relationships between the political institutions and economic development, supporting Hypothesis 2. Hypothesis 3, suggesting that a member nation's shared sovereignty will moderate the relationship between foreign direct investment inflows and outflows and the nation's economic development, is partially supported regarding FDI outflows. FDI outflows negatively impact economic growth, but shared sovereignty in interaction with negatively impacting FDI outflows worsens this impact in member nations.

6.2. Limitations of the Study and Future Research

The present study did not analyze the specific details of the political systems of member countries and the EU, which established its supremacy over the member nations. Additionally, there is no focus on the significant positive achievements of the EU in this study. Therefore, a more holistic analysis of the viability of the EU as an economic and political system involving more qualitative and quantitative data will help. Research should continue analyzing the status of democracy and the economic system in the member nations (Bickerton et al. 2022).

EU officials insert themselves into the governance of member nations. This lack of democratic accountability has been causing serious problems for member states and the system of governance in the EU (Hix and Hoyland 2022). Governments that resist pressure from the EU are called activist governments (Gabrisch and Werner 1998). This issue is also important for future research.

The viability of the single currency and the policies of the Central Bank of the EU (Fairless 2013) should be re-examined. Having one's own currency gives a country a wide latitude to program its national economy. The EU took away such an opportunity from the Eurozone countries.

Future research should analyze three scenarios for the EU's future. The first, the EU stays as it is. The second, the EU turns into a trade agreement only in the form of the European Trade Council as Winston Churchill (1946) suggested. The third, the EU is considered as a single country, a federation.

Even though the data came from member countries, the results were the outcome of the entire sample; EU countries served as observations in the sample. Therefore, specific results by country were not identified. Future research should pay attention to particular countries and make specific recommendations.

6.3. Research and Practical Implications

The results of the present study will be beneficial for member nations of the EU and research institutions to further investigate the status of national and shared sovereignty and economic growth in the EU. The EU has problems related to its underserved peripheral countries. The most critical issue is the legitimacy of the EU, the governing bodies of which tightly govern the member nations without any constitutional authority (Isiksel 2016). Furthermore, the EU isolates member nations from the external world and monopolizes the European market (Von Der Burchard et al. 2019; Piekutowska and Marcinkiewicz 2020). Governments in member nations should address the issues that impede the freedom of trade and investment. They also should revise their sovereignty and institutional setup to optimize them and facilitate effective governance, reasonable regulation, effective trade policy, financial stability, and rapid economic growth.

7. Conclusions

The European Union is an impressive political, economic, and social entity, but its existence has brought about a significant reduction in member nations' state sovereignty and independence. Consequently, true political competition among parties within member nations is often lacking. The lack of competing ideas that can be independently implemented without the EU's involvement has resulted in sluggish economic development. The absence of real competition among political factions is especially evident in the Eurozone, where political forces are unable to execute significant projects without the EU's approval, thereby hampering member nations' independence. Eurozone member states are more vulnerable to losing their sovereignty due to the over-delegation of political and economic power to the EU. This over-delegation often results in the inability of member nation governments to make necessary political, economic, and social decisions on domestic affairs and foreign relations. As a result, a member nation ceases to be a fully sovereign entity and becomes more of a semi-province of a larger territorial system known as the Union, which is not yet a federation (Hix and Hoyland 2022).

While Euroscepticism is reflected in emotion-laden public discourse (Fanoulis and Guerra 2017), complex data show that the founding of the EU aimed to achieve socio-economic goals for building strongly socially oriented societies that are inconsistent with the capitalist incentive system. This has led to a transformation that results in lowered productivity, effectiveness, and efficiency, as people are not motivated to work as they are in a capitalist system.

The present study's quantitative analyses reveal that the sovereignty index and its key sub-indices, including defense sovereignty, healthcare sovereignty, and climate sovereignty, negatively correlate with and impact economic growth. Additionally, the sovereignty index moderates the significant negative relationships between economic development, political institutions (specifically political rights), and FDI outflows. As a result, shared sovereignty has negative direct and moderating effects on economic growth. The EU should consider problems of sovereignty of institutional, and of economic development revealed in the present research in their further integration processes through the Cohesion Policies (as discussed in Farole et al. 2011).

National political parties should clarify to their citizens the truth about this conglomerate (Fanoulis and Guerra 2017), which restricts political rights and holds countries back from rapid economic development. The current setup of the EU needs to be revised, and member nations must find the correct solutions to their institutional problems to protect true democracy and achieve rapid economic development. This solution may involve weakening the legislative and executive functions of the European Union or establishing a true federation where countries lose their independence and become provinces of the federation. Consequently, the political system will change.

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Article

Application of Successful EU Funds Absorption Models to Sustainable Regional Development

Marko Šostar [1,*], Vladimir Ristanović [2] and Chamaru de Alwis [3]

[1] Faculty of Tourism and Rural Development, Josip Juraj Strossmayer University of Osijek, Vukovarska 17, 34000 Pozega, Croatia
[2] Institute of European Studies, Square of Nikola Pašić 11, 11000 Belgrade, Serbia; vladimir.ristanovic@ies.rs
[3] Faculty of Commerce and Management and Studies, University of Kelaniya, Colombo 11300, Sri Lanka; chamaru@kln.ac.lk
* Correspondence: msostar@ftrr.hr; Tel.: +385-98554442

Abstract: The research paper comprehensively and consistently addresses all relevant theoretical areas related to the topic and includes an extensive empirical analysis of the absorption of EU funds and their impact on the sustainable development of Croatia, Slovenia, Hungary, and Poland. The analysis aims to investigate the efficiency of the absorption of funds from the EU, the impact of these funds on regional development of countries, and the reasons for such impacts. The "Regional Development Model Based on EU Funds" was tested with the aim of applying the model to the Republic of Croatia, countries in the region, and other European countries, to achieve a higher level of absorption of financial resources from the available EU funds. Data for the empirical analysis were collected using a highly structured survey questionnaire completed by a sample of 244 respondents involved in the preparation and implementation of EU-funded projects. The contribution of economic science in theoretical terms arises from the development of scientific knowledge and ideas about the importance of increasing the number of development projects that will increase the absorption of funds from the European Union, thereby increasing economic activities in Croatia and the region. The expected contribution of economic science in the applied sense is based on the formulation of the "Regional Development Model Based on EU Funds", which is based on the application of knowledge, good practices, and stakeholder experiences, considering relevant indicators from available sources. The greatest contribution is demonstrated through testing the "Regional Development Model Based on EU Funds", which is applicable to the Republic of Croatia, countries in the region, and other European countries over a longer period. Finally, research into the impact of EU funds on the regional development of recipient countries is considerably less represented and very modest, and is only in the "upswing" of systematic scientific research. The research aims to fill the gaps in research and to encourage the thinking of key stakeholders responsible for regional development, who should eventually realize the importance of defining a regional policy aimed at EU funds as a key to regional development and reducing regional disparities within countries.

Keywords: sustainable regional development; EU funds; development projects; absorption

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1. Introduction

The European Union (EU) has a long-standing commitment to sustainable development, recognizing its importance in achieving social, economic, and environmental goals. EU funds play a significant role in advancing sustainable development in member states, directly and indirectly impacting various aspects of society. The impact of EU funds on sustainable development is substantial, touching upon various aspects of social, economic, and environmental well-being. These funds play a critical role in supporting member states' efforts to achieve a more sustainable and prosperous future, while also contributing to global sustainability goals such as the United Nations' Sustainable Development Goals (SDGs).

The application of successful EU funds absorption models to sustainable development is important for several reasons. By effectively utilizing EU funds, member states can promote sustainable development and address various economic, social, and environmental challenges. Efficient absorption of EU funds ensures that resources are allocated optimally and used effectively to address sustainable development priorities. This can lead to positive economic growth, job creation, and improved living standards for citizens. EU funds often support research and development projects, technology transfer, and innovative solutions to sustainable development challenges. By absorbing funds effectively, member states can foster innovation in key areas, such as renewable energy, waste management, and sustainable agriculture. EU funds aim to reduce economic disparities among regions by supporting less-developed areas. By applying successful absorption models, countries can ensure that funds reach these regions and contribute to sustainable development goals, such as poverty reduction and social inclusion. Effective EU funds absorption can attract further investments from both public and private sectors, amplifying the impact on sustainable development. This could lead to the establishment of new businesses, infrastructure improvements, and increased competitiveness. Applying successful absorption models requires strong coordination among various stakeholders, including national and regional authorities, private sector entities, and non-governmental organizations. This can lead to better policy coherence and the establishment of integrated approaches to sustainable development. Implementing and managing EU-funded projects requires administrative and technical capacity. By applying successful models, member states can strengthen their institutions, improve governance, and develop better project management skills, ultimately benefiting the overall sustainable development efforts. Successful absorption models often include robust monitoring and evaluation mechanisms, enabling member states to track the progress of funded projects and measure their impact on sustainable development. This feedback loop can inform future policy decisions and improve the effectiveness of EU funds.

The main advantage of EU funds is that they represent financial resources that do not need to be repaid and are part of the total investment, thereby directly influencing the economic growth of a certain country (Vukašina et al. 2022). In their study, Florkowski and Rakowska (2022) emphasize that co-financing of projects funded by EU funds has a significant impact on the further development of individual regions, enabling the implementation of multiple development projects. The research conducted by Walesiak and Dehnel (2023) confirms the effects of EU funds on individual regions, where improvements in the level of social cohesion and reduction in regional inequalities are evident. Management and strategic planning are the key to success, and projects and development have no place for politicization and promotion (Šostar 2021a).

This research deals with the development of an applicable development model for the absorption of EU funds applicable to the Republic of Croatia as well as other countries in the region. The reason for conducting this type of research is the existence of limitations and challenges faced by countries at all levels in absorbing EU funds. It is also crucial to determine the impacts on the regional development of individual countries due to the funds and implemented development projects. This research includes respondents who are experts in the preparation and implementation of projects from EU funds. The area covered by the research focuses on Croatia, Slovenia, Hungary, and Poland. The emphasis is on applying the developed model to the Republic of Croatia, as a relatively new EU member state that is still in the process of adapting its policies and procedures. The shared history of the development of the former common state, which included both Slovenia and Croatia, led them through the same developmental phases. Slovenia had access to EU pre-accession funds, which it utilized until its entry into the EU in 2004. After that period, it accessed funds available to EU member states. Since Croatia only joined the EU in 2013, it is evident that it is undergoing the same processes but with a time lag. Due to these reasons (shared history, people's mentality, and similarities), Slovenia has been chosen as an excellent country for conducting this research. As a country selected in the research

sample, Hungary, like Slovenia, used pre-accession funds until 2004 when it also became a full member of the EU and started using structural and cohesion funds. The reason for its selection lies in the fact that it was necessary to analyze the problems and achievements in the absorption of EU funds and the implementation of projects in a country that joined the EU at the same time as Slovenia, but on the other hand, does not share a common history and similarities with Croatia. Hungary shares a border with Croatia and the two countries are geographically very close, so this comparison was needed. On the other hand, Poland also became a full member of the EU in 2004, just like Slovenia and Hungary, but their degree of development and the impact of EU funds differ significantly. Poland has been the most successful in the EU in absorbing funds from the EU funds.

This paper is organized as follows: After the introduction, Section 2 introduces the theoretical framework of EU funds and the proposed approach to define a model of regional development based on absorbed EU funds. It also provides the hypotheses and methods; ANOVA (analysis of variance); coefficient data of the suitability index of the regression model; and regression beta coefficients for predictor variables. Section 3 presents materials and methods used in the research process. Section 4 presents results and a discussion. Section 5 discusses the conclusions.

1.1. Problem Statement

European Union (EU) funds, as an accessible source of financing for various project ideas and a factor with the potential to contribute to sustainable local, regional, and national socio-economic development, are becoming an increasingly prevalent topic of discussion in both professional and scientific circles. The Republic of Croatia follows the trend of other countries, in which stakeholders have behaved similarly: as the number of EU funds increased in content and scope, more stakeholders became involved, on one hand, in the preparation and implementation of projects, and on the other hand, in expert discussions on various issues related to EU funds in various ways. Stakeholders who deal with the preparation and implementation of projects financed through EU funds are mainly focused on a single clearly defined goal, which is to achieve as much funding as possible through as many projects as possible. Some countries are extremely successful in implementing many projects through EU funds financing. When entering a particular project, it is essential to decide which project to choose. To ensure the quality of the decision-making process is as high as possible, it is necessary to recognize the need for decision making and be aware of the time constraints that exist when making decisions. Selecting the most successful model for absorbing EU funds is undoubtedly the foundation for increasing economic activities and, ultimately, the regional development of countries. This research deals with the causes of the lower success of certain countries in absorbing funds from EU funds and the development of a unique model for efficiently attracting funds from EU funds applicable to the Republic of Croatia and other countries.

1.2. Significance of the Study

The application of successful EU funds absorption models to sustainable development is significant for several reasons. By effectively utilizing EU funds, member states can promote sustainable development and address various economic, social, and environmental challenges. The idea of the EU support program is to improve regional and local infrastructure networks (transportation, energy, and environment), including social infrastructure, as well as to support the private sector, and health and education sectors (Ristanović and Tošović-Stevanović 2016).

This research will provide a systematic and comprehensive review and analysis of existing knowledge in the field of research, which relates to the specificities of regional development under the influence of EU funds. The expected contribution to economic science in a theoretical sense stems from the development of scientific knowledge and thought on the importance of increasing the number of development projects that will improve the absorption of funds from the European Union, thus increasing economic

activities in Croatia and the region. The expected contribution to economic science in an applied sense is based on formulating the "EU Funds-based Regional Development Model," which is based on the application of knowledge, the adoption of good practices and experiences of stakeholders, and considering relevant indicators from available sources. The research itself will be conducted in four European countries (Croatia, Slovenia, Hungary, and Poland), which adds value to the scientific contribution based on different regional backgrounds. The most significant contribution will be through testing the "EU Funds-based Regional Development Model," which will be applicable to the Republic of Croatia, countries in the region, and other European countries over an extended period. Finally, research on the impact of EU funds on the regional development of beneficiary countries is significantly less represented and very modest, and only relates to the "rise" of systematic scientific research. This study aims to fill gaps in the research sense and stimulate the thinking of key stakeholders responsible for regional development, who should eventually understand the importance of defining regional policy focused on EU funds as the key to regional development and reducing regional differences within states. The mentioned research provides a basis for further scientific research in the field of EU funds absorption with the aim of balanced regional development.

2. Literature Review

The field of EU funds is an interdisciplinary area that involves researchers from various backgrounds, including economics, public policy, regional development, and sustainable development. Smart planning is the key to success, especially considering the limited financial and human resources (Šostar 2021a). Attitudes towards EU institutions can potentially influence the reduced number of project applications for EU funds. In their research, Crepaz and Hanegraaff (2022) prove that the impact is almost negligible. Crescenzi et al. (2020) show in their research that love for the EU cannot be bought, which is proven by the exit of the United Kingdom from the EU despite the EU funds which had a significant impact on their development.

In their research, Ciani and De Blasio (2015), suggest that EU funds have a limited impact on local employment measures, population, and household product prices. In their studies, Destefanis and Di Giacinto (2023) and Arbolino and Di Caro (2021) discuss the impact of EU funds on GDP, promoting regional resilience, and significant effects of the same during the COVID-19 pandemic. Álvarez-Martínez and Polo (2017) confirm in their research that EU funds have a short-term effect on economic development. Charasz and Vogler (2021) emphasize that EU funds have a long-term effect on local and state capacities and that the funds contribute to reducing bureaucracy. By analyzing two regression models, Kalfova (2019) concluded that quality state governance is important for the implementation of EU regional policy. In their research, Jasińska-Biliczak and Krzysztof (2020) suggest ways to measure the impact of EU funds on the regional development of a particular region, outlining efficiency evaluation criteria (examination of the provisions of the Opole Voivodeship Regional Development Program in terms of its consistency with the concept of sustainable development; assessment of the consistency of the governance structure and development capital; examination of the effectiveness of projects co-financed in the scope of public aid; research on the effectiveness of the contribution to co-financing development projects from the resources of the Opole Voivodeship Regional Development Program). In conclusion, they suggest that countries should adopt Poland's model of monitoring and evaluating the regional development system and EU funds, as Poland is a significant factor in absorbing EU funds.

Durand and Espinoza (2021) highlight that the role of fiscal authority in supporting an individual economy is a key factor and that, due to the newly approved EU recovery instrument, significant improvement of economic damage caused by the COVID-19 pandemic can be achieved. Codogno and van den Noord (2021) and Butkus et al. (2020) note that EU funds have a direct impact on the economic growth of the recipient country. They speak about the importance of responding before a potential crisis arises with a mechanism for

ready reaction in the future. In addition, during the financial crisis, EU funds significantly helped in maintaining employment and economic activities (Crescenzi and Giua 2018). Dicharry (2020) and Fratesi and Perucca (2018) noted that EU funds influence the economic growth of individual regions, but not at the same pace. On the other hand, Moreno (2020) noted that the financial crisis led to a decrease in investment and the absorption of funds from EU sources. When we observe the impacts of EU funds on the Greek economy, a positive effect of the funds on real GDP and disposable income is noticeable, while the effect is somewhat less on investments. The financial crisis revealed the instability of the Greek economy (Kechagia and Kyriazi 2021). Bostan et al. (2022) show in their study how EU funds are directly linked to an increase in the number of employees in companies in the medium and long term. Darvas et al. (2021) in their study find that the most successful regions have projects with longer durations, focusing on inter-regional co-financing and with a lower share of national co-financing. Less developed regions tend to grow and develop faster due to more efficient absorption of funds from EU sources (Antunes et al. 2020). Mugambi et al. (2021) assert that the efficiency in energy spending is uneven across regions in Spain, which is directly related to the criteria for allocating EU funds.

Although the United Kingdom is no longer a member of the EU, it is necessary to note that when using EU funds, it had a large share (direct and indirect) of funds that contributed to the economic growth of the country, especially less developed regions (Di Cataldo and Monastiriotis 2018). Sánchez and Jiménez-Fernández (2023) highlight that regions of EU member states are far more vulnerable due to the COVID-19 pandemic, and that this also affects their absorption of funds from EU sources. Human resources are the key to the success of every country, including in the planning and implementation of regional policies, with an emphasis on EU funds (Devčić and Šostar 2015; Veron and Sergejeff 2021).

In the context of the efficiency of EU funds, Melecký (2018) believes it is necessary to put the co-financing activities of projects in a broader context to understand the aforementioned. Following this, Šelebaj and Bule (2021), in their research, conclude that support from EU funds has a strong positive impact on almost all business indicators of companies and other project applicants. In addition, Muraközy and Telegdy (2023) emphasize the impact of EU funds on company inputs, workforce productivity, and capital intensification.

Lutringer (2023) and Wolleghem (2020), in their studies, highlight the reasons for insufficient absorption of funds from EU funds, emphasizing time and accounting mechanisms, administrative and financial capacities, and the nature of the funds themselves as the main limiting factors. Kersan-Škabić and Tijanić (2017) emphasize that the key to good absorption is investment in human resources, decentralization, investments, institutional framework, and infrastructure development. One of the problems, as pointed out by Medve-Bálint and Šćepanović (2020), is that a large share of EU funds is absorbed by foreign companies that take money out of the country. There are several studies that demonstrate the relationship between the quality of public administration and the absorption capacity of projects funded by EU funds (Baun and Dan 2017; Terracciano and Graziano 2016). In their research, Mendez and Bachtler (2022) emphasizes that regional government does not have an influence on the administrative performance of EU funds.

Fidrmuc et al. (2019) and Bourdin (2019) confirm that there is a significant impact of non-refundable funds on a certain area, emphasizing a greater impact in larger centers than in the periphery. Blouri and von Ehrlich (2020) use a general equilibrium model to assess the impact on wages, productivity, and infrastructure. Crucitti et al. (2023) notes that research should not only be guided by the amount of absorbed financial resources, but also by the way these resources are distributed. In his study, Hagemann (2019) highlights the importance of capacity, emphasizing that poor capacities strongly affect absorption power and the inability to reduce regional inequalities.

Although Poland's approach to EU funds has changed over the years, institutional capacities and efficient management have played a key role in the high level of absorption of funds from EU sources (Baschieri 2021). According to the study by Jagódka and Snarska

(2023), all regions in Poland have decided to develop human capital and innovation, which significantly increased the efficiency of EU funds. Murzyn (2018) noted that the smart growth of regions in Poland has significantly increased due to the use of EU funds. Marcu et al. (2020) conducted a study in Romania where they highlight poor capacities at the start of using funds from EU sources due to a lack of experts in the field, while over time the situation stabilized. Progress in the absorption of funds from EU sources occurred due to the growth of knowledge and experience, and an increase in transparency and information and communication systems. The creation of a new region in Hungary (Budapest Region and Pest County Region) in 2020 brought about changes that the administration was unprepared for. Specifically, the changes happened so quickly that it directly affected the level of absorption of EU funds (Szabó et al. 2021). Additionally, the role of national authorities is an important factor in absorbing EU funds, with an emphasis on investing in human resources and the development of quality projects that will lead to an increase in the utilization of funds (Barković and Šostar 2013; Andrlić et al. 2018).

Darvas et al. (2019b) discuss in their research the importance of reducing corruption in a country to access EU funds more easily and to properly direct these resources. Darvas et al. (2019a) highlight in their research the negative correlation between the share of projects under the management of local entities and economic growth, which means that local needs should be raised to a higher level to be linked with the allocation of financial resources from EU funds. Lădaru et al. (2018) show differences in operational programs from which EU fund competitions are announced. Differences are visible at various levels of fund absorption efficiency, indicating that something was wrongly planned in the programming process at higher levels, which is often a misalignment with the needs on the ground.

In their research, Maleković et al. (2018) and Šostar et al. (2018) note the strong impact of EU funds on regional development in the Republic of Croatia. The obtained funds accelerated the processes of institutions and individuals to adapt to European legislation and build capacities, although administrative obstacles are visible and affect the loss of part of the funding. In the study by Bańkowski et al. (2022), administrative barriers were also highlighted as a bottleneck in the absorption of EU funds. The fact that a larger number of projects does not necessarily mean greater economic growth of a particular region should certainly be considered, and it is important to properly direct funds from EU funds to those areas that contribute most to growth (Devčić and Šostar 2012).

Every crisis impacts the efficiency of EU funds for a particular environment or investment. Correctly directed funds in the case of any market anomalies are the key to success. The COVID-19 pandemic has significantly affected the crisis worldwide, while the EU tries to finance further development of its regions with strong recovery mechanisms (Sakkas et al. 2021). Several studies have investigated the results of the Recovery Plan for Europe as a whole, as well as those of specific countries (Bankòwski et al. 2021; Pfeiffer et al. 2021; Picek 2020).

When speaking of conducted research related to EU funds and their impact on the regional development of certain countries, few authors have taken up the challenges these countries face. According to Kersan-Škabić and Tijanić (2017), it is evident that some studies have attempted to capture the comprehensive relationship between administrative capacities, political governance, and the implementation of projects funded by the EU. Cunico et al. (2021) emphasize that there is no adequate model for monitoring and analyzing the impact of EU funds on regional development, and that this depends on a range of factors. Conversely, Maras (2022) confirm that there is a significant connection between European funding and reduction in regional disparities, especially when including regional and local authorities in the processes (Marcu et al. 2020). We can agree that there are a large number of variables that need to be measured in order to assess the impact of EU funds on the regional development of a particular country, but the position is that there are a number of ways in which this can be measured, such as economic growth models, regional development models, impact assessment models, multi-criteria decision analysis (MCDA), econometric models, panel data analysis, spatial analysis, and simulation models. When

we talk about the capacities necessary for attracting and utilizing funds from the European Union, they are divided into three categories: administrative capacities, financial capacities, and macroeconomic capacities (Šostar 2021b).

Administrative capacity primarily refers to the ability of stakeholders individually, but even more so the ability of the system, to carry out tasks related to the preparation and implementation of all prescribed and entrusted procedures related to the funds of the European Union. In their research, Țigănașu et al. (2018) prove that high-quality institutional management, as a leading dimension of administrative capacity, has a positive impact on the absorption rate of funds from EU funds.

Financial capacities refer to the abilities of stakeholders and the system to fully finance these procedures. Macroeconomic capacity relates to the limitation whereby a country is constrained by the amount of funds it can draw from the structural funds. According to Aivazidou et al. (2020), less successful local authorities need to change their strategic focus and prioritize strengthening their administrative capacities rather than increasing the absorption of funds from EU sources. Due to capacity limitations, Madeira et al. (2021) emphasize the importance of following a smart specialization strategy and focusing on areas that will bring us the most benefits in financing regional development. A very interesting study presented by Incaltarau et al. (2020) highlights the role of the government in reducing corruption to increase the absorption of funds from EU sources, which have a direct impact on the regional development of specific regions.

There is research on methods of measuring the impact of EU fund resources on the macroeconomic indicators of recipient countries. Two approaches are mentioned: the econometrics approach and the simulation model approach. Among the simulation models, the HERMIN, HERMES, QUEST II, and ECOMOD models appear (Bradley et al. 2022; Surubaru 2021; Piątkowski 2020; Roeger et al. 2022). The macroeconomic effects of EU funds are visible in employment, infrastructure development, GDP changes, and personal consumption. As Poland has historically been the most successful country in attracting funds from the EU, it is important to analyze what it has done to be successful (Szlachta 2004).

It is evident that the effect of EU funds is greater in some regions and smaller in others. In the poorest regions, the spillover effect does not contribute to reducing regional inequalities but represents a great opportunity for the future period (Maras 2022). It has also been proven (Aiello et al. 2019) that less developed regions require more financial resources due to having higher administrative and bureaucratic challenges, particularly due to the lower level of capacity of local authorities.

3. Research Objectives and Hypothesis

The subject of the research is the absorption of funds from EU funds and their impact on the regional development of Croatia, Slovenia, Hungary, and Poland. The analysis aims to investigate the efficiency of absorbing EU funds, the impact of these funds on the regional development of the countries, and the reasons for such impacts. Each country has its own approach to regional development and different regional policy priorities. However, all countries belonging to the eurozone have a common, shared goal, which is evident in balanced regional development with positive microeconomic and macroeconomic indicators. EU funds are the right path to success, including the human and material potentials of each of these countries. The following research hypotheses (Figure 1) are presented: H1: There is a cause-and-effect relationship between the absorption of European Union funds and the sustainable regional development of beneficiary countries; H2: Investing in human resources significantly increases the utilization of available European Union funds; H3: Strengthening material resources significantly increases the utilization of available European Union funds.

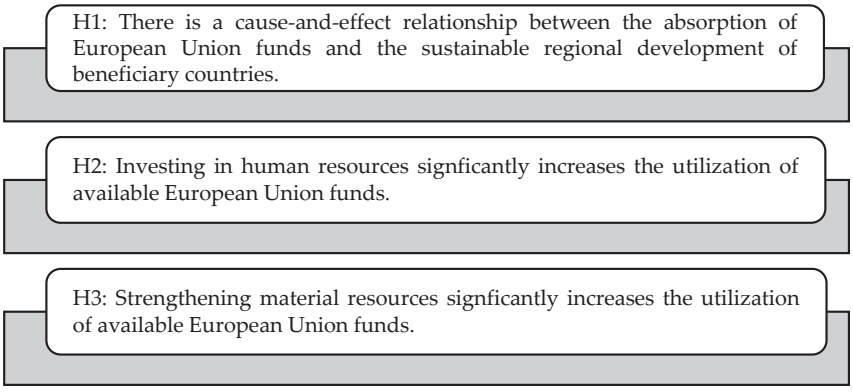

Figure 1. Hypotheses of the study.

As the research is comprehensive and includes several factors on which the efficiency of absorption of EU funds and their impact on regional development depend, it is necessary to mention that the focus of the research hypotheses is not only human and material resources as instruments of increasing absorption. It is important to maintain sustainable regional development by investing in different dimensions in the analyzed countries because of their differences and different approaches to the same problem. Thus, in some countries, the focus will be on human capacities, while in other countries, the focus may be on investing in infrastructure.

The purpose of the research is to familiarize the attitudes of key stakeholders involved in the preparation and implementation of projects from EU funds in Croatia, Slovenia, Hungary, and Poland regarding the level of absorption of funds from EU funds, their impact on regional development, and the reasons for such impacts, through testing the "EU Funds-based Regional Development Model." Based on the conducted research, the aim is to confirm the "EU Funds-based Regional Development Model," which would be applicable to the Republic of Croatia. The conducted research would be applicable to the Republic of Croatia, countries in the region, and other European countries. In fact, the work aims to increase the absorption of EU funds that are available and will become available to the Republic of Croatia. The main reason for choosing the mentioned countries is that they are EU members and have gone through the same processes as the Republic of Croatia. They had access to the same EU funds that Croatia has now, and they receive funds from structural and cohesion funds that Croatia received. Hungary and Slovenia are ideal candidates because their geographical location, historical heritage, and mentality are similar to those of the Republic of Croatia. Poland was chosen because it is the country that most effectively uses EU funds, having the highest level of utilized funds available to it through past EU programming periods. As a result, Poland was the only EU country not affected by the global financial crisis in 2008.

4. Methodology of Research

Given the established hypotheses, secondary data will be systematically researched using scientific literature in the fields of economic and regional development as well as EU funds. The deductive method will be used, where hypotheses will be attempted to be proven, and the inductive method, through which general conclusions will be reached. Abstract methods will be used to separate the essential from the non-essential, and the classification method will be applied using specialization and generalization methods. In addition, the systematic analysis method and synthesis method will be used, as well as the dialectical approach, meaning that phenomena will be observed as a dynamic rather than a static approach. In addition, based on the developed "EU Funds-based Regional Development Model," these phenomena will also be examined through a questionnaire,

as well as using existing statistical indicators to test the applicability of the model to the Republic of Croatia. Primary research will be conducted in four countries (Croatia, Slovenia, Hungary, and Poland), while the respondents will be key stakeholders in these countries involved in the processes of preparation and implementation of projects from EU funds. The total number of respondents will initially be 400 experts in the preparation and implementation of projects from EU funds in Croatia, Slovenia, Hungary, and Poland. The selected sample is based on an internal database of experts in project preparation and implementation in Croatia, Slovenia, Hungary, and Poland, which consisted of a total of 400 experts (100 per each individual country) who participated in the preparation or implementation of at least 5 projects each. The survey questionnaire was prepared in the Lime Survey program and was sent via email to 100 experts in each country from the mentioned internal database. A total of 244 respondents responded to the survey (69 from Croatia, 62 from Slovenia, 62 from Hungary, and 51 from Poland). The used internal database is a document that contains personal data of respondents (first name, surname, and e-mail) and cannot be part of a publicly published document due to the protection of personal data and the anonymity of the respondents themselves. Furthermore, the internal database is the result of the author's long-standing work on this research, following 15 years of participation in the preparation and implementation of projects funded by EU funds in the Republic of Croatia.

All respondents are employed in institutions dealing with the preparation and implementation of projects from EU funds or work as consultants in the preparation of documentation for attracting EU funds. These are individuals who possess knowledge, experience, and expertise in the field of preparation and implementation of development projects, and they are positioned as being key to regional development in each country. Respondents participated in the study by defining their experiential attitudes, where their perception of the researched issue was recognized.

During the processing of data obtained from the questionnaire, the ANOVA (analysis of variance) method was used as a method of linear modeling to estimate the relationship between fields. ANOVA was used to test if the means change across input categories. Based on this, the research hypotheses were analyzed for pre-defined variables that were tested through coefficient data of the suitability index of the regression model and regression beta coefficients for predictive variables.

The ANOVA model was chosen because of its ability to conduct simultaneous multiple comparisons between regions, i.e., countries, allowing us to discern differences. It helps in testing the established hypotheses and can also be used to analyze interaction effects. In the case of multiple comparisons, the risk of making an error is high, while ANOVA assists in controlling the error, enhancing the integrity of the research (Fisher 1925). Coefficient data of the suitability index of the regression model were also used to estimate how well the regression model fits the data (Galton 1885). Regression beta coefficients for predictive variables were employed to observe the impact of each variable on the corresponding variable (Yule 1911).

Before carrying out the research procedure (secondary and primary), a "Model of regional development based on EU funds" was created.

The Figure 2 shows a model of regional development based on EU funds. Key areas are defined as follows: human resources, material resources, the level of EU fund absorption, regional autonomy, and regional development. Indicators are set for each area and further elaborated through a series of questions posed to respondents for the purpose of examining the above-mentioned model. The indicators are divided as follows:

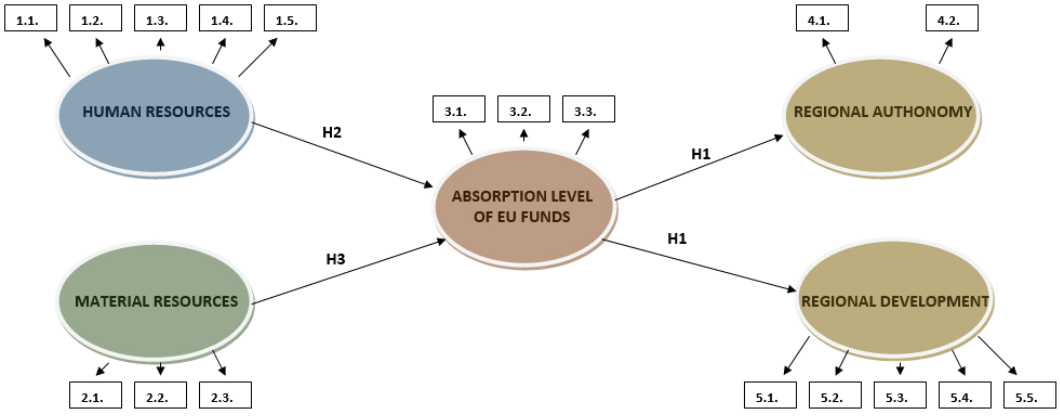

Figure 2. Model of regional development based on EU funds.

Human resources

1.1. Education at all levels in project preparation for EU funds
1.2. Awareness of financing opportunities from EU funds
1.3. Creativity of key people in preparing projects for EU funds
1.4. Motivation of key people in preparing projects for EU funds
1.5. Team collaboration in preparing projects for EU funds

Material resources

2.1. Financial capacities for co-financing projects from EU funds
2.2. Alignment of strategic documents with development needs
2.3. Level of technological readiness for implementing projects from EU funds

Level of EU fund absorption

3.1. Number of prepared projects for EU funds
3.2. Contracting rate of funds from EU funds
3.3. Number of successfully implemented projects from EU funds

Regional autonomy

4.1. Regional competitiveness index
4.2. Level of financial dependence on centralized state resources

Regional development

5.1. Level of consumption
5.2. Number of investments
5.3. Unemployment rate
5.4. Population size
5.5. Level of competitiveness

Within the "Model of regional development based on EU funds", hypotheses were set that needed to be confirmed. The model was then tested with statistical analysis of the questionnaire applied in these countries and available secondary data. The hypotheses were proven, and the model was confirmed as applicable in Croatia and EU member and candidate countries.

5. Results and Discussion

By analyzing survey questionnaires in Poland, Slovenia, Hungary, and Croatia, we tested the proposed "Model of Sustainable Regional Development Based on EU Funds".

Table 1 lists the results of the descriptive analysis by scales described under the instruments. The data presented are shown for each scale and for respondents within each country.

Table 1. Descriptive data by scales and by countries of origin of the respondents.

	Country	Number	Arithmetic Mean	Standard Deviation	Min	Max
Education at all levels in the preparation of projects for EU funds	Poland	51	17.4118	1.73409	14.00	20.00
	Slovenia	62	5.8065	2.04730	4.00	15.00
	Hungary	62	6.3871	1.94477	4.00	12.00
	Croatia	69	7.5217	2.96850	4.00	19.00
	Total	244	8.8648	4.98827	4.00	20.00
Awareness of funding opportunities from EU funds	Poland	51	13.2353	1.64424	9.00	15.00
	Slovenia	62	4.9516	1.55160	3.00	11.00
	Hungary	62	5.9516	2.47894	3.00	15.00
	Croatia	69	6.6087	2.00893	3.00	13.00
	Total	244	7.4057	3.63614	3.00	15.00
Creativity of key individuals in preparing projects for EU funds	Poland	51	17.8235	1.51929	15.00	20.00
	Slovenia	62	6.8710	1.47641	4.00	9.00
	Hungary	62	7.0323	1.81042	4.00	12.00
	Croatia	69	8.8116	2.98661	4.00	18.00
	Total	244	9.7500	4.71917	4.00	20.00
Team collaboration in the preparation of projects for EU funds	Poland	51	9.8235	0.38501	9.00	10.00
	Slovenia	62	3.2742	0.77183	2.00	4.00
	Hungary	62	3.5161	1.06728	2.00	7.00
	Croatia	69	4.6377	1.50461	2.00	8.00
	Total	244	5.0902	2.70803	2.00	10.00
Motivation of key individuals in preparing projects for EU funds	Poland	51	16.8235	2.38081	13.00	20.00
	Slovenia	62	6.5806	1.81567	4.00	12.00
	Hungary	62	6.8226	2.04478	4.00	13.00
	Croatia	69	9.4493	2.79988	5.00	18.00
	Total	244	9.5943	4.52648	4.00	20.00
Financial capacities for co-financing projects from EU funds	Poland	51	9.2353	1.12407	7.00	10.00
	Slovenia	62	3.2903	0.83739	2.00	5.00
	Hungary	62	3.1935	0.80650	2.00	4.00
	Croatia	69	3.5362	1.44079	2.00	9.00
	Total	244	4.5779	2.63681	2.00	10.00
Alignment of strategic documents with development needs	Poland	51	9.6471	0.48264	9.00	10.00
	Slovenia	62	3.0484	0.85751	2.00	5.00
	Hungary	62	3.4355	1.31350	2.00	7.00
	Croatia	69	4.6957	1.83355	2.00	10.00
	Total	244	4.9918	2.78590	2.00	10.00

Table 1. *Cont.*

	Country	Number	Arithmetic Mean	Standard Deviation	Min	Max
Level of technological readiness for the implementation of projects from EU funds	Poland	51	9.1176	0.84017	7.00	10.00
	Slovenia	62	3.2258	0.87627	2.00	4.00
	Hungary	62	3.5806	1.34954	2.00	7.00
	Croatia	69	4.4638	1.59576	2.00	9.00
	Total	244	4.8975	2.54057	2.00	10.00
Number of prepared projects for EU funds	Poland	51	4.5294	0.61165	3.00	5.00
	Slovenia	62	1.4677	0.50303	1.00	2.00
	Hungary	62	1.4194	0.49748	1.00	2.00
	Croatia	69	1.3623	0.83966	1.00	5.00
	Total	244	2.0656	1.41850	1.00	5.00
Contracted funds rate from EU funds	Poland	51	9.2941	0.75615	8.00	10.00
	Slovenia	62	3.3387	0.90433	2.00	6.00
	Hungary	62	3.4194	0.73659	2.00	5.00
	Croatia	69	3.4348	1.49979	2.00	9.00
	Total	244	4.6311	2.61902	2.00	10.00
Number of successfully implemented projects from EU funds	Poland	51	13.7647	1.22618	10,00	15,00
	Slovenia	62	4.9355	1.37746	3.00	9.00
	Hungary	62	4.9839	1.16636	3.00	8.00
	Croatia	69	6.6812	2.28481	3.00	12.00
	Total	244	7.2869	3.77664	3.00	15.00
Regional competitiveness index	Poland	51	27.1176	2.24185	24.00	30.00
	Slovenia	62	10.8548	1.99052	6.00	14.00
	Hungary	62	11.5323	4.76228	8.00	30.00
	Croatia	69	13.0435	5.85972	6.00	28.00
	Total	244	15.0451	7.52896	6.00	30.00
Level of financial dependence on centralized state funds	Poland	51	25.9412	2.23080	23.00	30.00
	Slovenia	62	10.2097	2.33391	6.00	18.00
	Hungary	62	11.1129	2.48342	7.00	19.00
	Croatia	69	13.7536	4.83372	6.00	24.00
	Total	244	14.7295	6.75867	6.00	30.00
Level of personal consumption	Poland	51	8.5882	0.98339	7.00	10.00
	Slovenia	62	3.3871	0.91176	2.00	6.00
	Hungary	62	3.8387	0.63229	2.00	5.00
	Croatia	69	5.0870	1.89224	2.00	10.00
	Total	244	5.0697	2.28415	2.00	10.00
Level of state consumption	Poland	51	5.2353	0.95054	4.00	7.00
	Slovenia	62	3.3065	1.12481	2.00	8.00
	Hungary	62	3.6129	1.61301	2.00	9.00
	Croatia	69	4.3478	2.31254	2.00	10.00
	Total	244	4.0820	1.77820	2.00	10.00

Table 1. *Cont.*

	Country	Number	Arithmetic Mean	Standard Deviation	Min	Max
Number of investments	Poland	51	9.1765	0.79261	8.00	10,00
	Slovenia	62	3.3226	0.84493	2.00	4.00
	Hungary	62	3.8387	0.70580	2.00	5.00
	Croatia	69	2.8696	1.38174	2.00	9.00
	Total	244	4.5492	2.60295	2.00	10.00
Unemployment rate	Poland	51	5.8824	0.90878	4.00	8.00
	Slovenia	62	5.5161	0.97075	2.00	6.00
	Hungary	62	5.2258	0.87627	2.00	6.00
	Croatia	69	5.6522	1.23462	2.00	10.00
	Total	244	5.5574	1.03875	2.00	10.00
Population	Poland	51	7.9412	0.64535	7.00	9.00
	Slovenia	62	3.9194	0.87400	2.00	6.00
	Hungary	62	3.9516	1.01509	2.00	7.00
	Croatia	69	4.0435	1.91307	2.00	10.00
	Total	244	4.8033	2.04331	2.00	10.00
Level of competitiveness	Poland	51	9.0588	0.73244	8.00	10.00
	Slovenia	62	3.6129	0.66171	2.00	5.00
	Hungary	62	3.6290	0.90958	2.00	6.00
	Croatia	69	2.8406	1.38928	2.00	10.00
	Total	244	4.5369	2.55045	2.00	10.00

In Table 2, the ANOVA (analysis of variance) is presented, which shows whether the differences between individual groups are statistically significant. The F-ratio must be significant if there are differences. The last column contains the confidence coefficient. If it is less than 0.05, meaning 5%, then there are differences. It is clear that all scales are different from one another, and further analysis using the post hoc test showed that Poland has statistically significantly higher results on all scales compared to Slovenia, Croatia, and Hungary. This data speaks of clear differences between countries in various aspects and processes that are important for attracting funds from EU sources.

Table 2. ANOVA results for all scales within the survey according to the amounts of respondent scores from Croatia, Slovenia, Hungary, and Poland.

		Sum of Squared Deviations	df	Mean Squared Deviation	F	Sig.
Education at all levels in the preparation of projects for EU funds	Between groups	4,810,579	3	1,603,526	311,375	0.000
	Within groups	1,235,957	240	5150		
	Total	6,046,537	243			
Awareness of financing opportunities from EU funds	Between groups	2,281,511	3	760,504	195,981	0.00
	Within groups	931,321	240	3881		
	Total	3,212,832	243			

Table 2. *Cont.*

		Sum of Squared Deviations	df	Mean Squared Deviation	F	Sig.
Creativity of key people in the preparation of projects for EU funds	Between groups	4,356,884	3	1,452,295	330,422	0.00
	Within groups	1,054,866	240	4395		
	Total	5,411,750	243			
Team collaboration in the preparation of projects for EU funds	Between groups	1,514,840	3	504,947	453,585	0.00
	Within groups	267,176	240	1113		
	Total	1,782,016	243			
Motivation of key people in the preparation of projects for EU funds	Between groups	3,706,203	3	1,235,401	232,979	0.00
	Within groups	1,272,629	240	5303		
	Total	4,978,832	243			
Financial capacities for co-financing projects from EU funds	Between groups	1,402,733	3	467,578	391,295	0.00
	Within groups	286,788	240	1195		
	Total	1,689,520	243			
Alignment of strategic documents with development needs	Between groups	1,495,631	3	498,544	306,519	0.00
	Within groups	390,353	240	1626		
	Total	1,885,984	243			
Level of technological readiness for implementation of projects from EU funds	Between groups	1,202,050	3	400,683	262,464	0.00
	Within groups	366,389	240	1527		
	Total	1,568,439	243			
Number of prepared projects for EU funds	Between groups	391,771	3	130,590	322,511	0.00
	Within groups	97,180	240	0.405		
	Total	488,951	243			
Rate of contracted funds from EU funds	Between groups	1,402,275	3	467,425	424,083	0.00
	Within groups	264,529	240	1102		
	Total	1,666,803	243			
Number of successfully implemented projects from EU funds	Between groups	2,837,030	3	945,677	360,895	0.00
	Within groups	628,888	240	2620		
	Total	3,465,918	243			
Regional competitiveness index	Between groups	9,563,211	3	3,187,737	181,668	0.00
	Within groups	4,211,293	240	17,547		
	Total	13,774,504	243			
Level of financial dependence on centralized state funds	Between groups	8,554,029	3	2,851,343	268,771	0.00
	Within groups	2,546,119	240	10,609		
	Total	11,100,148	243			
Level of personal consumption	Between groups	900,888	3	300,296	196,417	0.00
	Within groups	366,928	240	1529		
	Total	1,267,816	243			
Level of state spending	Between groups	123,645	3	41,215	15,343	0.00
	Within groups	644,716	240	2686		
	Total	768,361	243			

Table 2. *Cont.*

		Sum of Squared Deviations	df	Mean Squared Deviation	F	Sig.
Number of investments	Between groups	1,411,237	3	470,412	480,067	0.00
	Within groups	235,173	240	0.980		
	Total	1,646,410	243			
Unemployment rate	Between groups	12,928	3	4309	4149	0.07
	Within groups	249,269	240	1039		
	Total	262,197	243			
Population	Between groups	635,413	3	211,804	134,073	0.00
	Within groups	379,145	240	1580		
	Total	1,014,557	243			
Level of competitiveness	Between groups	1,345,421	3	448,474	457,534	0.00
	Within groups	235,247	240	0.980		
	Total	1,580,668	243			

The variable "Education at all levels in the preparation of projects for EU funds" is statistically significantly different between the selected countries in which the research was conducted (F = 311.375, df = 3, 240, $p < 0.05$). It is visible that $p < 0.05$, which is significant. It was recorded that Poland has the highest level of education for project preparation for EU funds, while Slovenia has the lowest.

The variable "Awareness of funding opportunities from EU funds" is statistically significantly different between the selected countries in which the research was conducted (F = 195.981, df = 3, 240, $p < 0.05$). It is visible that $p < 0.05$, which is significant. It was recorded that Poland has the highest level of awareness of funding opportunities from EU funds, while Slovenia has the lowest.

The variable "Creativity of key persons in the preparation of projects for EU funds" is statistically significantly different between the selected countries in which the research was conducted (F = 330.422, df = 3, 240, $p < 0.05$). It is visible that $p < 0.05$, which is significant. It was recorded that Poland has the highest level of creativity in project preparation, while Slovenia has the lowest.

The variable "Team cooperation in the preparation of projects for EU funds" is statistically significantly different between the selected countries in which the research was conducted (F = 453.585, df = 3, 240, $p < 0.05$). It is visible that $p < 0.05$, which is significant. It was recorded that Poland has the highest level of team cooperation for project preparation for EU funds, while Slovenia has the lowest.

The variable "Motivation of key persons in the preparation of projects for EU funds" is statistically significantly different between the selected countries in which the research was conducted (F = 232.979, df = 3, 240, $p < 0.05$). It is visible that $p < 0.05$, which is significant. It was recorded that Poland has the highest level of motivation for EU fund preparation, while Slovenia has the lowest.

The variable "Financial capacity for co-financing projects from EU funds" is statistically significantly different between the selected countries in which the research was conducted (F = 391.295, df = 3, 240, $p < 0.05$). It is visible that $p < 0.05$, which is significant. It was recorded that Poland has the highest level of financial capacity for co-financing projects from EU funds, while Hungary has the lowest.

The variable "Alignment of strategic documents with development needs" is statistically significantly different between the selected countries in which the research was conducted (F = 306.519, df = 3, 240, $p < 0.05$). It is visible that $p < 0.05$, which is significant.

It was recorded that Poland has the highest level of alignment of strategic documents with development needs, while Slovenia has the lowest.

The variable "Level of technological preparedness for the implementation of projects from EU funds" is statistically significantly different between the selected countries in which the research was conducted (F = 262,464, df = 3, 240, $p < 0,05$). It is evident that $p < 0.05$, which is significant. It has been recorded that Poland has the highest level of technological readiness for the implementation of projects from EU funds, while Slovenia has the lowest.

The variable "Number of projects prepared for EU funds" differs significantly between the selected countries in which the research was conducted (F = 322.511, df = 3, 240, $p < 0.05$). It is evident that $p < 0.05$, which is significant. It has been recorded that Poland has the highest number of prepared projects for EU funds, while Croatia has the lowest.

The variable "Contracted funds rate from EU funds" differs significantly between the selected countries in which the research was conducted (F = 424.083, df = 3, 240, $p < 0.05$). It is evident that $p < 0.05$, which is significant. It has been recorded that Poland has the highest rate of contracted funds from EU funds, while Slovenia has the lowest.

The variable "Number of successfully implemented projects from EU funds" differs significantly between the selected countries in which the research was conducted (F = 360.895, df = 3, 240, $p < 0.05$). It is evident that $p < 0.05$, which is significant. It has been recorded that Poland has the highest number of successfully implemented projects from EU funds, while Slovenia has the lowest.

The variable "Regional Competitiveness Index" differs significantly between the selected countries in which the research was conducted (F = 181.686, df = 3, 240, $p < 0.05$). It is evident that $p < 0.05$, which is significant. It has been recorded that Poland has the highest regional competitiveness index, while Slovenia has the lowest.

The variable "Level of financial dependence on central state funds" differs significantly between the selected countries in which the research was conducted (F = 268.771, df = 3, 240, $p < 0.05$). It is evident that $p < 0.05$, which is significant. It has been recorded that Poland has the highest level of financial dependence on central state funds, while Slovenia has the lowest.

The variable "Level of personal consumption" differs significantly between the selected countries in which the research was conducted (F = 196.417, df = 3, 240, $p < 0.05$). It is evident that $p < 0.05$, which is significant. It has been recorded that Poland has the highest level of personal consumption, while Slovenia has the lowest.

The variable "Level of government spending" differs significantly between the selected countries in which the research was conducted (F = 15.343, df = 3, 240, $p < 0.05$). It is evident that $p < 0.05$, which is significant. It has been recorded that Poland has the highest level of government spending, while Slovenia has the lowest.

The variable "Number of investments" differs significantly between the selected countries in which the research was conducted (F = 480.067, df = 3, 240, $p < 0.05$). It is evident that $p < 0.05$, which is significant. It has been recorded that Poland has the highest number of investments, while Slovenia has the lowest.

The variable "Unemployment rate" differs significantly between the selected countries in which the research was conducted (F = 4.149, df = 3, 240, $p < 0.05$). It is evident that $p < 0.05$, which is significant. It has been recorded that unemployment rates are very close in the examined countries, with the perception of high unemployment being the highest in Poland and the lowest in Hungary.

The variable "Population size" differs significantly between the selected countries in which the research was conducted (F = 134.073, df = 3, 240, $p < 0.05$). It is evident that $p < 0.05$, which is significant. It has been recorded that Poland has the largest population, while Slovenia has the smallest.

The variable "Level of competitiveness" differs significantly between the selected countries in which the research was conducted (F = 448.474, df = 3, 240, $p < 0.05$). It is

evident that $p < 0.05$, which is significant. It has been recorded that Poland has the highest level of competitiveness, while Croatia has the lowest.

The main reason for this is the fact that Poland's awareness of the importance of EU funds was far greater than that of everyone else. Immediately after signing the pre-accession agreement, Poland had a strong campaign on the importance of EU funds and significant investments in educating the entire regional development system for the preparation and implementation of projects according to EU methodology. In addition, strong public information campaigns were conducted and potential project stakeholders were approached, considering the future of co-financing projects from EU structural funds. Teams at all levels were prepared to work on projects, significant importance was placed on motivating people, and capacities were prepared for financing large projects. Regional development policy was moving towards adapting to the current situation and needs of Poland on the one hand, and EU legislation on the other. As a result, Poland achieved the best results in terms of the number of successfully co-financed and implemented projects from EU funds, which had a huge impact on investments, consumption, and competitiveness, and thus influenced the regional development of the country. Poland's preservation from the financial crisis that recently affected the whole world is mainly due to these reasons. Poland is the only EU country that had growth in GDP per capita during the crisis.

In the continuation of the analysis, the results indicate the interconnection of different aspects of attracting EU funds.

As part of the first hypothesis, which states that there is a cause-and-effect relationship between the absorption of European Union funds and the regional development of beneficiary countries, a hierarchical regression analysis was used.

From Table 3, it can be seen that the adjusted R^2 for the second step of the analysis is 0.767, which means that the model explained approximately 77% of the variance, and that the F-ratios are statistically significant. From Table 4, it can be seen that the number of prepared projects for EU funds is a better predictor than the number of successfully implemented projects from EU funds. The beta coefficient of the "Number of prepared projects for EU funds" is $\beta = 0.602$, $t = 10.283$, $p < 0.01$, and the beta coefficient for the "Number of successfully implemented projects from EU funds" is $\beta = 0.219$, $t = 3.101$, $p < 0.05$. These data support the posited hypothesis that there is a cause–effect relationship between the absorption of European Union funds and the regional development of recipient countries (HYPOTHESIS 1 ACCEPTED). For a more precise explanation of the hypothesis, it should be noted that regression analysis is an indicator of correlation, not a cause–effect relationship. However, since it can be logically assumed that the direction in this case is cause–effect, we confirm the hypothesis in this way with the remark that it is about the assumed direction of influence.

Table 3. Coefficient data of the suitability index of the regression model.

Model	R	Adjusted R2	Change Statistics				
			Change in R2	Change in F Ratio	df1	df2	Change in R2
1	0.862 a	0.741	0.742	696,931	1	242	0.000
2	0.877 b	0.767	0.026	27,290	1	241	0.000

Note: a, b mean the steps of analysis. a is the first step and b is the second step.

According to Table 4, the number of prepared projects is more significant than the number of successfully implemented projects. Of course, both variables are extremely important predictors for regional development, but the data show that the overall project capacity with which a country competes for EU funds is also extremely important. The assumption is that countries with a larger number of projects have a wider choice and greater opportunities to choose more projects that meet the criteria of EU funds from a larger number of projects.

Table 4. Regression beta coefficients for predictor variables "Number of prepared projects for EU funds" and "Number of successfully implemented projects from EU funds" in relation to the criterion variable "Regional development".

Model		Standardized Coeff.	t	Significance
		Beta		
1	(Constant)		9101	0.000
	Number of prepared projects for EU funds	0.862	26,399	0.000
2	(Constant)		4578	0.000
	Number of prepared projects for EU funds	0.602	10,283	0.000
	Number of successfully implemented projects from EU funds	0.219	3101	0.002

To test Hypothesis 2, which states that investing in human resources significantly increases the utilization of available European Union funds, a hierarchical regression analysis was also conducted. From Table 5, the adjusted R^2 for the fourth step of the analysis is 0.847, which means that the model explained approximately 85% of the variance, and that the F-ratios are statistically significant.

Table 5. Coefficient data of the suitability index of the regression model.

Model	R	Adjusted R2	Change Statistics				
			Change in R2	Change in F Ratio	ss1	ss2	Significance of Change in F Ratio
1	0.893 a	0.796	0.797	949,178	1	242	0.00
2	0.915 b	0.837	0.41	61,481	1	241	0.00
3	0.920 c	0.844	0.08	12,643	1	240	0.00
4	0.922 d	0.847	0.04	5892	1	239	0.16

Note: a, b, c, d mean the steps of analysis. a is the first step, b is the second step, c is the third step and d is the fourth step.

In the Tables 6 and 7, the variable "Education at all levels in the preparation of projects for EU funds" was proven to be a statistically significant predictor of the criterion variable "Number of successfully implemented projects from EU funds"—the regression coefficients of the hierarchical regression analysis are $\beta = 0.401$, $t = 6.704$, $p < 0.05$. The other beta coefficients are $\beta = 0.214$, $t = 3.178$, $p < 0.05$, for the variable "Creativity of key people in the preparation of projects for EU funds", $\beta = 0.205$, $t = 3.209$, $p < 0.05$ for the variable "Team collaboration in the preparation of projects for EU funds ", and $\beta = 0.147$, $t = 2.427$, $p < 0.05$ for the variable "Motivation of key people in the preparation of projects for EU funds".

As we can see according to the beta coefficients, education at all levels in the preparation of projects for EU funds is the most important predictor, but creativity, team collaboration, and motivation of key people in the preparation of projects for EU funds are also very important. Based on these results, it can be claimed that HYPOTHESIS 2 IS ACCEPTED, i.e., this research has determined that the level of utilization of available EU funds can be significantly increased by investing in human resources.

As part of Hypothesis 3, the claim that strengthening material resources significantly increases the utilization of available European Union funds was examined. The hypothesis was also tested by hierarchical regression analysis. The model is also significantly explained; the adjusted R2 is 0.844 or almost 85% of the variance. The measures "Level of technological readiness for the implementation of projects from EU funds", "Alignment of strategic documents with development needs", and "Financial capacities for co-financing projects from EU funds" were taken as predictor variables, while the criterion variable was "Number of successfully implemented projects from EU funds".

Table 6. Regression beta coefficients for predictor variables "Education at all levels in the preparation of projects for EU funds", "Creativity of key people in the preparation of projects for EU funds", "Team collaboration in the preparation of projects for EU funds", and "Motivation of key people in the preparation of projects for EU funds" in relation to the criterion variable "Number of successfully implemented projects from EU funds" (own elaboration).

Model		Standardized Coefficients	t	Significance
		Beta		
1	(Constant)		5810	0.000
	Education at all levels in the preparation of projects for EU funds	0.893	30,809	0.000
2	(Constant)		2168	0.031
	Education at all levels in the preparation of projects for EU funds	0.544	10,563	0.000
	Creativity of key people in the preparation of projects for EU funds	0.404	7841	0.000
3	(Constant)		2013	0.045
	Education at all levels in the preparation of projects for EU funds	0.436	7427	0.000
	Creativity of key people in the preparation of projects for EU funds	0.296	5032	0.000
	Team collaboration in the preparation of projects for EU funds	0.227	3556	0.000
4	(Constant)		1307	0.192
	Education at all levels in the preparation of projects for EU funds	0.401	6704	0.000
	Creativity of key people in the preparation of projects for EU funds	0.214	3178	0.002
	Team collaboration in the preparation of projects for EU funds	0.205	3209	0.002
	Motivation of key people in the preparation of projects for EU funds	0.147	2427	0.016

Table 7. Data on the coefficient index of the suitability of the regression model.

Model	R	Adjusted R2	Change Statistics				
			Change in R2	Change F Ratio	df1	df2	Change in R2
1	0.881 a	0.775	0.776	839,446	1	242	0.000
2	0.912 b	0.830	0.055	78,838	1	241	0.000
3	0.920 c	0.844	0.015	23,206	1	240	0.000

Note: a, b, c mean the steps of analysis. a is the first step, b is the second step and c is the third step.

According to Table 8, HYPOTHESIS 3 IS ACCEPTED, i.e., it has been determined that there is a statistically significant correlation between certain aspects of existing material resources and the quantity, i.e., number of projects from EU funds. The most important aspect of material resources relates to the "Level of technological readiness for the implementation of EU fund projects" whose beta coefficient is $\beta = 0.432$, $t = 8.642$, $p < 0.01$, followed by "Alignment of strategic documents with development needs" $\beta = 0.315$, $t = 6.462$, $p < 0.01$, and "Financial capacities for co-financing projects from EU funds" $\beta = 0.232$, $t = 4.817$, $p < 0.01$.

Table 8. Regression beta coefficients for predictor variables "Level of technological readiness for the implementation of EU fund projects", "Alignment of strategic documents with development needs", and "Financial capacities for co-financing projects from EU funds" in relation to the criterion variable "Number of successfully implemented projects from EU funds".

	Model	Standardized Coefficients	t	Significance
		Beta		
1	(Constant)		3500	0.001
	Level of technological readiness for the implementation of projects from EU funds	0.881	28,973	0.000
2	(Constant)		2501	0.013
	Level of technological readiness for the implementation of projects from EU funds	0.542	11,669	0.000
	Alignment of strategic documents with development needs	0.412	8879	0.000
3	(Constant)		2300	0.022
	Level of technological readiness for the implementation of projects from EU funds	0.432	8642	0.000
	Alignment of strategic documents with development needs	0.315	6462	0.000
	Financial capacities for co-financing projects from EU funds	0.232	4817	0.000

According to Marcu et al. (2020), the means to improve the absorption of funds from the EU are to increase administrative capacities, improve project quality, better coordinate among institutions, and involve regional and local stakeholders in governance. Wolleghem (2020) and Aivazidou et al. (2020) also confirm in their research the importance of capacity over preferences, particularly regarding the assertion that decentralization, strategic planning, and financial capacities play a positive role in the utilization of EU funds. This emphasizes that simplifying rules and procedures would increase absorption and implementation of the funds. Biedka et al. (2021) emphasize the importance of investing in human resources as a key driver of regional development and ensuring high-quality project application and implementation. Pîrvu et al. (2019) emphasize the importance of changing the strategic orientations of EU cohesion policy and directing funds towards innovation, as well as social and environmental strategies. The results of the research conducted by Šostar (2021b) emphasize the importance of human resources, not only in regional planning, but also in the preparation and implementation of projects funded by EU funds. People are a very important factor; in the end, a higher level of education means a larger number of projects. It has been proven that many countries have problems due to the low level of education regarding the preparation and implementation of projects from EU funds. People are a form of wealth and investing in human resources is investing in the future. Problems that arise during the preparation of projects for EU funds are also problems of financial capacity. It is often the case that less developed countries, regions, cities, or villages have low annual budgets with insignificant financial resources allocated for co-financing projects. The underdeveloped regions that need investment in development and technology suffer the most. Compliance of strategic documents with the projects to be applied for is the basis for quality planning. Large bureaucracy and administration are visible, and it is necessary to minimize this in compliance with the laws and regulations and rules of the tender. The study of Šostar and Marukić (2017) explains how poor implementation of public procurement procedures leads to the return of money from already funded projects, which is a direct consequence of insufficient investment in human resources.

6. Conclusions

The European Union's regional policy is designed to reduce economic and social disparities between member states by supporting regional development. The European Union implements its regional policy through cohesion policy. By co-financing projects in the areas it covers, the development of individual regions is encouraged. However, it does not necessarily mean that more approved funds from EU funds result in greater regional development. Therefore, we need to measure the real effects and impacts of attracted funds on regional development within each fund-using country. EU funds have had a strong impact on the regional development of fund-using countries. The best example is the economic crisis (2008), which affected most European and other countries, thereby drastically reducing investments and leading to a decline in standards in these countries. Poland, as a country that has directed all its resources to exploit the funds available through development projects, was one of the few countries that managed to avoid the crisis, and experienced slight GDP growth.

To identify the main problems that countries face in absorbing EU funds, to determine the differences in the approach to regional policy, and to establish successful models of absorption of EU funds, research was conducted in Croatia, Poland, Hungary, and Slovenia. For this purpose, a unique "EU Fund-Based Regional Development Model" was established, within which hypotheses were set that needed to be confirmed. Then, the model was tested by statistical analysis of the conducted questionnaire in these countries and available secondary data. The hypotheses were proven, and the model was confirmed as applicable in Croatia and member countries, as well as candidate countries of the EU.

The research results show the importance of human resources, not only in regional planning, but also in the preparation and implementation of projects financed from EU funds. People are a very important factor; ultimately, a higher degree of education means a larger number of projects. It has been proven that many countries have problems due to a low level of education for the preparation and implementation of projects from EU funds. The degree of readiness of projects is important when issuing public calls for project delivery. Only those with completely prepared documentation can apply for the competition. The competition itself lasts a very short period, which means that if the project is not ready or in the final phase of readiness at the time of the competition announcement, there is a high probability that it will not be able to apply for the competition. In this way, a large part of the funds allocated for a particular country remains unused. To ensure that a larger number of the projects are ready on time, it is crucial to have a satisfactory number of people at all levels educated for the preparation and implementation of projects financed from EU funds. In addition, there is a great need to provide information about the possibilities of financing projects with EU funds. Indeed, many potential applicants are not at all aware of the possibility of financing their projects. They either have not heard of any possibilities, or have heard about some information, but not enough, or have heard enough but do not trust and are skeptical about it. Therefore, it is important to inform the public daily through various media about the possibilities of financing projects from EU funds. Here, the connection between the level of education and information can be emphasized, because it is not a rare case that people who should convey information about current competitions from EU funds do not have enough information themselves or are late in conveying this to target groups. For this reason, it is important to adequately educate these people and "push" a policy of daily information transfer to potential users of EU funds. Sometimes it is not enough to just educate people for the preparation and implementation of projects from EU funds. People who deal with this work must have an appropriate degree of creativity. Insufficient creativity can turn a high-quality project idea into an average project, while a creative person can turn an average idea into a quality project. For this reason, it is necessary to select individuals who fit the profile of people who have the potential to be successful in project management so that the emphasis of projects is placed not only on quantity but also on quality. In the preparation and implementation of projects financed from EU funds, it is important to work as a team. Many projects require

gathering all stakeholders who directly or indirectly have some influence on the project or will, in turn, be directly or indirectly affected by it and their environment. It is necessary to "gather minds" and present the best possible solution to the satisfaction of all stakeholders. When preparing projects, it is important that project partners, in addition to the applicant, participate actively and that their needs and resources are maximally utilized by involving them in all processes of the application and implementation of projects. For the entire project to function, it is necessary to work as a team from the beginning to the end of the project implementation. Often, such team cooperation leads to cooperation of the same partners in the future, which is an indicator of quality and satisfying teamwork. All of the above is important in the processes of preparation and implementation of projects financed from EU funds; however, if the persons responsible for initiating regional activities through the preparation and implementation of projects financed from EU funds are not motivated enough, the projects will not be of high enough quality, their number will be insufficient, and all this will ultimately lead to poor absorption of EU funds. A relevant question is about how to motivate an individual. The preparation and implementation of projects is a very complex process, requires a lot of knowledge, skills, and experience, and should certainly be adequately paid. The individual is also motivated by the environment in which they work. Interpersonal relationships, a workspace, and an organized reward system are all factors that lead to the satisfaction of an individual who thus increases the quality, speed, and efficiency of their work.

Problems that arise during the preparation of projects for EU funds are problems of financial capacity. It is often the case that less developed countries, regions, cities, or villages have low annual budgets with insignificant financial resources allocated for co-financing projects. Those experiencing the greatest "suffering" are those underdeveloped regions that most need investment in development and technology. Projects that the EU co-finances through available funds must mostly be co-financed by the applicant and partners on the project in a certain percentage. These percentages range between 10 and 50% of the total value of each project. This, at the very start, creates limitations that are practically unsolvable. In the end, this problem leads to the absorption of funds for investment and development projects only by those regions that are already sufficiently developed and have a large amount of funds at their disposal. Those small, underdeveloped regions, without financial capabilities, are again forgotten. Thus, the differences between the regions deepen. This problem encompasses most countries, some more, some less, and the only solution is the involvement of state authorities through regional development policy and co-financing policy of projects crucial for the development of a particular region. Strategic documents are sometimes made "spontaneously", without any concrete direction of development, without an idea, and without a real desire to achieve a satisfactory level of development. Strategic documents are prepared without consulting the "little man", and without lower levels where problems exist, which often leads to creating wrong development priorities with measures that cannot help those most in need. These strategic documents often end up in "drawers", without real application, with "wandering", many unknowns, and without problem solving. Development strategies should represent the real state and analyze the current situation for given goals over a certain period. Such documents must be aligned with strategic documents at the national and EU levels, and the content must be focused on addressing pressing issues and balanced, sustainable development of regions and the country. However, pressure must be exerted on the implementation of these documents and the sanctioning of disinterested actions. Proactivity in their realization is the key to success for the beneficiaries. The research also showed the relationship between applied projects, approved projects for financing, and truly implemented projects for which funds have been fully paid. Many prepared and applied projects do not necessarily mean a high level of absorption of EU funds. Here, the relationship between quality and quantity can be observed. As EU funds are associated with very large financial resources, "instant consultants" often appear in the process of project preparation and implementation. These are individuals without sufficient knowledge, skills, and experience in project preparation

and implementation, with an emphasis on hyper-production and a low degree of quality. These projects are rarely approved for financing, but this type of "consultant" charges well for their service. Another situation that arises is that projects are approved for financing, but they are very difficult or impossible to implement, and when the first major problem arises in implementation, funds must be returned to the EU. All the above directly influence the regional development of a particular country and the reduction in regional differences within it. However, the question arises as to why some countries are more successful in absorbing funds from EU funds than others. The best positive example is Poland, as a country that has used the most of the EU funds. One of the reasons for this is that Poland had a vision. Regional policy, which was designed at national levels, served the absorption of financial resources from EU funds. Preparations started years before accession, so Poland was ready for EU funds. Significant efforts were made to prepare institutions, organizations, and entrepreneurs for the incoming funds. A strong information campaign, coupled with a series of workshops and educational cycles, strengthened institutional and human capacities. Projects began to be prepared in advance, with an emphasis on the highest degree of readiness of project documentation when funds become available. The result of this is many quality projects ready for implementation at the moment of the announcement of the competition. The implemented projects covered all areas of development, which is the result of striving for uniform regional development. Large financial resources obtained from the EU through projects have stimulated investments, increased consumption, and raised the level of competitiveness of the Polish economy to a very high level. This is relevant to the fact that Poland is the only EU country that saw an increase in economic activity during the financial crisis, which recently engulfed the entire world. Despite this, Poland recorded growth, which is certainly the result of a large financial "injection" by the EU through project financing.

In this paper, a unique "Model of regional development based on EU funds" was established, and it was proven that the model is functional and applicable to the Republic of Croatia, as well as other EU countries over a longer period. As there is a cause-and-effect relationship between the absorption of EU funds and the regional development of beneficiary countries, it is crucial to invest in human and material resources to raise the level of absorption to a high level.

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The Dynamics of Fund Absorption: Evaluating the Efficacy of EU Structural Funds in Mitigating Regional Inequalities—Calabrian Case

Guzmán A. Muñoz-Fernández [1,*], Angela Bertucci [1], José E. Ramos-Ruiz [2] and Maria Luisa Garo [3]

[1] Department of Business Organization, Faculty of Law, Economics and Business Studies, University of Cordoba, 14071 Cordoba, Spain; angebertucci@gmail.com
[2] Department of Applied Economics, Faculty of Law, Economics and Business Studies, University of Cordoba, 14071 Cordoba, Spain; d22raruj@uco.es
[3] Independent Researcher, 89900 Vibo Valentia, Italy; marilu.garo@gmail.com
* Correspondence: guzman.munoz@uco.es

Abstract: The European Union aims for territorial cohesion, with human capital as a key factor. Assessing how investment in regional human capital enhances this cohesion is therefore essential. This study assesses the impact of the EU Structural Funds (ESFs) in Calabria (Italy), a region grappling with economic challenges and a brain drain phenomenon. Aimed at fostering regional cohesion, ESFs have been directed towards supporting Calabrian graduates' pursuit of master's degrees, intending to incentivize their retention or return postgraduation. A comprehensive survey of the beneficiaries of these subsidies was carried out to determine their employability in the region and the probability of the return of migrants, analyzed by logistic regression of the data. Results demonstrate a dual effect: while the quality of education and EU funding positively influence graduates to work in Calabria, acquiring advanced skills paradoxically diminishes this propensity. Moreover, although the likelihood of returning to Calabria for those working elsewhere does increase, ESF support counterintuitively reduces this probability. The findings reveal a vicious cycle; they equip graduates with high-level skills that facilitate their access to the labor market but simultaneously encourage their migration due to more favorable conditions elsewhere. It is suggested that synergies between ESF-funded policies and those supported by the European Regional Development Fund (ERDF) should be encouraged.

Keywords: European structural fund; human capital; cohesion policy; Calabria

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1. Introduction

Since its establishment, the European Union (EU) has strived to fortify economic, social, and territorial cohesion, dedicating a significant portion of its budget to alleviate disparities, particularly in remote regions plagued by various challenges (European Union 2008; Gross and Debus 2018; Hawes 2014). The Cohesion Policy, the second-largest budget allocation, seeks to diminish territorial and social imbalances with differentiated support based on regional development and Gross Domestic Product (GDP) per capita (Ahner 2009; Boldrin et al. 2001; Fiaschi et al. 2018; Giua 2017). However, using GDP per capita as the sole criterion for classifying regions and allocating funds is inadequate. European territories are diverse, possessing unique territorial assets—collectively termed "territorial capital"—rooted in their respective economic, cultural, social, and environmental contexts. This capital influences Cohesion Policy fund utilization and regional investment returns (Camagni 2017; Crescenzi et al. 2020b; Fratesi and Perucca 2019; Fratesi and Percoco 2014).

Therefore, assessing Cohesion Policy effectiveness is crucial for understanding its regional development impact and how it leverages territorial capital to enhance well-being (Calegari 2021; European Parliament's Committee 2019). Despite extensive evaluations, the

literature remains divided on whether the policy effectively fosters growth, convergence, and harmonious EU development (Dall'Erba and Le Gallo 2008; Notermans 2016). Conflicting findings arise from empirical, conceptual, and methodological discrepancies (Begg 2010; Dall'Erba and Fang 2017; Fratesi 2016), coupled with the policy's diverse objectives and complex regional, national, and local regulations (Bachtrögler et al. 2020; Crescenzi et al. 2020b; Medeiros and Rocha 2014).

Furthermore, economic cohesion has waned, with polarization between Europe's northwestern core and its southern and eastern peripheries, exacerbating social and territorial divergence (Notermans 2016; Farole et al. 2011). The Cohesion Policy's relationship with territorial capital is intricate: Regions with abundant capital tend to support each other, but the policy's multifaceted nature means investments do not always directly promote growth (Camagni 2017; Fratesi and Perucca 2019). Enhancing absorption capacity is key: Not just funding volume but sustainable utilization of EU funds matters (Aivazidou et al. 2020). Recent studies posit human capital and institutional quality as pivotal in achieving policy targets, linking education quality, labor market institutions, and youth unemployment reduction (Becker et al. 2013; Crescenzi et al. 2020a; Lahtinen et al. 2020; Tosun et al. 2016).

Addressing gaps in local-level effectiveness studies, our research examines the Cohesion Policy's impact on higher education and youth employment in Calabria, Italy—an Objective 1 area (Caldas et al. 2018; Giua 2017; Fratesi and Perucca 2019). The choice of Calabria for this study has two reasons. Firstly, although Calabria has natural and territorial resources like Sardinia or Provence-Alpes-Côte d'Azur and has received European funding to overcome its historical problems, it is characterized by significant structural problems that prevent foreign investment and reduce its attractiveness. Secondly, Calabria, unlike other southern Italian regions such as Puglia or Sicily, which received the same ESFs to reduce emigration flow and achieve their goals to retrain young human resources, still has a high emigration rate. We thus focused on human capital investments from 2014–2020 (Regione Calabria 2015), as evidence suggests such spending promotes economic growth (Cuaresma et al. 2018; Di Caro and Fratesi 2022).

The main objective of this research is to analyze the impacts that postgraduate scholarships, funded through the Structural Funds, have on access to the labor market and migration dynamics in the Calabria region. This analysis aims to scientifically substantiate proposals aimed at enhancing the efficacy of cohesion policy in the employment sector.

A distinctive aspect of this research, unlike previous studies, is that it does not focus on macroeconomic values. Instead, it specifically concentrates on assessing the effectiveness of these educational aids in combating unemployment and migration in the region. The purpose is to discern the local effects of investing in human capital as a tool for regional cohesion, thereby offering a more focused and in-depth perspective on its influence in the local community.

In this study, we assume that although they may have a positive impact on the integration of Calabrian graduates into the local job market, the investments of the ESFs that are aimed at improving the competencies of graduates have a modest impact at the regional level and are not sufficient to prevent the migration of the most highly qualified individuals. The methodology used to measure the outcomes of these programs was to survey graduates from the University of Calabria who received ESFs for their postgraduate studies, assessing their employment status, educational attainment, and their prospects for working in Calabria postgraduation.

This research was organized in a structured manner to achieve the main objective. Beginning with this introduction, an exhaustive bibliographic review was carried out, focusing on the Cohesion Policy and Structural Funds of the European Union as well as on the study of education and regional development. Additionally, an analysis of youth employment in Calabria during the period 2014–2020 was conducted. Following this, the research questions guiding this study are presented, accompanied by a detailed description of the methodology used. Subsequently, an analysis of the collected data is detailed, which

is subject to critical discussion. Finally, the work concludes with the presentation of the conclusions derived from the research.

2. Literature Review

2.1. Development Aid and Structural Funds in the European Union

The European Union's Cohesion Policy, executed through Structural Funds, is designed to mitigate regional disparities and bolster competitiveness and employment across Europe (European Commission 2021). Rooted in the Treaty on the European Union's objective of promoting harmonious development, these funds predominantly assist regions with less than 75% of the EU average GDP per capita. They target areas with inadequate investment, elevated unemployment, and deficient services and infrastructure (Pinho et al. 2015).

Structural Funds encompass several key components. The European Regional Development Fund (ERDF) addresses regional imbalances by fostering infrastructure development, job creation, local projects, and small business aid. The European Social Fund Plus (ESF+) has continued from the 2014–2020 cycle to uphold the European Pillar of Social Rights, preserving employment and fostering social inclusivity. The Cohesion Fund (CF) funds environmental initiatives and trans-European transport in states with a gross national income below 90% of the EU-27 average. Additionally, the Just Transition Fund (JTF), a novel instrument under the European Green Deal, facilitates regions and populations in adapting to the social and environmental repercussions of transitioning towards the EU's 2030 energy and climate targets, aspiring for a climate-neutral economy by 2050 based on the Paris Agreement (European Commission 2021).

These funds, although distinct in objectives and sectors, form an integrated financial system that bolsters economic activities in their respective regions. They enhance both tangible and intangible infrastructures, thus promoting human capital development and investment (Biedka et al. 2022; Startiene et al. 2015). The evolving perception of their efficacy in meeting Cohesion Policy goals reflects society's dynamic nature. The Structural Funds are public investments that stimulate growth and convergence in capital-scarce regions (Vukašina et al. 2022). However, exogenous factors like technological change indicate that internal shifts and economic geography (Scotti et al. 2022) cultivate a conducive environment for capital accumulation in beneficiary regions. This improves their absorptive capacity and the utilization of Structural Funds (Ciani and de Blasio 2015; Crescenzi and Giua 2016; Kersan-Škabić and Tijanić 2017).

From a neoclassical perspective, Structural Funds are vital for budgetary allocations and distribution within disadvantaged EU areas. Similarly, endogenous growth theories emphasize the long-term role of public policies in growth through human capital, innovation, and knowledge investments. When merged with economic geography theories, it becomes evident that Cohesion Policy impacts vary across European regions. This variation is contingent upon their approach to fund allocation (Marzinotto 2012; Vukašina et al. 2022). Absorption capacity stems from socio-economic and institutional development levels and each beneficiary's capability to efficiently utilize the funds (Presbitero 2016). Various impediments, whether financial, institutional, or legal, can compromise the effectiveness of the Structural Funds (Lewandowski 2023).

The scientific literature indicates a positive correlation between Structural Funds and regional development, with direct ties between EU funds and foreign investment (Caldas et al. 2018; Startiene et al. 2015) and long-term competitiveness (Tijanić and Obadic 2015). Nonetheless, factors such as high fiscal decentralization (Tosun 2014), adverse regional traits like corruption or poor governance, and inefficient administrative capacity can hinder these funds' impact. In some cases, Structural Funds may even exacerbate structural inequalities (Czudec et al. 2019) or inadvertently disrupt income convergence within the EU (Breidenbach et al. 2019; Jagodka and Snarska 2023).

2.2. Education, Formation, and Territorial Growth

In recent programming cycles (2014–2020 and 2021–2027), the European Union's Structural Funds have prioritized innovation and smart growth, underscoring the critical role of education, formation, and innovation in fostering growth (Sánchez Trujillo et al. 2020). Human capital is increasingly recognized as a dynamic, lifelong process essential for cultivating basic cognitive skills and enabling individuals to acquire specialized skills (Schweisfurth and Raasch 2018), thereby mitigating the risk of skill atrophy (Dräbing and Nelson 2017).

Aligned with the Europe 2020 Strategy for growth and jobs, education emerges as a cornerstone for smart, sustainable, and inclusive growth. It facilitates access to higher education in less developed areas, enhancing employability and competitiveness and ultimately reducing poverty. The strategy sets ambitious targets, including reducing early school leavers below 10% and ensuring at least 40% of the 30–34-year-old age group attains tertiary education. It advocates for increased investment in tertiary education and lifelong learning, linking education with research and development to foster prolonged economic growth (European Commission 2010).

As of 2022, the EUROSTAT data reveal a varied distribution of education levels across Europe. Eastern countries exhibit lower proportions of individuals with low education, while countries like Spain, Italy, and Portugal report higher rates (over 40%). Conversely, Ireland, Luxembourg, and Sweden boast high tertiary education rates (over 45%), with Romania, Italy, Croatia, and the Czech Republic at the lower end (below 25%). Notably, over 80% of Europeans aged 25–54 years have at least upper secondary education, a contrast to the 68% of the 55–74-year-old age group who have achieved the same level (EUROSTAT 2023).

The 2021–2030 policy framework targets supporting individuals in attaining higher education levels to meet the growing demand for skilled workers, thereby driving innovation and economic growth and improving citizen well-being. The European Education Area Resolution (2021–2030) aims for a minimum of 45% of the 25–34-year-old age group to have tertiary education by 2030 (European Commission 2023).

Investment in human capital should extend beyond primary or secondary education, offering European citizens opportunities for tertiary education and continuous professional training. The Bologna (European Commission 1999) and Copenhagen (European Commission 2002) have facilitated a pan-European higher education area, enhancing mobility, qualification recognition, and cooperation in vocational education (European Commission 1999; European Commission 2002). This fosters exchanges among diverse European cultures and traditions (Powell and Solga 2010).

Education's role in economic growth can be seen in three ways: as a driver of growth, a result of growth, or having a bidirectional relationship with growth. It is pivotal for labor market integration and prosperity, transferring knowledge and ideas from the educated to businesses and projects and fostering innovation (Dudzevičiūtė and Šimelytė 2018). European strategies concur that higher education levels are vital for employment and prosperity, contributing to equitable territories both economically and knowledge-wise (Caleiro 2018).

However, the positive impact of education on territorial growth is not always clear-cut. Endogenous growth theory posits that higher skills and education levels positively influence physical capital productivity and growth (Marquez-Ramos and Mourelle 2019). Yet, local conditions such as job scarcity or low wages can weaken the education–growth nexus, prompting skilled labor migration (Quintano et al. 2018; Pinho et al. 2015).

Migration trends among university graduates reveal that the majority remain in their region of study, though those who migrate for education are more likely to relocate post-graduation (Ciriaci 2014). Factors influencing migration include university reputation, labor market accessibility (Aronica et al. 2023; Dotti et al. 2013), and local economic conditions (Hermannsson et al. 2019). Lagging regions often become net exporters of students and fail to attract those from other areas. This one-way migration of skilled individuals from poorer to richer regions—selective migration—exacerbates spatial inequalities and perpetuates

regional disparities in human capital (Cerqua et al. 2022; Guzi et al. 2021; Sardadvar and Vakulenko 2021).

2.3. The Vicious Circle of Skilled Worker Migration in Southern Italy

Historically, the migratory outflows from the Italian Mezzogiorno have shaped the socio-economic fabric of southern Italy. The 150-year timeline reveals a transition from the predominantly uneducated migrants of the early 20th century to the present-day exodus of educated young adults (Etzo 2011). This shift, particularly evident since the latter half of the 20th century, has been exacerbated by economic crises and a decrease in labor-intensive industries (Bonifazi et al. 2021). Since the 1990s, a resurgence in emigration has been noted, predominantly among those with secondary and higher education, propelled by disparate economic development between the southern regions and the more affluent central and northern Italy (Etzo 2011; Odoardi and Muratore 2019). Today's migratory flows are characterized by the internal and international relocation of individuals seeking superior educational and professional opportunities, contributing to a self-perpetuating cycle of territorial dualism and the enrichment of foreign labor markets at the expense of local development (Aronica et al. 2023; Basile et al. 2019).

The drivers of this migration are multifaceted, with educational and employment opportunities being primary motivators for those seeking regions where their skills are recognized and rewarded (Ferrara et al. 2018). The statistical narrative provided by the Instituto Nazionale di Statistica (ISTAT) for 2018 (ISTAT 2018) delineates a stark portrait of interregional transfers, signifying a substantial migration of the educated populace from the Mezzogiorno to more prosperous regions, further depleting the south's human capital (Statista 2019).

While labor mobility is traditionally seen as a mechanism for economic equilibrium, the Italian scenario deviates from this model due to the selective nature of the migration, which prioritizes highly qualified individuals. This selective emigration, as opposed to a homogenous distribution of workers, reinforces the dualistic nature of the Italian economy, exacerbating regional inequalities (Basile et al. 2019; Ballatore and Mariani 2019). The intervention of public policies has, paradoxically, not mitigated but seemingly intensified these disparities, perpetuating a negative cycle of talent outflow and contributing to the competitive advantage of the northern regions (Coniglio and Prota 2017).

In a critical analysis of regional policy effectiveness, Coniglio and Prota (2017) highlighted the divergent outcomes in Puglia and Basilicata, regions that have implemented cohesion policies to stem the brain drain. Basilicata's incentives for postgraduate studies have been undercut by a sustained outflow of human capital, while Puglia's bid to synchronize education with local industry demands has seen limited success, with many skilled workers still facing underemployment or job insecurity. Kerr et al. (2016) underscored the potential benefits of return migration, which can significantly contribute to social and human capital by reintegrating global knowledge and resources; however, such potential remains largely unrealized due to persistently low return rates.

On an individual level, experiences abroad offer invaluable exposure and opportunities for collaboration (Avveduto 2012). Nevertheless, these experiences do not inherently counteract the inequalities between peripheral and core regions. The propensity for international migration among the higher-skilled cohort, including those trained with regional and European funding, remains pronounced (Aronica et al. 2023).

The consequences of this ongoing skilled migration are profound, stripping regions not only of their human capital but also of their social and cultural identity. The resulting depletion in territorial capital is accompanied by the diminution of skilled labor, leading to brain drain effects and lessened contributions from those who remain. These changes culminate in a multi-faceted loss that spans economic, social, cultural, and institutional dimensions, posing complex challenges for the affected territories (Grebeniyk et al. 2021; Amodio 2022).

Policies aimed at curbing this brain drain must consider the nuanced needs of the local skilled workforce and create conditions conducive to the retention and return of human capital. Such measures would not only counteract the current outflow but could also transform the region into a hub that attracts and nurtures talent, thereby fostering sustainable socio-economic growth.

2.4. Calabria Region Context

The Calabria region, covering the extreme southern part of Italy, spans 15,080 km^2. It has approximately 1,947,131 inhabitants (3.2% of Italy's total population), with an average density of about 128 people per km^2, which is distributed unevenly across the region (ISTAT 2020). Since 2000, there has been a clear downward trend in population growth (an overall rate of −18%). This decline is attributable to a low birth rate (7.4% in 2020) and a high mortality rate (11.2%), resulting in a natural population decrease (−2.9%) and a lack of territorial attractiveness. The region's attraction index for external migration for study or work was only 27.2% in 2015, significantly lower than the national average of 32.6%, and the net migration rate was negative (−14.1%) (AdminStat 2020).

In 2019, Calabria's GDP per capita was 33.61 billion euros, accounting for −1.88% of Italy's total GDP for that year (Statista 2019). The unemployment rate stood at 21.9%, with the rate among young workers reaching a peak of 48.6%. The general wealth of the inhabitants is considerably low (ISTAT 2021), with a poverty rate significantly higher (30.6%) than the national figure (11.8%). The percentage of individuals in relative poverty (34.6%) is more than double that of the entire country (15.0%) (ISTAT 2020). These conditions have positioned Calabria as the third-lowest Italian region in terms of employment rate and the highest in unemployment (Iaquinta et al. 2020). The region is experiencing a worsening phenomenon of "human desertification" (Musolino et al. 2020), driven by a low level of industrialization (in 2017, companies in Calabria represented only 2.5 percent of the national total (ISTAT 2020)), a noncompetitive production system (characterized by low levels of internationalization and innovation), poor infrastructure and transport accessibility, and inadequate development in information and communication technologies (Musolino et al. 2020).

Based on the literature reviewed, it becomes essential to evaluate the effectiveness of the European Funds (ESF) aimed at enhancing the skill set of Calabrian graduates, thereby improving their employability prospects within their native region and encouraging the repatriation of those employed outside the region.

The effectiveness of the ESFs was evaluated through a bottom-up (micro-level) approach using a tailor-made questionnaire aimed directly at assessing whether or not the objective of disbursing ESFs in the Calabria region was achieved.

The following research questions are posed as the basis for the empirical verification process within this study:

- Research Question 1 (RQ1): To what extent does the perceived quality of the knowledge, competencies, and skills acquired through master's programs funded by the ESF, as well as the employment situation at the start of the postgraduate program, positively influence the likelihood of Calabrian graduates finding employment in their region of origin?
- Research Question 2 (RQ2): Does the perceived quality of the knowledge, competencies, and skills acquired in the master's programs funded by the ESF, along with the employment situation at the start of the postgraduate program, positively influence the decision of Calabrian graduates living abroad to return to Calabria?

These questions are integral in evaluating the strategic deployment of the ESF and serve as a critical component for the formulation of policies aimed at regional educational advancement and employment stimulation.

3. Materials and Methods

Survey Design and Implementation

To investigate the professional trajectories of master's graduates from Calabria who were beneficiaries of European Union Development Funds (EUDF) for their enrollment in postgraduate programs, a specific survey design was developed. This instrument was based on the adaptation of questions from previous studies, specifically the work conducted by Abreu et al. in 2014 (Abreu et al. 2014). This adaptation was carried out to explore the specific dynamics and post-master's professional outcomes in this particular context. The questionnaire, conducted from March 2021 to June 2022, was addressed to all Calabrian graduates who received ESFs from the Calabria region and was distributed through the website Google Form and distributed by email.

The introductory email explained the research objectives and indicated that the University of Córdoba (Spain) was responsible for data collection and management and that participation was anonymous, free, and voluntary. We also indicated that the results would be published in scientific projects.

The survey questions were developed considering the research questions. The questionnaire was designed in Italian and consisted of three parts. The first part referred to the educational qualifications and characteristics of the master's program attended, while the second part consisted of 12 questions about the overall satisfaction with the master's program, the subsequent professional status, and the future perspective regarding a possible return to Calabria. A 5-point Likert scale was used for these questions, which were dichotomized to use endogenous and exogenous variables in the logit models. Finally, the third part referred to the sociodemographic characteristics of the respondents. The administered questionnaire is reported in the Table S1 from Supplementary Materials.

The questionnaire's validity was determined by consensus among the authors and by a pretest with eight randomly selected graduates from Calabria. The length of the survey, the appropriateness of the questions, and the equivocality of the meanings were evaluated.

This study was designed to empirically assess the efficacy of EU Structural Funds allocated from 2014 to 2020 to the Calabria region. It specifically scrutinizes the funds awarded to Calabrian graduates for enrollment in master's programs within and beyond regional boundaries, aiming to enhance their professional skills and competencies. Our analysis was bifurcated into two primary segments. Initially, we delineated the attributes of Calabrian graduates who availed ESFs for higher educational pursuits, such as master's degrees, locally or outside Calabria. This examination encompassed their perceptions and responses regarding various aspects of the master's programs, including the quality of education and the breadth and depth of skill acquisition.

The study employed two logistic regression models to analyze the effects of ESFs on the employability of graduates from Calabria. The first model examined the impact of these funds on the employability of graduates who remain within Calabria. The second model evaluated how EFs influence the inclination of Calabrian graduates who are currently working and living outside the region to consider returning to their place of origin. Statistical analyses were conducted using STATA18 (Stata Corp., College Station, TX, USA).

This bifurcated approach aimed to understand both the direct regional benefits of ESFs on local graduates and their broader influence on the geographic mobility decisions of the Calabrian diaspora. Table 1 presents a detailed description and operationalization of each variable used in our analysis, laying the groundwork for testing the proposed research hypotheses.

Table 1. Study Variables.

Variable	Type	Description
Acquired skills during the master's program (ASM)	Categorical	Value 1 if acquired skills during the master's program are perceived useful and 0 otherwise
Appropriate wage (AW)	Categorical	Value 1 if the respondent received an appropriate wage (salary commensurate with own skills and knowledge) at the time of master enrolment and 0 otherwise
Importance of skills acquired (ISA)	Categorical	Value 1 if the respondent perceived as relevant for his/her employability the skills acquired and 0 otherwise
Overall perceived quality (OPQ)	Categorical	Value 1 if the quality of the knowledge acquired is perceived high and 0 otherwise
Permanent contract (PC)	Categorical	Value 1 if the respondent had a permanent contract at the time of master's program enrolment and 0 otherwise
Perceived utility of subsidy (PU)	Categorical	Value 1 if the graduate believes that the ESF subsidy received was useful and 0 otherwise
Time to find a job after master's degree (TIME)	Categorical	Value 1 if the graduate found a job within 6 months after the master's program and 0 otherwise.
Working status (WS)	Categorical	Value 1 if the respondent worked at the time of master's program enrolment and 0 otherwise
Control Variables		
Age	Quantitative	Age of respondents at master's program enrolment
Gender	Categorical	Respondent's gender
Population	Categorical	Total number of persons living in the respondent's living area (25,000–50,000, 50,000–75,000, or 75,000–100,000)
Disciplinary area	Categorical	The field of respondent' specialization (health area, scientific-technological area, or humanistic-social area)

The selected determinants affecting the likelihood of work in Calabria following the attainment of a master's degree financed by European funds were divided between graduates' employment conditions at master's program enrolment and graduates' perceptions about the master's program topics.

For both determinants, the following equation was applied:

$$y = \frac{e^{(\beta_0+\beta_1 x_1+\beta_2 x_2+\beta_3 x_3+\beta_4 x_4+\beta_5 x_5+\beta_6 x_6+\beta_7 x_7+\beta_8 x_8)}}{1+e^{(\beta_0+\beta_1 x_1+\beta_2 x_2+\beta_3 x_3+\beta_4 x_4+\beta_5 x_5+\beta_6 x_6+\beta_7 x_7+\beta_8 x_8)}} \quad (1)$$

The predicted probability was determined by each logistic regression model.

4. Results

The survey garnered participation from one hundred and sixty-six graduates originating from Calabria, representing the entire population of Calabrian graduates who received

ESFs. The cohort predominantly consisted of male respondents, constituting 54.2%, with an average age across the sample being 32.5 years. A regional analysis revealed that the majority of these graduates, accounting for 41.6%, hailed from the province of Reggio Calabria. Conversely, the provinces of Crotone and Cosenza had the lowest representation, yielding 7.8% and 4.8% of responses, respectively. Educational backgrounds were varied, with over 60% possessing degrees in the humanities and social sciences. Graduates with degrees in the scientific and technical fields comprised 27.6% of the sample. A minority of 11.7% held degrees within the health sector.

Regarding academic institutions, most respondents, 66.9%, completed their degrees at universities within Calabria. The remaining one-third were split between those who graduated from institutions outside the Calabria region (8.3%) and those who obtained their degrees online (24.8%). Funding patterns showed that over half of the respondents, specifically 54%, received grants for their first master's program, whereas 45.8% were funded for a second master's degree. The duration of these master's programs was predominantly no longer than 12 months for 82.1% of the participants, while a smaller fraction, 17.9%, engaged in extended programs lasting up to 18 months. The structure of the master's programs for all respondents entailed 1500 h of classroom instruction complemented by 300 to 350 h of practical internship or project work. Notably, less than 1% of the survey participants underwent 400 h of internship training. The detailed characteristics of the survey respondents are comprehensively documented in Table 2.

Table 2. Sociodemographic variables.

	Frequency	**Percentage**
No. of responders	166	
Age, mean (S.D.)	32.5 (6.3)	
Gender		
Males	90	54.2%
Females	76	45.8%
Province		
Catanzaro	58	34.9%
Cosenza	8	4.8%
Crotone	13	7.8%
Reggio Calabria	69	41.6%
Vibo Valentia	18	10.8%
Disciplinary Area		
Health area	20	12.0%
Scientific-technological area	46	27.7%
Humanistic-social area	100	60.2%
Master University Location		
In Calabria	112	67.5%
Online	41	24.7%
Outside Calabria	13	7.8%
Master's Degree		
First	90	54.2%
Second	76	45.8%
Master's Duration		
12 months	136	81.9%
15 months	30	18.1%

Empirical Analysis Results

The outcomes of the logistic regression analysis were rigorously evaluated using several diagnostic tests. The Omnibus test yielded a highly significant result ($p < 0.001$), indicating that the models as a whole are statistically significant. Furthermore, the Hosmer and Lemeshow tests, along with the chi-square values for respondents, all returned values greater than 0.1, suggesting a good fit of the models. To address potential multicollinearity issues, a stepwise estimation approach based on the likelihood ratio was employed. This

iterative process ensured that the final models included only those variables that were statistically significant.

The binary logistic regression models outlined in Table 2 were employed in this analysis:

- Model 1 Analysis: The first logistic regression model revealed that the presence of European Funds (ESFs) subsidies and the perceived quality of education in master's programs significantly influence the employment location of Calabrian graduate's postgraduation. Specifically, graduates who received ESFs and appraised the subsidies as beneficial demonstrate a markedly higher likelihood of securing employment within Calabria (β = 3.85, SE: 1.55, p = 0.013). Additionally, a positive association was observed between the perceived high quality of master's program education and the probability of working in Calabria postgraduation (β = 5.39, p = 0.016). Conversely, graduates who rated the skills acquired during their master's program as very high were found to be 50% less likely to work in Calabria after completing their studies (β = −4.35, SE: 2.25, p = 0.053);
- Model 2 Analysis: The second logistic regression model assessed the likelihood that graduates who lived outside of Calabria at the time of enrolling in a master's program would return to the region postgraduation. The results indicate that those who were employed during their master's enrollment had an increased probability of returning to Calabria (β = 2.66, SE: 1.53, p = 0.082). In contrast, for graduates perceiving the ESFs subsidy as beneficial, the likelihood of returning to Calabria after attaining their master's degree decreased significantly by 38% (β = −4.41, SE: 1.93, p = 0.022).

In both models, the control variables of age, gender, population of origin, and academic discipline of the respondents were analyzed and were not significant in any of the models analyzed, so they are not included in Table 3.

Table 3. Logistic regression.

	(M1) Probability of Working in Calabria	**(M2) Probability of Returning to Calabria**
Acquired skills during the master's program (ASM)	−4.36 ** (2.250)	20.14 (4710)
Appropriate wage (AW)	0.78 (0.680)	-
Importance of skills acquired (ISA)	0.48 (2.013)	19.60 (2269)
Permanent contract (PC)	0.80 (0.705)	-
Perceived utility of subsidy (PU)	3.85 ** (1.550)	−4.41 ** (1.925)
Overall perceived quality (OPQ)	5.39 ** (2.240)	−40.39 (5228)
Time to find a job after master's degree (TIME)	−0.58 (0.729)	0.17 (1.136)
Working status (WS)	−0.17 (0.750)	2.66 * (1.528)
Control Variables	Yes	Yes
Constant	Yes	Yes
McFadden's R^2	0.246	0.543
Cox–Snell R^2	0.283	0.529
Cragg–Uhler (Nagelkerke)	0.382	0.705
LRchi2 (p-value)	25.28 (0.065)	39.13 (<0.001)

Note: * $p < 0.10$; ** $p < 0.05$.

5. Discussion

The Cohesion Action Plan presents an opportunity for the educational sector to enhance the capabilities of the youth and address unemployment through the implementation of policies supported by the Structural Funds (Council of the European Union 2021). Knowledge, an essential intangible element for a nation's wealth, has recently taken a central role in economic development (Sánchez Trujillo et al. 2020). High levels of education and

proficiency in tacit and transversal skills form the cornerstone for creatively contributing to the development of new products, particularly in crafting their symbolic value.

Furthermore, high educational standards and practical experience elevate organizations' and individuals' ability to assimilate external cognitive elements (Schweisfurth and Raasch 2018). The European Union has prioritized investing in youth education as a key driver for economic development (European Council 2015). Given the escalating importance of knowledge, the ambivalent impact of public investment in higher education in economically lagging contexts becomes particularly significant, as evidenced by recent actions in certain Italian regions. Calabria, for example, has invested substantial resources in the advanced training of its human capital, explicitly aiming to boost regional economic development.

Therefore, this study focuses on two key aspects: On the one hand, it examines whether the funding provided for pursuing master's degrees, which facilitate higher professional qualifications, effectively contributes to the integration of young residents in Calabria into the regional labor market. On the other hand, it analyzes whether completing these master's programs encourages Calabrians living outside the region to return to it.

The first model of this study indicated that the existence of subsidies facilitating young people in undertaking a master's degree and the perceived educational quality of these postgraduate programs enhance the likelihood of job retention among young people in the Calabria region after completing their studies. This relationship suggests that access to quality postgraduate education can enrich education and improve employment prospects for young Calabrians, which is in line with the findings of Dudzevičiūtė and Šimelytė (2018). However, an inverse correlation was also observed between the variable "skills acquired during the master's program" and the likelihood of graduates staying to work in the region. Thus, we infer that as young people acquire greater professional competencies, their intention to remain in Calabria decreases, reflecting a phenomenon consistent with the brain drain theory, as discussed by Morano-Foadi (2006) and Dohlman et al. (2019). These results indicate that although the program promotes the integration of young people into the regional labor market, it fails to effectively retain the more qualified individuals, posing significant challenges for talent retention in the region.

The second model aimed to investigate the possibility of return for Calabrians living abroad who benefited from European Funds. The results reflected the paradox of the multifaceted interaction between these European Funds, the training of graduates, and the local labor market. Although graduates working outside the region perceive that they are more likely to return to Calabria after completing a master's degree, the variable of European Funds' subsidies for master's studies has a more intensely negative effect on the inclination to return. This suggests a more complex relationship between fund perception and migration and return decisions, likely influenced by factors such as career prospects and employment opportunities available elsewhere (Hermannsson et al. 2019) that are absent in Calabria.

Participation in master's programs has enabled Calabrian graduates to gain significant experiences, as postgraduate course content is vital for job placement and future employment opportunities. The master's experience proves beneficial in acquiring technical-professional competencies for job hunting. However, these skills and experiences are not aiding in securing employment within Calabria, where a clear disconnect between employability and completed master's degrees is evident, as suggested by Kerr et al. (2016). This contradiction might stem from a lack of specific job opportunities suited to their qualifications.

Beneficiaries of regional policies have found employment outside their birth regions, often in economically more dynamic and mature contexts that better absorb highly qualified human capital (Pinho et al. 2015). This phenomenon, a physiological brain drain, occurs with training investment in economically peripheral regions like Calabria and should be anticipated and managed with other active employment policies in the region, aligning with

the thematic objective of the 2014/2020 ESF investment in the policy measure's application region (European Commission (ESF 2014/2020) n.d.).

The reasons for the disconnect between fostering increasingly high competencies and the region's absorption of new qualified labor must be understood as a result of a multidimensional phenomenon. On one hand, the region promotes initiatives to encourage graduates to enhance their knowledge and skills; on the other, it appears ineffective in supporting the labor market's demand for new and qualified workers. This issue is influenced by factors including high tax pressure, crime rates, lack of significant infrastructure, slow bureaucracy, and inefficient social services and support policies (Lombardo and Falcone 2011; Lucatelli and Peta 2010).

We suggest that regional development policymakers aiming to promote regional developments through "human capital shocks" should consider integrating regional intervention programs more fully, namely by fostering synergies between ESF-funded policies and those supported by the European Regional Development Fund (ERDF), which is responsible for promoting business competitiveness even though it also promotes smart specializations of territorial contexts. This integration, which has already been requested in the new EU Structural Funds programming, could address both labor supply and demand sides, considering a human capital approach along with growing Calabrian companies' capacity to absorb human capital and, more broadly, qualifying a local and regional innovative business ecosystem.

This challenging situation in Calabria is further complicated by increased international mobility, reducing the economic appeal of less developed regions in favor of those with stronger economies. Indeed, a vicious cycle exists between promoting a knowledge economy and low educational levels: The lack of qualified human capital diminishes development opportunities, and inversely, in a structurally backward economy, investments in training highly qualified workers are negated by their propensity to migrate (Docquier et al. 2009).

The consequences of this paradoxical situation and the historical problems from which the region of Calabria suffers are enormous. Firstly, the continuing massive loss of young human resources impoverishes the entire social fabric and reduces the chance of coherent and integrated social, financial, and technological development, as is recommended instead in the Cohesion Policy. Secondly, the territories lack new entrepreneurial initiatives, widening the gap with the advanced European regions. Thirdly, the region performs poorly in terms of investment attractiveness, which exacerbates the vicious circle described above. From the results of this work, and assuming a broader view of the issue, it is clear that ESFs disbursed in this way and without proper control of the actual impact on the territory are not only ineffective in reducing inequalities but also create new inequalities as they can worsen the socio-economic situation and thus contribute to widening the gap between European regions. The introduction of such a policy should be planned according to a different approach in which not only the needs of the people but also the characteristics and needs of the territory should be thoroughly assessed so that the policy is beneficial in the shortest possible time not only for the people but also for the territory that provides the resources.

This study has limitations. Primarily, the population mainly comprised participants from the provinces of Catanzaro and Reggio Calabria, with Cosenza, the most populous Calabrian province and home to one of the three Calabrian universities, being underrepresented. Further investigation is needed into the lack of surveyed graduates residing in this province. Secondly, the survey was conducted after the COVID-19 pandemic spread, which prompted many Calabrian citizens to move from northern regions, reducing emigration rates. Thirdly, the actual reasons driving some respondents not to return to Calabria were not specifically investigated. Further studies should delve into the causes of Calabria's low rate of employed graduates and the negative repercussions due to the loss of more qualified workers. While the employed quantitative methodology offers significant insights, integrating qualitative methods such as interviews and case analysis could provide a deeper understanding of graduates' experiences and perceptions.

Future research should focus on deepening our understanding of the factors influencing the low rates of return among highly qualified graduates to less developed regions such as Calabria. It is also essential to extensively examine the interplay between EU funding, skill development, and labor migration in various developing European areas. Such studies could provide crucial insights for the formulation of more effective policies and strategies in the field of regional development.

6. Conclusions

This study conducted a comprehensive analysis of the EU Structural Funds in Calabria, revealing a complex landscape. The results show that the ESFs have been effective in improving the skills and education of graduates in the region, thereby facilitating their integration into the labor market. However, these same funds have generated unintended effects, such as the intensification of brain drain and the increase in regional disparities. Graduates, upon improving their skills and competencies, tend to seek employment opportunities in regions with more dynamic economies, leaving Calabria in an unfavorable cycle of loss of talent and qualified human resources.

Contrary to the expectations raised by Calabria's policymakers through the disbursement of EFs, this dynamic acts as a vicious circle in which the Calabria region itself continues to lose economic and human resources and increases the disparities with the more advanced regions through the same measures it takes to reduce these disparities.

From a future policy perspective, the need for more holistic and locally adapted approaches becomes evident. Employment policies must go beyond skill development and consider creating an attractive working environment that retains graduates in the region. This includes incentives for businesses investing in innovation and technology as well as support for entrepreneurship, especially among highly qualified workers. These measures could help transform the improvement in education and skills into a driver of local growth and development.

Regarding the impacts on economic policy and society, the results underline the importance of regional economic planning that considers both human capital and the needs of the local labor market. Brain drain represents not only a loss of investment in education but also carries a significant social and economic cost for the region. Economic policies must, therefore, focus on closing the gap between the supply of skills and the demand of the labor market, thereby promoting a more balanced and sustainable socioeconomic development.

This study highlights the complexity of the effects of the ESF in regions like Calabria. While the funds have improved education and skills, they have also contributed to significant challenges in terms of talent retention and regional cohesion. Adapting EU cohesion policies to local realities, with an integrated approach that combines skill development and employment opportunities, is crucial to turn investments in human capital into real assets for regional development.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/economies12010010/s1. Table S1: Questionnaire variables.

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European Funding for Sustainable Transport Systems—Influencing Factor of Regional Economic Development in Romania

Ana Maria Bocaneala [1,*], Daniel Sorin Manole [2], Elvira Alexandra Gherasim [1], Bianca Motorga [1] and Livia Cristina Iliescu [1]

[1] Economics 1 Doctoral School, Bucharest University of Economic Studies (ASE), 010374 Bucharest, Romania; gherasim.alexandra@gmail.com (E.A.G.); biancamotorga11@gmail.com (B.M.); livia.iliescu@yahoo.com (L.C.I.)
[2] Department of Economic Sciences, Constantin Brâncoveanu University, Calea Bascovului 2a, 110095 Pitești, Romania; danielsorinmanole@yahoo.com
* Correspondence: anamaria.bocaneala@gmail.com

Abstract: Sustainable development is a core concept in regional development. Sustainability is characterized by supporting the building of resilient infrastructure and promoting the sustainable industry. In this context, sustainable transport is particularly important as it represents an opportunity for regional development. This research aims to quantify the impact of investments through structural instruments, specifically EU funds, on promoting a sustainable transport system and eliminating barriers from large-scale transport networks. This study focuses on the impact of these investments on regional economic development in Romania. The analysis used data from all eight development regions of the Romanian economy between 2014 and 2020. Panel data regression models, including the generalized difference method of moments (Dif-GMM) and the system GMM method (Sys GMM), were employed. This study confirms the idea that European structural and investment funds (ESIFs) play a positive role in promoting sustainable transport for regional economic development. Additionally, the quality of regional governance is identified as a key factor in economic development. This study, therefore, reveals a convergence effect between regions. Regions with a lower initial GDP per capita develop quicker compared to regions with a higher initial GDP per capita, indicating a "catch-up" effect. From a policy perspective, these issues can guide decision making and resource allocation.

Keywords: regional development; sustainable transport; European funds; economic development; sustainable development

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1. Introduction

The Romanian economy has transitioned from slow growth to rapid development based on the principles of sustainable development. It is essential to coordinate the interaction between economic production and environmental consequences for sustainable economic development. Development that meets current demands without affecting the capacity of future generations to satisfy their own needs is known as sustainable development (Romanian Government 2018). As a result, it objectively represents the sustainable level of economic development. However, in order to achieve ecological growth, it is necessary to identify the possible measures that contribute to sustainable development, such as sustainable transport—the main source of pollution reduction. Green economy, of which sustainable transport is an integral part (MRDPA 2016), represents an important source for promoting high-quality sustainable economic development. Sustainable transport plays a key role in promoting sustainable economic development by promoting economic development based on low-carbon technologies, i.e., reducing pollution. Sustainable transport can

have an impact on local economic development. The Green New Deal (GND 2023) has a global perspective, but local, national, and regional actions are still needed. On the 14 July 2021, the European Parliament adopted several proposals to adapt EU climate, energy, and transport policies with the aim to reduce net greenhouse gas emissions by at least 55% by 2030. All EU initiatives on green economy are interconnected and complementary, so any measures which need to be taken must consider the income and costs they generate.

One aspect of regional development is sustainable development, which is the process of changing the dynamic balance between social, economic, and environmental factors (Mach et al. 2021). Green economy represents an economy providing a higher quality of life for all within the ecological limits of the planet (GEC 2023). The economic aspect of this is about promoting economic growth and development. This is an aspect of economic development that we will also follow in our research by analyzing the impact of sustainable transport on regional development. Transportation can be a key facilitator of sustainable economic growth and can act as a magnet for regional economic growth by attracting resources from other regions (Pradhan and Bagchi 2012). Transport is an important factor in transforming human life, from trade to production, education, research, entertainment, culture, and defense. An efficient transport system can have certain positive outcomes in terms of economic growth, such as lower transport costs, reduced time, economic and communication opportunities are created, increased employment, tourism, and foreign investment.

The aim of regional development is to reduce the socio-economic disparities between different places, raise living standards, and provide residents with high-quality services by promoting and diversifying economic activity and investment in both the public and private sectors (Apostolache 2014). The European Commission adopted a package of proposals in 2022 to set up EU policies to reduce the Union's net greenhouse gas emissions by at least 55% by 2030 compared to the 1990 levels (European Commission 2021a). Europe has to reduce its emissions if it plans to become the first continent to be carbon neutral by 2050 and make its commitments in the European Green Deal a reality (European Commission 2020). The regulation on effort sharing for the mandatory annual reduction in greenhouse gas emissions by EU Member States in the period 2021–2030 (European Commission 2021b) requires each member state to reduce emissions in the building, road and inland waterway transport, agriculture, waste, and small industries sectors. These targets are set considering the baseline situation and the different capabilities of each member state and are based on the GDP per capita, adjusted to ensure cost-effectiveness. The Executive Vice President of the Green Pact, Frans Timmermans, says that all parts of the transport sector must actively contribute to achieving our climate and zero-pollution targets (European Commission 2023).

In Romania, green economy is linked to sustainable development. The National Strategy for Sustainable Development—Horizons 2012–2020–2030 states that, by using appropriate economic policy means, the productivity of material and energy consumption resources can be increased at an average annual rate of 3–4% over the period 2008–2030 (Ardeleanu et al. 2012). An attractiveness study by Ernst &Young in 2021 (EY Romania 2021) considers Romania to be a desirable place in which to engage in the green economy, as it can take advantage of the opportunities provided by the Fair Transition Mechanism and the European Green Deal in addition to other funds allocated to the green economy. Romania is among the countries with the lowest GHG emissions per capita in the European Union, yet it ranks among the top states when the same indicators are compared to the size of GDP (Popovici 2021).

The decision to analyze the impact of EU funding on sustainable transport in Romania was driven by some gaps or unresolved issues in the existing literature. These gaps often arise from the need to understand, in the context of sustainable development and economic growth, the exact impact of policy interventions, the effectiveness of funding allocation, and its apparent effects. While numerous studies have been conducted on the general impact of EU funds on economic development, few studies explicitly address Romania, particularly

with regard to sustainable transport. Research in this area could help to uncover the specific benefits of EU-funded sustainable transport projects, such as reduced carbon emissions, improved urban mobility, and economic benefits. Another motivating factor for research on this topic could be the need to evaluate the efficiency and effectiveness of the allocation of EU funds to sustainable transport projects in Romania. The question of whether these funds are optimally used to achieve the desired results in terms of sustainability and economic development could drive research in this area.

Given the EU's focus on reducing regional inequalities, it is important to understand how investment in sustainable transport supports this objective in the Romanian context, which, in turn, could be an important motivation for research. A research agenda that focuses on the long-term outcomes and sustainability of EU-funded projects in Romania can provide valuable information for future policy making and funding allocation. Addressing these gaps or answering specific research questions could make an important contribution to knowledge about the impact of EU funding on sustainable transport in Romania and provide valuable information for policymakers, practitioners, and future research in this area.

Through this research, it is highlighted that Romania has made commitments in terms of climate policy and pollution reduction. This research, thus, underlines the importance of promoting green economy through the effective use of EU funds for sustainable transport. Since there is no established system of indicators to evaluate the green economy (Adarina et al. 2019), our research analyzes the financial allocation of EU funds for sustainable transport and its impact on the GDP of the developing regions in Romania. The economic indicators used in this study are the financial allocations for the Objective 7 funding line of "Promoting sustainable transport systems and removing bottlenecks in major network infrastructures" and the GDP per region. The state remains the most important actor in the implementation of clean technology innovation and the growth of the green economy. The nation's overall development is part of each region's development, and their potential for progress has been and continues to be encouraged by European Union Structural Funds (Mach et al. 2021). On the other hand, green economic development can contribute to a country's gross domestic product (GDP), leading to economic growth (Ali et al. 2021). Research suggests that a growing GDP per capita has come to be a primary aspect driving carbon emissions (Zhu and Gao 2019). Transport became the supplier of around 1/4 of the EU's overall CO2 emissions in 2019 (European Parliament 2023). Of these, 71.7% originated from avenue shipping, in line with a document by the European Environment Agency (European Parliament 2023). Thus, funding sustainable transport could cause a decrease in carbon emissions; however, the GDP per capita will still continue to trend upwards. Advanced transport infrastructure may be an essential element in the improvement of the economy, and righting plans of delivering infrastructure investments may affect the boom capacity of the areas in which they are applied and help reduce local disparities so as to obtain a sustainable economy and maintain social stability (Mohmand et al. 2016). Studies in India reveal that there is a two-way causality between road transport infrastructure and economic growth (Pradhan and Bagchi 2012). This means that road transport drives economic growth and vice versa; therefore, an increase in transport investments would have a positive effect on economic growth. The same study concludes that there is a two-way causal relationship between road transport infrastructure and gross domestic capital formation and also reveals a bidirectional causality between economic growth and gross domestic capital formation (Pradhan and Bagchi 2012). Research findings also show that transport infrastructure plays a positive role in promoting economic growth in "Belt and Road Initiative" (BRI) countries (Chao Wang et al. 2020).

Sustainable transportation policies reduce air pollution and, thus, contribute directly to better health and green economy development. Sustainable transport aims to build flexible and resilient transport structures that support economic growth, enhance public health, and contribute to a more sustainable environment (Hmamed et al. 2023). The results from some studies suggest that transport infrastructure has a promotional effect on economic

development and a significant and positive effect on economic growth (Zhang and Cheng 2023; Ghosh and Dinda 2019). Research on the U.S. shows that federal spending on transportation infrastructure increases the economy's capital stock, increasing its capacity to produce goods and services and leading to more job opportunities and a higher GDP (IHS Markit 2021). On the other hand, studies in China show that transport infrastructure is an important factor in regional economic growth (Qiuming Lai 2020).

The main trend in economic development is regional economic competition, and transport infrastructure is an important driving force for integrating regional resources and promoting economic development (Wei-Guo Ma 2021). Research shows a positive impact of regional operational programs on regional entrepreneurial and socio-institutional capital (Zhironkin and Cehlár 2022). This positive impact moves regions forward on the path of sustainable development, a phenomenon which has a practical impact on the efficiency of the disbursement of EU funds. Similarly, our research highlights the effects of EU funding in the sustainable transport sector on regional development in Romania. Structural funds are the main instrument for green project initiatives and have a positive impact on a country's macroeconomic indicators (Mach et al. 2021).

This paper is structured as follows. The Introduction introduces the reader to the topic of regional economic development and its relationship with the green economy and sustainable transport. Section 2 provides a review of the most relevant studies in the field. Section 3 is dedicated to the methodology and the main data sources used. Section 4 is divided into three sub-sections: *4.1. The Distribution of ESIF Funds for Cohesion Policy Objective 7: "Promoting sustainable transport systems and removing bottlenecks in major network infrastructures."; 4.2. Some Evolution Patterns in Romanian Regional Economic Growth;* and *4.3. The effects of ESIF Investments on Regional Economic Development.* Section 5 presents the main discussion, while the last section, Section 6, has been dedicated to our conclusions.

2. Literature Review

The literature review chapter is divided into three parts: 2.1. The Relationship Between Green Economy and Sustainable Development; 2.2. Brief Reflections on Sustainable Transport as One of the Components of the Green Economy; and 2.3. General Reflections on Investments in ESI funds. This division is based on Karl Burkart's hexagon. According to Karl Burkart (UNEP 2011), the green economy is located in a hexagon of "green" zones (Figure 1).

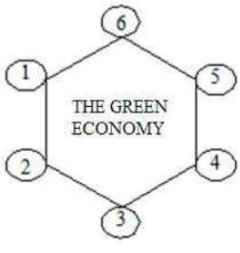

Figure 1. The green hexagon. Source: UNEP 2011. Where 1 corresponds to renewable energy, 2 to "Green" constructions, 3 to sustainable transport, 4 to water management, 5 to waste management, and 6 the managing the earth. Each corner of the hexagon can be described by the multitude of directions of European and/or national strategies. These European policies are reflected in the ESIF funds aimed at reducing disparities between regions and contributing to the growth of the economy.

2.1. The Relationship between Green Economy and Sustainable Development

The Secretary-General of the United Nations António Guterres (UN 2023) argues that the green economy is the future, based on knowledge and social and technological innovation (GEC 2023). According to the United Nations' Environment Programme, the goal of the green economy is to ensure that natural resources are used for sustainable development while reducing carbon emissions and pollution, increasing energy and resource efficiency,

and promoting economic growth and development (UNEP 2011) as well as facilitate the improvement of social development (ICC 2012). The improvement of low-carbon transport is a requirement of the green economy to deal with electricity intake and reduce global warming (Zhu and Gao 2019). For this new economy, the issue of energy efficiency and the principle of low carbon emissions are of primary significance (Bobylev et al. 2015). The green economy can contribute to the systematic improvement of the competitiveness of entities and lifestyles, supporting a nation's social and economic development, and to the alignment of territorial and regional asymmetries (Vertakova and Plotnikov 2016). Other authors (Chapple et al. 2011; Sulich 2020) have defined the green economy as an activity that reduces energy consumption and/or improves environmental quality through the use of less polluting means of transport. This is because the transport sector has both a negative environmental effect (ranking third in the world for carbon dioxide emissions) and a large potential for "green" growth models (Hryhorak and Trushkin 2020).

In the UNEP report (UNEP 2011), agriculture, cities, forests, waste management, industry, tourism, buildings, water, renewable energy, and transportation are the sectors that, together, constitute the green economy. The concept of green economy incorporates ideas related to sustainable development issues. Sustainable development goes hand in hand with an increased responsibility of companies, governments, and society as a whole to achieve a balance between current and future material and transport needs (Zhironkin and Cehlár 2022). Human survival and development require the transition to a green economy (Lavrinenko et al. 2019). The green economy is a system of economic activities that leads to the improvement of human life (Ali et al. 2021; Ciocoiu 2011) without seriously endangering the natural environment for future generations, i.e., humanity's responsibility towards future generations (Bina 2013).

On the other hand, the green economy is viewed as a paradigm for addressing environmental sustainability concerns, climate change, and economic growth (Ciocoiu 2011). Regional economic growth is the subject of our research, that is, growth which is influenced by the impact of sustainable transport funding. Research shows (Bobylev et al. 2015; OJEU 2023) that the transition to a green economy will be achieved differently in different countries, in accordance with the degree of development, the socio-economic priorities, and the environmental culture varying depending on the unique characteristics of each nation's natural, human, and physical capital. Thus, through our research, we will analyze the sustainable transport component as part of the green economy in the developing regions of Romania. In order to achieve the transition to a green economy, it is necessary to raise general awareness so that the population understands the need for a green economy (Trică and Papuc 2013). However, the type of green economy will vary considerably from one nation to another, since it will depend on the specifics of each country, its natural and human capital, and its level of development (Ardeleanu et al. 2012).

Decision makers at the state level play a key role in achieving a green economy, as its implementation largely depends on them (Apostolache 2014). The transition to a new green economic model, based on sustainable development, is recognized to be one of the most important and best responses to global crises, particularly in terms of managing social and environmental problems (Apostolache 2014). Integrating green economy growth into regional development strategies requires more attention to cross-sectoral cooperation, especially between environmental ministries and regional/local authorities (Olsen et al. 2012). In the context of numerous crises and accelerating resource scarcity, the economic paradigm of "greening the economy" has assumed critical importance in regional and global processes of sustainable development (UNECE 2023).

2.2. Brief Reflections on Sustainable Transport as One of the Components of the Green Economy

Following the financial year 2007–2013, the 2014–2020 period saw strategic programming of EU cohesion exercised in a new light, in line with the provisions of the Europe 2020 Strategy. These provisions included the following: each member state was to draft a national strategic document stating the country's thematic development objectives and

allocation of European funds through a Sustainable Development and Investment Partnership negotiated with the European Commission; the European Commission was to lay out a Common Strategic Framework; and Subsequent Programs needed to be set up, guaranteeing the member states' steadfast commitment to accomplishing the goals set by the Union regarding the programming of community funds (Russu 2019). According to the Investment Plan for Europe 2021, 500 million EUR were to be invested through the European Fund for Strategic Investments in the transport sector but also in other important sectors such as education, water, etc. (European Commission 2016).

Regional development is a complex process involving several interdependent legislative and institutional components that establish new types of relationships between different sectors and areas of activity and between authorities and communities. In Romania, regional development has emerged as a necessity, on the one hand, to correct existing regional disparities and, on the other hand, to adopt and implement European Union legislation in this field. Regional economic development leads to an increase in regional quality of life and well-being, and quality of life is reflected in the regional GDP. In a study on the development of transport infrastructure in the center region of Romania and the need for improving regional connectivity published in 2022 (Romanian Government 2022), it is mentioned that, at the level of economic indicators, the GDP is strongly and significantly correlated with its components related to industry (rho = 0.76, $p < 0.05$), trade, transport, and storage (rho = 0.98, $p < 0.05$). This shows that industry, trade, and transport are the sectors that drive the evolution of the GDP, and, among the main components of the GDP, a high and statistically significant correlation exists between industrial branches and trade, transport, and storage.

The Sustainable Transport Strategy of 2007–2013 and 2020–2030 includes sustainable transport policies focused on increasing the cost-effectiveness and attractiveness of transport modes with high potential in terms of transport capacity and environmental protection (Militaru et al. 2021). Sustainable transport refers to transport modalities that are sustainable in terms of their effects on the environment and society. In the European Union, the main cause of greenhouse gas emissions is transport. This problem is global, but it can be solved locally. As we know, transportation enables people to access work, education, healthcare services, shops, and other services. Means of transport represent an important and very diverse category of indispensable tools of civilization, and, at the same time, they are generators of pollution of natural factors (Militaru et al. 2021). According to Karl Burkart (2012), sustainable transport is one of the six main sectors of the green economy, with the others being renewable energy, green buildings, water management, waste management, and land management (Burkart 2012). Our research aims to highlight the impact of the green economy and sustainable transport developed with the help of EU-funded projects and then analyze their role in the development of Romania's economy in recent years but especially during current crises such as wars in the region or COVID-19. Alonso et al. (2015) found that, in urban areas where pollutants and, therefore, the effects of unsustainable transport structures are concentrated, sustainable mobility is a prerequisite for achieving sustainable cities. The transportation system in developing countries suffers from many problems such as traffic congestion and lack of reliable and safe public transport (Abdel Wahed Ahmed and Abd El Monem 2020), which can lead to social inequalities or cause irreversible damage to the environment. Urban transportation has many detrimental effects that can influence sustainability goals (Alonso et al. 2015). Lately, the emphasis has been on replacing traditional means of transport (in many cases physically and morally outdated) with ecological ones: bicycles, electric bikes, electric motorcycles, multiple-occupant vehicles, electric vehicles, green train services, and freight vehicles, hybrid cars, and monorails (Abdel Wahed Ahmed and Abd El Monem 2020).

This transition to "green" transport requires a master plan on the level of public transport and beyond. The general objective of said master plan is to guide the planning, development, and maintenance of a prospective multimodal system of transportation that will contribute to the sustainable development of a city and region of the country in

question. Developing a sustainable and environmentally friendly transportation system is the best solution for meeting the transportation needs of an ever-growing urban population (CEF 2023). Green transportation has wide-ranging benefits, such as less or no environmental pollution, saving money, contributing to building a sustainable economy, and improving health (Abdel Wahed Ahmed and Abd El Monem 2020). A sustainable urban transport system requires the consolidation of said system's characteristics and its integrated management. According to Abdel Wahed Ahmed and Abd El Monem (2020), this integrated manner of management includes features such as mobility, accessibility, safety, social equity, efficiency, security, convenience, comfort, low carbon emissions, and environmental friendliness. Most studies on sustainable transport focus on the environmental impacts of motorized transport (Török 2015) so sustainable development could be seen as only referring to these environmental impacts (Toth-Szabo and Várhelyi 2012; Klimecka-Tatar et al. 2021). We cannot consider urban transport as an isolated aspect, as it should be put into perspective and studied together with other aspects of urban life. When we discuss urban transport, other aspects of urban life must be taken into account, and we should not isolate the matter. To address the significant contribution of transport (commercial transport) to greenhouse gas emissions, it is recommended that governments develop a green sustainable transport strategy (GTS). The main goal of green transportation is to minimize the negative impact of transportation on the environment while taking into account current and future transportation needs (Wang et al. 2021). As a quality contribution to economic growth, the key is to improve the overall productivity of green factors. Previous research has focused on empirical analyses of growth rates and determinants of total factor productivity while paying less attention to the influence of green factors (Wiederkehr et al. 2004). According to studies, an environmentally sustainable transport system is one in which transport does not threaten public health or ecosystems and meets access needs consistent with (a) the use of renewable resources below their rate of regeneration and (b) the use of non-renewable resources below the rate of regeneration of their renewable substitutes (MEIP 2023a).

2.3. General Reflections on Investments in ESI Funds

On the 1 January 2007, Romania became a member of the European Union. Although being a member state entails both rights and obligations, Romania has received 54 billion EUR since its accession (Ang and Marchal 2013). For the period 2021–2027, Romania will have 52 billion EUR at its disposal in this multiannual financial year, 17.4 billion EUR of which are allocated through the program created by the EU-NextGenerationEU for the health crisis. Governments have a key role in influencing private sector investments by improving the conditions for investment in sustainable transport infrastructure and setting investment policies (Constantinescu et al. 2017). On the other hand, in terms of the importance of governance for accessing and implementing ESIF-funded projects, research shows that, in well-governed regions, there is a strong interest in fighting corruption and improving policies to attract greater funding, longer and more interregional projects, and smaller national co-financing (Charron 2016; Zsolt Darvas et al. 2021). Regions with good governance represent interest and security in the absorption of funds. On average, these regions receive more funds per capita, regardless of the level of economic development, unemployment, or other political factors. Current environmental and social challenges require new ways of managing economic development that take into account natural factors and improve the quality of people's living conditions. For this reason, the concept of a new economy has emerged (MEIP 2023b), alongside sustainable development, defined as development for future generations.

The focus of this research will be the financial and political instruments that can be used on a national or regional level to increase investments in carbon-intensive road transport infrastructure. Romania relies on the EU Cohesion Funds and Regional Development Funds for most of the funding needed for new transport infrastructure and the Task Force highlights this. The Romanian Government can also rely on the C4 component

of sustainable transport from the NRRP (National Recovery and Resilience Plan) for the modernization of road infrastructure and sustainable transport. The program has a financial allocation of over 7000 million EUR (MT 2015). The objectives of transport in Romania must, therefore, be in line with current EU policies. In 2011 the *White Paper on Transport* was published, outlining clear objectives, such as an efficient and integrated mobility system, innovation for the future, including technology and behavior, and modern infrastructure and smart financing (European Commission 2021c). Romania can also rely on the NEB (New European Bauhaus), as this trans-disciplinary approach is necessary for the challenges of our time. Financing opportunities for NEB objectives are realized through the European Regional Development Fund (ERDF) and the Program for the Environment and Climate Action (Life) (EY Romania 2021). The mission of the NEB is to translate the European Green Pact into a tangible change in the quality of life, create a new lifestyle that combines sustainability with aesthetics, use less carbon, and be inclusive and affordable for all, respecting European and global diversity (Boc 2017).

Urban planning is no longer just the result of the interaction between architecture, engineering, public health, and sociology but also includes computer science and urban technologies, the use of renewable energies, and increased energy efficiency (Gacichevici 2021). At the regional level, the development of urban mobility and the provision of financial support can also be achieved through the Operational Program for Technical Assistance 2014–2020 (OPTA), complementing other programs receiving European funding such as ROP 2014–2020 and Priority Axis 4, including things such as bicycle track networks or the modernization of pedestrian routes in order to reduce CO2 emissions, a project complementing the "integrated urban mobility corridor" financed by the ROP (Regional Operational Program).

Taking into account all these theoretical observations, the aim of this research paper is to estimate the effects of ESIF investments targeting the thematic Objective 7 of the Cohesion Policy, "promoting sustainable transport systems and removing bottlenecks in major network infrastructure", on regional economic development in Romania for the programming period 2014–2020. Therefore, the following hypotheses were put forward:

H1. *ESIF investments positively influence, even if slightly, regional economic development in Romania*.

H2. *The regional governmental quality index positively influences regional economic development*.

H3. *There is a convergence effect between regions based on the initial value of the real GDP per capita*.

H4. *The governmental quality index exhibits a moderating effect on the relationship between ESIF investments and economic development. Therefore, the impact of ESIF investments on economic development is amplified by good governance quality*.

3. Methodology

The main objective of this research is to quantify the impact of investments with structural instruments (POIM and ROP) aimed at promoting a sustainable transport system and eliminating bottlenecks in key network infrastructures on regional economic development in Romania's eight development regions. We did not apply any specific selection criteria for the selection of development regions in Romania, as the country is already divided geographically and administratively into eight development regions. This pre-defined regional framework covers the entire territory of Romania, ensuring that our analysis is representative of the country's extensive geographical, economic, and social diversity. By using all eight regions available within this established framework, our study inherently covers a wide range of urban and rural environments, economic structures, and demographic profiles, providing a holistic view of the impact of sustainable transport investment across Romania.

Our analysis will use a regression for panel data at the level of the eight development regions of the Romanian economy for the period 2014–2020, considering the implementation of the projects on the horizon "n + 3" years (having as the last available year the year 2022). The analysis focuses on capturing the effects of the implementation of the thematic objective OT7—"Promoting sustainable transport systems and removing bottlenecks in major network infrastructures"—financed by the ROP and the LIOP through two European funds, namely the Cohesion Fund (CF) and the European Regional Development Fund (ERDF). The Cohesion Policy includes 11 thematic objectives for economic development and growth for the period 2014–2020 (European Commission 2020). The European Regional Development Fund (ERDF) invests in the social and economic development of all regions and cities in the EU. The Cohesion Fund (CF) invests in the environment and transport in less prosperous EU countries. These aspects are highlighted in Figure 2.

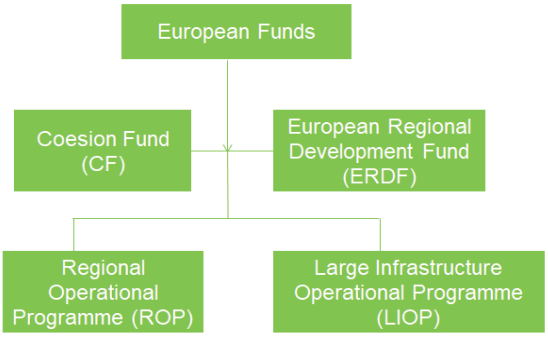

Figure 2. European structural and investment funds. Source: authors' elaboration based on information from the European Commission.

In order to fulfill the objective of this research, statistical data were extracted from the "Open Data—List of operations/List of beneficiaries and operations for projects contracted on Operational Programmes", published by the Romanian Government (Romanian Government 2022).

From this database, the financial data of all projects contracted to fulfil the thematic objective OT7—"Promotion of sustainable transport systems and removal of bottlenecks in major network infrastructures"—were extracted, filtering the entire database by this objective and resulting in the main programs which financed OT7, that is, the LIOP and the ROP.

Thus, out of the 15,553 projects in the database, covering all 14 thematic objectives, the sample was narrowed down to a total of 380 projects that subscribed to the OT7 objective. Subsequently, only projects funded in the period 2014–2020 with the possibility of an extension "n + 3" years were selected, resulting in 364 projects funded to meet OT7. Data were aggregated at the regional level by location and by years after the project start date. The reporting currency was RON. A breakdown of the data collection procedure is detailed in Appendix A.

In our econometric demarche, we excluded 13 projects contracted in 2022, using in the analysis a sample of 351 projects covering the period 2014–2021.

The choice of panel data regression models Dif-GMM and Sys-GMM as analytical tools was based on a comprehensive and methodologically rigorous approach to understanding the impact of sustainable transport investments on economic development in Romania. The initial phase involved testing different specifications using ordinary least squares (OLS) methods for both cross-sections (regions) and periods, incorporating fixed effects to account for unobserved heterogeneity across regions and time. This preliminary analysis served as a fundamental step towards understanding the underlying dynamics of the data and any fixed or random effects present.

The application of the Hausman test helped us determine the suitability of fixed and random effects models based on the consistency of the estimators. The unanimous indication of the consistency of random effects models (REM) guided the choice of model specification for the initial analysis. This step ensured that the model chosen best represented the characteristics of the data and balanced the unobserved heterogeneity with the efficiency of the estimators. The robustness check phase, which included estimation with the Dif-GMM and Sys-GMM methods, addressed specific econometric challenges not fully covered by the SEM method, in particular, dynamic relationships and endogeneity. GMM methods are particularly suitable for panel data where past outcomes may influence current outcomes and where endogenous relationships may exist between predictors and the outcome variable. Therefore, we switched to GMM for this phase.

The inclusion of the Sargan test in the GMM analysis phase was essential for assessing the validity of the instrumental variables used in the models to ensure that the instruments were not correlated with error terms, which would otherwise affect the reliability of the estimated coefficients and the overall validity of the model.

The dependent variable is the real GDP per capita transformed by the GDP deflator with a base of 2015 = 100.

The following were used as the explanatory variables:

- Real ESIF investments per capita (RON)—ESIF investments were transformed into comparable prices using the GDP deflator with a fixed base of 2015 = 100.
- The initial value of the real GDP per capita, which, at the beginning of the programming period of 2014, was expressed in comparable prices by deflation using the GDP deflator with a fixed base of 2015 = 100.
- The quality of governance index at the regional level obtained through a survey conducted over three years (2013, 2017, and 2021) (European Commission 2021d).
- As a spillover effect variable, the GDP in neighboring regions (weighted average) was considered. This additional variable is constructed to reflect the spatial spillover effects of economic development.

The inclusion of the initial value of the real GDP per capita was determined by capturing the convergence effect. Capital flows towards the least developed region will cause the respective region to develop as well as the other regions, and their GDP per capita will be higher. These spatial feedback loops should, therefore, be integrated into the evaluation of PC (ESIF investments) effects on regional economic development to capture both direct and indirect (feedback) investment effects.

The European Quality of Government Index (EQI) captures average citizens' perceptions and experiences regarding corruption, quality, and impartiality of three essential public services—health, education, and police—in their region of residence. The index is based on the largest survey conducted to date, measuring perceptions of the quality of government in the EU. The survey gathers the opinions and direct experience, in the areas of public health, education, and law enforcement, of over 129,000 respondents in a total of 208 regions from all 27 EU member states at the NUTS1 or NUTS2 level. The survey questions are based on the concept of quality of government as a comprehensive, multi-dimensional concept consisting of high impartiality and quality of public service delivery and low corruption.

The value of real GDP was taken from the National Accounts database of Eurostat, and the EQI index was taken for three survey years—2013, 2017, and 2021—from the study by Charron et al. (2014, 2015, 2019, 2022).

The general form of the panel data regression model is the following:

$$\begin{aligned} log(real\_GDP\_per\_capita)_{i,t} &= \alpha_0 + \alpha_1 log(ESIF\_funds\_per\_capita)_{i,t} + \alpha_2 EQI_{i,t} + \\ &+\alpha_3 log(real\_GDP\_per\_capita)_{i,2014} + \alpha_4 average\_GDP\_neighboring\_regions_{i,t} + \epsilon_{i,t} \end{aligned} \quad (1)$$

where $i = 1, 2, \ldots, 8$ represents the eight regions, $t = 2014, 2015, \ldots, 2021$ represents time (period 2014–2021), and α_j, $j = 0, 1, 2, 3, 4$ are the parameters of the model.

This is a log–log model in which the slope parameter measures the relative change in economic growth because of a relative change in the value of ESIF investments. Thus, if investments increase by 1%, then the real GDP per capita increases, on average, by α_1%, ceteris paribus.

In the application of panel data models, it is important to decide the type of model (with fixed effects or random effects). Therefore, it must be decided whether these effects are treated as fixed (FEM) or random (REM), which requires the application of the Hausman test. Applying the Hausman test initially involves estimating a random effects model. A high value of the chi-square statistic for the Hausman test, related to a *p*-value (prob.) lower than the significance threshold of 0.05, leads to significant differences between the coefficients, which requires rejecting the random effects as inconsistent, and concludes that the panel estimation based on fixed effects models (FEM) is more suitable. If the value of the respective test is relatively low (accompanied by a high *p*-value), it dictates the approach of random effects models (REM).

In the analysis of panel data models, homoscedasticity is checked with the White test, and, if the phenomenon is not present, the common remedy is to use heteroscedasticity-corrected standard errors, a strategy which is based on improving the standard deviations of the estimators without modifying the estimations of the coefficients.

Also, based on the Breusch–Pagan Lagrange Multiplier (LM) test, the consistency of the random effects was evaluated by comparing a random effects panel regression model with a simple regression.

The analysis also included a section of a robustness check focused on handling endogeneity as well as evaluating the stability of the estimated models when different estimation methods were used. Specifically, the analysis involved estimating models using various methods, such as fixed effects (FE), the generalized method of moments difference (Dif-GMM), and the system GMM method (Sys GMM). By using multiple estimation techniques, this analysis was aimed at determining whether the impact of the ESIF funds remained constant and reliable across different methodologies.

The random effects model (REM) assumes that individual-specific effects are uncorrelated to the explanatory variables. When this assumption is violated, the REM is inconsistent, and it might be more appropriate to use a fixed effects model or a method that allows for endogeneity, such as GMM.

GMM is a more flexible estimation method that, unlike REM, can handle endogeneity problems, assuming that there are valid instruments available. This is achieved by exploiting the orthogonality conditions between the instruments and the error term to estimate the parameters.

The problem of endogeneity typically arises from omitted variables, a measurement error of the variables included in the model, and/or simultaneity between the dependent and independent variables (Barros et al. 2020).

Dif-GMM (difference GMM) and Sys-GMM (system GMM) are two estimation techniques used in econometrics to address endogeneity and unobserved heterogeneity in the analysis of panel data models. While both methods rely on the general framework of the generalized methods of moments, they differ in terms of the instruments used and how they handle data dynamics.

Consequently, a dynamic panel model was estimated in which the lagged dependent variable played the role of the predictor variable, to capture the persistence effect, as follows:

$$\begin{gathered} log(real\_GDP\_per\_capita)_{i,t} = \alpha_0 + \alpha_1 log(ESIF\_funds\_per\_capita)_{i,t} + \alpha_2 EQI_{i,t} + \\ + \alpha_3 log(real\_GDP\_per\_capita)_{i,0} + \alpha_3 average\_GDP\_neighboring\_regions_{i,t} + \\ + log(real\_GDP\_per\_capita)_{i,t-1} + \epsilon_{i,t} \end{gathered} \quad (2)$$

4. Empirical Results

4.1. The Distribution of ESIF Funds for Cohesion Policy Objective 7: "Promoting Sustainable Transport Systems and Removing Bottlenecks in Major Network Infrastructures"

When analyzing the distribution of ESIF investments targeting the Cohesion Policy Objective 7 of "Promoting sustainable transport systems and removing bottlenecks in major network infrastructures", it is possible to highlight 364 contracted projects, implemented at the regional level, by using two main operational programs, the POIM and the ROP. Thus, 234 projects have been implemented under the POIM and 130 projects under the ROP (Figure 3).

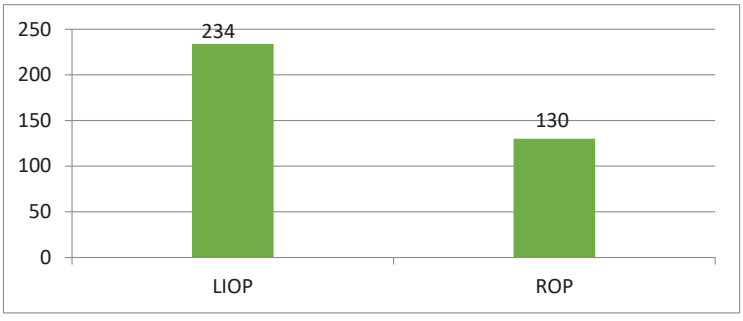

Figure 3. Projects implemented per operational programs LIOP and ROP. Source: author's elaboration based on data from the Romanian Government, Statistics, 2022.

Out of the 364 projects implemented, we selected the top 1 project in each region to analyze the objectives and results achieved. The criterion used to select the top one project in each region was the highest amount of eligible expenditure. By analyzing the table of the most relevant implemented projects (see Appendix B), it can be highlighted that the projects' objectives as well as their results have been successfully implemented and are in line with the main core desideratum of Policy Cohesion Objective 7. Appendix B provides an example of good practice in each region.

The year 2020 was the year in which most projects related to thematic Objective 7 (OT7) were implemented. Thus, as shown in Figure 4, a total of 62 projects were implemented. The average number of projects per year was 40.4. The year 2022 was the year with the lowest number of projects, i.e., 13 projects. The low number of projects in that year was due to the fact that 2022 was the year of extension of the funding period.

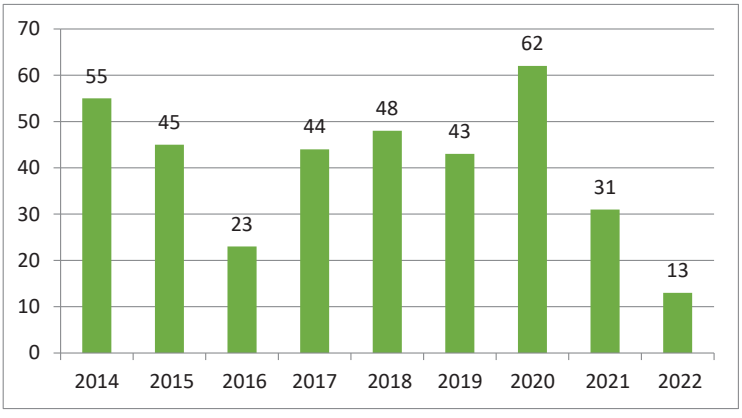

Figure 4. Projects implemented per year. Source: author's elaboration based on data from the Romanian Government, Statistics, 2022.

Figure 5 shows the distribution of the projects implemented across the eight development regions. Most projects were implemented in the south-east development region, with a total of 74 projects, followed by the north-west region, with 62 projects. The Bucharest Ilfov region had the fewest projects because it is the most developed one in the country, and thematic objective OT7 was also achieved through other sources of funding.

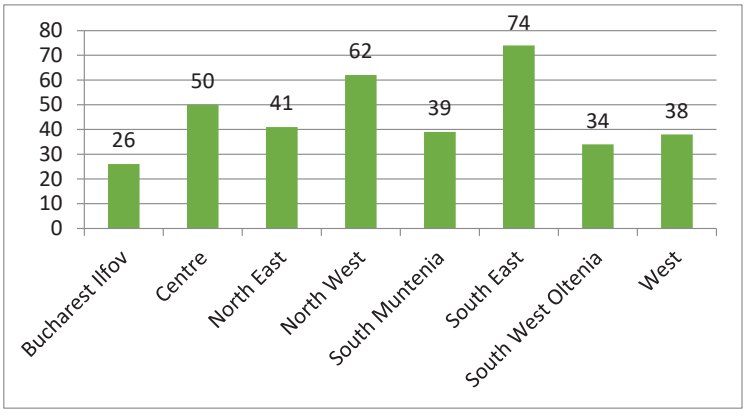

Figure 5. Projects implemented per region. Source: author's elaboration based on data from the Romanian Government, Statistics, 2022.

The highest amount of eligible expenditure, i.e., the value of the projects implemented (Figure 6) was in the center region, with a value of 11,492,754,812 RON, followed by the west and north-west regions. The average eligible expenditure in the eight development regions was 5,933,391,000 RON.

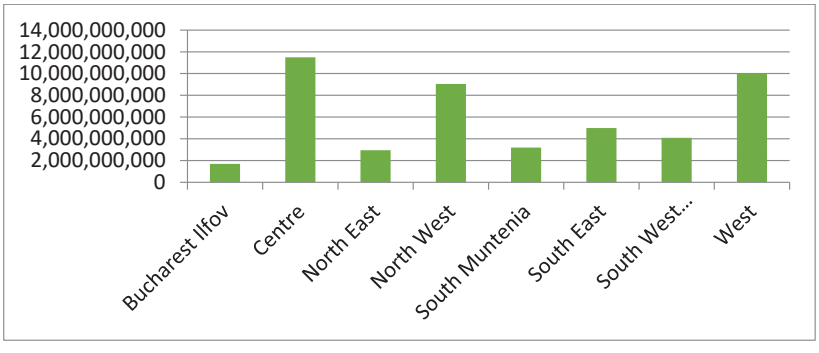

Figure 6. Distribution of eligible expenditure by development region. Source: author's elaboration based on data from the Romanian Government, Statistics, 2022.

Figure 7 shows the distribution of eligible expenditure by year (2014–2022). As it can be seen, 2014 was the year in which the projects with the highest amount of eligible expenditure were implemented.

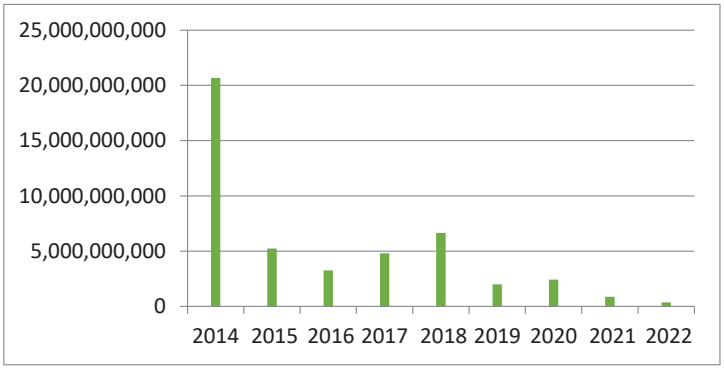

Figure 7. Distribution of eligible expenditure by year. Source: author's elaboration based on data from the Romanian Government, Statistics, 2022.

4.2. Some Evolution Patterns in Romanian Regional Economic Growth

When analyzing the evolution of the real GDP per capita among the Romanian regions during the 2014–2021 period, Bucharest–Ilfov emerges as a clear outlier in terms of economic development (see Figure 8). The region's strong performance can be attributed to several factors, including its status as the country's capital and largest city, its high concentration of businesses and industry, and its position as a major hub for commerce, finance, and technology.

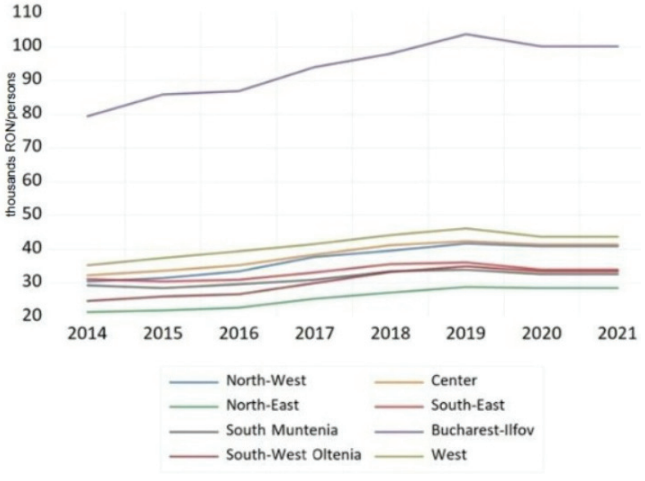

Figure 8. The evolution of regional economic development in Romania. Source: author's calculation based on data from Romanian Government, Statistics, 2022.

Trailing significantly behind Bucharest–Ilfov are the west, center, and north-west regions. These regions also experienced economic growth during this period, albeit at a more modest pace. Their economies are generally more diverse, with a mix of agriculture, manufacturing, services, and emerging technology sectors contributing to their GDP. Additionally, these regions benefit from their geographical proximity to Western Europe, which can facilitate trade and investment.

However, the gap between Bucharest–Ilfov and these other regions suggests that there are substantial regional disparities in terms of economic development within Romania.

This underscores the importance of targeted policies and investments to promote more balanced regional development, particularly in areas such as infrastructure, education, and innovation, which can help stimulate economic development.

In conclusion, while Bucharest–Ilfov stands out as an outlier in terms of economic development over the 2014–2021 period, other Romanian regions like the west, center, and north-west have also made economic progress, demonstrating the potential for growth across the country.

4.3. The Effects of ESIF Investments on Regional Economic Development

In the first stage of our analysis, different specifications were tested, considering fixed effects models for both cross-sections (regions) and periods using the ordinary least squares method. The redundancy of fixed effects was tested to decide which of these models was suitable for modeling the sample (fixed effects, random effects, or both). The Hausman test was applied to determine the type of effects (fixed or random) in the estimated models, considering that a low probability in this test suggests the use of fixed effects, while, on the other hand, a high probability suggests the application of random effects. The results of the Hausman test unanimously highlighted the consistency of the estimator based on random effects (REM). In the estimated models, errors were corrected with robust standard errors. Also, the results of Breusch and Pagan's Lagrangian multiplier test for random effects confirmed the choice of random effects.

Table 1 presents different specifications of the general model, alternatively testing the impact of different predictors for the random effects models and estimating the coefficients of these models. The analysis also comprises a robustness-checking section, in which the model was estimated using the GMM method in both of its versions (Dif-GMM and Sys-GMM). The Sargan test is crucial for the evaluation of the validity of differential GMM estimation results and for ensuring the reliability of the instrumental variables used in an analysis. If the test indicates a violation of over-identifying restrictions, this may indicate the presence of endogeneity problems or weak instruments, calling into question the reliability of the estimated coefficients. In the context of GMM differential estimation, the Sargan test examines whether the instruments used in the estimation are not correlated with the model's error term. If the *p*-value is greater than a specified significance level, this indicates that over-identifying restrictions are valid and that the instruments are exogenous within the model. The results of the Sargan test in our study showed that the instruments were valid.

Table 1. The results related to the models.

Models	REM Model 1	REM Model 2	REM Model 3	REM Model 4	REM Model 5	REM Model 6	REM Model 7	REM Model 8	Dif-GMM [1]	Sys-GMM
log(real GDP per capita) (−1)						0.766 ***			0.600 ***	0.634 ***
log(ESIF funds per capita)	0.043 **	0.414 ***	0.039 ***	0.028 ***	0.014 ***	0.0082 **	0.029 ***	0.058 ***	0.088 **	0.028 **
log(initial level of GDP per capita)		0.988 ***	0.869 ***	0.832 ***	1.01 ***	0.144 ***		0.968 ***	0.482 ***	0.291 ***
The weighted average of the gross domestic product from neighboring regions			0.005 ***	0.086 ***		0.0040 **				
EQI				0.196 ***	0.23 ***	0.089 *	0.231 ***		0.135 ***	0.138 ***
log(ESIF funds per capita)*log(initial level of GDP per capita)								0.0046		

Table 1. *Cont.*

Models	REM Model 1	REM Model 2	REM Model 3	REM Model 4	REM Model 5	REM Model 6	REM Model 7	REM Model 8	Dif-GMM [1]	Sys-GMM
log(ESIF funds per capita)*EQI					0.031	0.0078 *				
Constant	3.84 ***	3.83 ***	0.788 ***	1.18 ***	0.231 ***	0.492 ***	4.143 ***	0.454 ***		0.541 **
Observations	64	64	64	64	64	64	64	64	48	56
No. of groups	8	8	8	8	8	8	8	8	8	8
No. of instruments									26	30
Wald test	64.04 ***	5123.51	3617 ***	1956.97 ***	1865.7 ***	3616 ***	21.60 ***	6536.45 ***	1504 ***	740.42 ***
R2 Within	0.283	0.283	0.287	0.52	0.49	0.85	0.54	0.283		
Between	0.13	0.98	0.98	0.98	0.97	0.99	0.13	0.982		
Overall	0.13	0.93	0.94	0.95	0.94	0.99	0.17	0.936		
Sargan test Prob.									98.34 (0.28)	70.24 (0.23)

Source: authors' estimations. [1] Arellano–Bond dynamic panel data estimation. *, **, *** denote significance at 10%, 5%, and 1% levels.

The results obtained highlighted a positive and statistically significant impact on economic development, at the 1% significance level, of ESIF investments dedicated to promoting sustainable transport systems and removing bottlenecks in major network infrastructure, albeit to a small extent, confirming hypothesis H1. This demonstrates that investing in sustainable transport systems and improving infrastructure networks have positive effects on regional economic development. Despite the effect being small, it was statistically significant, suggesting that these investments are a valuable tool for promoting economic development. This variable had a significant positive effect across almost all models, suggesting that an increase in the ESIF funds per capita is associated with an increase in the GDP per capita. The effect varied across the models, with the strongest effect being registered in model 2 (REM).

The convergence effect, highlighted by the statistical significance of the initial GDP per capita, was revealed to lead to an increase in the real GDP per capita, thus validating hypothesis H3. Regions with a lower initial GDP per capita grew at a faster rate than those with a higher initial GDP per capita. This implies that a process of convergence was taking place, with poorer regions catching up with richer ones. The catch-up effect, often referred to as convergence in economic literature (Solarin et al. 2023), is a phenomenon in which lower-income regions grow faster than higher-income regions, reducing income disparities over time. This effect is important in the context of regional economic development as it suggests that lagging regions have the potential to improve their economic status compared to more affluent areas. Moreover, reducing inequality among and within countries is one of the 17 goals in the 2030 Agenda for Sustainable Development.

This variable was significant in most models, and the effect was notably strong in models 2 to 5 and 8. Additionally, perceptions of the quality of governance also lead to economic development, with the EQI index utilized in our study exhibiting a positive and statistically significant impact on the regional GDP per capita, thus validating hypothesis H2. The quality of governance tends to encompass various factors, including the efficiency of public services, the level of corruption, the rule of law, and the respect of citizens' rights. Good governance promotes transparency, reduces the risk of corruption, ensures the efficient use of resources, and creates a favorable environment for business and investment, leading to economic development. This variable was significant in several models, indicating a positive relationship between environmental quality and the GDP per capita. The statistical significance of the weighted average of the gross domestic product of neighboring regions suggests regional spillover effects, which can influence a region's GDP per capita.

Furthermore, a positive impact of the previous period's real GDP per capita on the current GDP per capita was also highlighted. This result is evidence of the persistence or autocorrelation of the real GDP per capita, meaning that regions that had a higher GDP per capita in the previous period are likely to have a higher GDP per capita in the current period. This finding indicates that regions with a high GDP per capita tend to maintain their economic momentum, suggesting a degree of stability and continuity in economic performance, which may be due to a variety of factors, such as robust industrial structures, strong institutional capacities, or high levels of human capital, which allow these regions to sustain their economic advantage over time. The results can also be interpreted in terms of path dependency.

Once a region develops a certain economic structure or achieves a certain level of wealth, it may be difficult to significantly change its economic trajectory in the short term. This could be due to institutional inertia, sunk costs, or the persistence of social and economic inequalities.

In order to evaluate the impact of ESIF investments on regional economic development and their relationship with the quality of governance, the statistical significance of the interaction term between the two was analyzed, which pointed out no potential impact, thus invalidating hypothesis H4. The positive sign of the interaction term highlights that the positive impact of ESIF investments would be even more pronounced in regions with a better quality of governance, but the impact was not statistically significant.

The interaction between the ESIF funds per capita and the initial GDP per capita and that between the ESIF funds per capita and the EQI were explored, but they showed limited significance.

A potential explanation could be that the interaction between ESIF investments and the quality of governance may have sector-specific impacts that are not captured in an aggregate measure of economic development, such as the GDP per capita, but still have significant impacts in specific sectors, like education or healthcare.

The robustness analysis based on the results of Dif-GMM and Sys-GMM maintained the same results, revealing that the main three hypotheses, that is, H1, H2, and H3, had been preserved and were fully validated.

Therefore, the investments made through the European Structural and Investment Funds (ESIFs) designed to promote sustainable transport had a positive impact on economic development, even if the effect was slight. This implies that regions receiving the respective funds experience a boost in their economic development. The funds could contribute to job creation, infrastructure improvement, or other factors that stimulate economic activity. However, the effect was found to be relatively small. The Wald test indicated the overall significance of the models, with all the models (except for model 2) showing a strong significance. R2 values provide insight into a model's explanatory power, with the higher values seen in the R2 for model 6 (0.85) suggesting that variation within groups over time was well explained in this model. For the GMM models, the Sargan test investigates the validity of the instruments used. The probability values suggested that the instruments utilized in our study were valid.

Therefore, we can conclude the following: All the models showed that ESIF funds positively impact the regional GDP per capita, albeit to varying extents. Higher initial levels of GDP per capita generally lead to higher subsequent levels, indicating a persistence of economic status. Regional spillover effects and environmental quality also play a role in economic development. The consistency across the different models strengthened the reliability of these findings.

The quality of regional governance plays a crucial role in economic development. Regions with better governance, which implies, among other things, a more efficient public administration, a better implementation of policies, and lower levels of corruption, are likely to have a more favorable economic environment that stimulates development.

This study also confirmed a convergence effect between regions based on the initial value of the real GDP per capita. This suggests that regions with a lower initial GDP per

capita grow faster than those with a higher initial GDP per capita, with all the other factors being constant. This could be the result of a catching-up process in which less developed regions grow faster to reach the level of more developed regions.

In conclusion, the data suggest that European funds intended to promote sustainable transport systems had a positive impact on Romanian regional development. This impact was moderated by the initial economic conditions and environmental quality, with evidence of regional spillover effects. These findings hold significant implications for policymakers in terms of prioritizing investment areas and understanding the multifaceted influences on regional economic development.

5. Discussion

This methodological approach reflects a rigorous and multi-layered analytical process that begins with the specification of the base model and moves to more complex and robust methods to address the complexity of the data and the research questions. The shift from the SEM to the GMM methodology is based on statistical tests such as the Hausman test and the Sargan test, which provide the most accurate and reliable information on how sustainable transportation investments affect regional economic development. This methodology recognizes the complexity of the relationships under study and takes a comprehensive approach to accurately model these relationships.

Starting with SEM, based on pre-testing, and moving to the GMM method for more detailed analysis and endogeneity concerns, this study not only increases the robustness of the results but also contributes significantly to the existing literature on this topic.

This study assesses the quality of regional governance and its role in economic development through a multifaceted approach, focusing on the perception of governance quality and its direct impact on the regional GDP per capita. Specifically, it uses the European Quality of Government Index (EQI) as a key indicator to evaluate regional governance. The EQI is comprehensive, incorporating factors such as the efficiency of public services, the level of corruption, the rule of law, and the respect for citizens' rights, which are critical dimensions of good governance. This study uses the EQI, which aggregates perceptions and experiences of governance quality from the perspective of citizens and businesses within regions. The findings underline a positive and statistically significant relationship between the quality of governance (as measured by the EQI) and the regional GDP per capita. This relationship confirms the hypothesis that a better governance quality directly contributes to economic development. High EQI scores, indicative of good governance, are associated with higher levels of regional economic performance.

The results of this research clearly demonstrate the positive impact of ESIF investments in sustainable transport systems and eliminating bottlenecks in major network infrastructures on economic development. This demonstrates that investments in sustainable transport systems and the improvement of infrastructure networks have positive effects on regional economic development. The effect is statistically significant, suggesting that these investments are a valuable tool for promoting economic development.

From a policy perspective, this finding could justify the allocation of ESIF funds to sustainable transport and infrastructure projects. Policymakers could consider increasing funding in these areas to further boost economic development. These findings also have implications for sustainable development. The positive impact suggests that investments in sustainable transport and infrastructure could contribute to economic development without compromising environmental sustainability.

Perceptions of the quality of governance can also influence investment decisions. Regions with better governance are likely to attract more investments, further driving their economic development. Good governance is important not only for economic development but also for social development and the well-being of citizens. Regions with good governance tend to have better public services, lower levels of corruption, and higher degrees of social justice. Regions with good governance are more likely to compete effectively in the

global economy, attract foreign direct investment (FDI), promote innovation, and create high-quality jobs, which, in turn, lead to sustainable economic development.

The convergence effect, highlighted by the statistical significance of the initial GDP per capita, has been revealed to lead to an increase in the real GDP per capita. Regions with a lower initial GDP per capita are growing at a faster rate than those with a higher initial GDP per capita. This means that there is a process of convergence taking place, whereby poorer regions are catching up with richer ones.

Despite the positive convergence trend, regions with a lower initial GDP per capita may still require continued policy attention and investment support to maintain the momentum of growth and address other potential challenges associated with economic development, such as environmental issues, infrastructure development, and social inequalities.

Taken together, these results highlight the importance of ESIF investments and good governance in fostering regional economic development. They also underscore the role of regional convergence in balancing economic development across regions. These findings can guide policy recommendations and future research directions, particularly in the context of regional development and EU funding.

Although the effect is small, it is important to note that these types of investments often have long-term effects that may not be immediately evident. Improved transport and infrastructure can lead to increased efficiency, productivity, and economic competitiveness over time.

6. Conclusions

This study confirms the positive role of ESIF investments in promoting sustainable transport on regional economic development. However, the impact is relatively small, suggesting that the volume of investments needs to be substantial in order to trigger significant growth. The quality of regional governance is also a crucial factor for economic development. Regions with a better governance quality demonstrate a higher rate of economic growth. This implies that, in addition to financial investments, the effective use of funds, which is often linked to the quality of governance, is crucial for economic development. This study reveals a convergence effect across regions, whereby regions with a lower initial GDP per capita grow faster than those with a higher initial GDP per capita, indicating a "catch-up" effect. The factors contributing to the catch-up effect are the following: 1. Lagging regions can achieve rapid growth by adopting and integrating technologies that have already been developed in more advanced regions. 2. Investments in education and training can improve the quality of the workforce in less-developed regions. 3. Improvements in governance and in the institutional framework can create a more favorable environment for economic activity. 4. Investments in infrastructure (transport, utilities, and communications networks) can significantly reduce transaction costs and connect lagging regions to larger markets, stimulating economic activity and growth. 5. Targeted policy interventions and financial support, such as those provided by the ESIFs, can support the development of lagging regions by funding projects in the areas of infrastructure, education, and technology.

The quality of regional governance and its role in regional economic development are reflected in regional development policies, which have a strong instrumental character, and in the European Union's funds, which contribute to the financing of sectorial policies such as, for example, agricultural policy, social policy, environmental protection policy, and sustainable development policy. Romania's policies are correlated with the policies of the European Union. Regional governance, in the sense intended in our study, can be measured by referring to the efficiency of access to the EU funds needed for the development of sustainable transport, taking into account the administrative diversity at the level of each region and the cooperation with regional and local authorities as well as with community administration, for example, by sharing best practices and results or by establishing partnerships between regional institutions open to voluntary association.

This study identifies the mechanisms through which the quality of governance affects economic development. The first one comprises transparency and corruption reduction: good governance increases transparency and accountability in public administration. This creates a more predictable and secure environment for business and investment. Second, effective governance ensures that public resources are allocated and used efficiently, maximizing the impact of investments, including those in sustainable transport and infrastructure, on economic growth. The third one is centered around the business and investment climate: the quality of governance shapes the overall business environment, influencing investment decisions, operational costs, and the competitiveness of regions. A favorable governance environment attracts investments, stimulating economic activity and growth. By using the European Quality of Government Index (EQI) as its central measure, this study effectively captures the quality of regional governance and demonstrates its significant role in fostering economic development. The positive correlation between governance quality and the regional GDP per capita underlines the crucial importance of efficient, transparent, and accountable governance structures in promoting sustainable economic growth.

This finding provides a strong basis for policy recommendations aimed at improving governance standards to foster regional development.

The limited impact of ESIFs on promoting sustainable transport can be attributed to a complex interplay of adequate funding, administrative efficiency, strategic orientation, and contextual factors. Addressing these challenges requires streamlined administrative processes, increased capacity building for project management, strategic planning to align investments with regional needs, and comprehensive evaluation mechanisms to assess and adjust funding strategies for greater effectiveness.

From a policy perspective, these conclusions can guide decision making and re-source allocation in the following ways:

Increase and Improve the Use of ESIFs: Given the positive impact of ESIF investments tackling sustainable transport on economic development, policymakers should consider increasing these investments. Moreover, efforts should be made to ensure that these funds are used efficiently and effectively, contributing to substantial economic development.

Improve Governance Quality: Enhancing the quality of regional governance should be a priority. Good governance practices can ensure the efficient use of investments and foster an environment that is conducive to economic development.

Target Less Developed Regions: The existence of a convergence effect suggests that focusing resources on less developed regions can be effective. As these regions have been shown to grow faster, targeted investments could promote balanced regional development and reduce economic disparities.

The main limitation of this study is the time period, as a longer period of analysis might reveal different results as well as refine the measures of key variables and explore alternative model specifications. On the other hand, the period of analysis (2014–2020) for assessing the impact of European Structural and Investment Funds (ESIFs) on sustainable transport in Romania includes economic fluctuations, policy changes, and external events, all of which can affect the allocation and effectiveness of ESIFs as well as the broader context of sustainable transport development. In the analysis of the 2014–2020 period, our study did not explicitly account for potential changes in economic conditions or policy priorities that might have influenced the outcomes of ESIF investments in sustainable transport in Romania. While these factors—ranging from economic fluctuations to shifts in EU and national policy priorities and major events such as the COVID-19 pandemic—undoubtedly affect the effectiveness and focus of infrastructure investments, our methodology was primarily designed to assess direct impacts without taking into account these dynamic external variables. The following are among the factors not explicitly accounted for in our study that could have influenced the outcomes of ESIF investments: 1. EU Policy Priorities: The EU's emphasis on sustainable development and Cohesion Policy may have influenced the prioritization of sustainable transport projects. The launch of the European Green Deal

towards the end of the study period (2019) may also reflect a shift in priorities, which could have affected project implementation and funding. 2. Socio-political Changes: Events such as elections, changes in government, or shifts in regional governance structures could affect the continuity and focus of sustainable transport projects. 3. COVID-19 Pandemic: Although primarily affecting the world in 2020, the onset of the COVID-19 pandemic could have had a significant impact on the latter part of the study period, affecting the use of public transport and project implementation timescales and potentially shifting priorities towards health and safety. The inclusion of policy event studies or more nuanced qualitative analyses could capture the interplay between policy changes, economic trends, and investment outcomes. By addressing these issues, subsequent research can provide deeper insights into optimizing ESIF use under different conditions, ultimately improving policy recommendations for sustainable transport development in Romania.

Thus, future research directions in the field of the impact of EU funds on regional development in Romania can have multiple valences. Firstly, the projects implemented and analyzed in our research can be examples of good practice. Secondly, future research could be developed at the European level and include studying the impact of major events such as the COVID-19 pandemic on public transport systems and sustainable mobility trends. Also, further research is needed regarding the environmental outcomes of ESIF-funded transport projects, including reductions in greenhouse gas emissions, improvements in air quality, and contributions to climate change mitigation.

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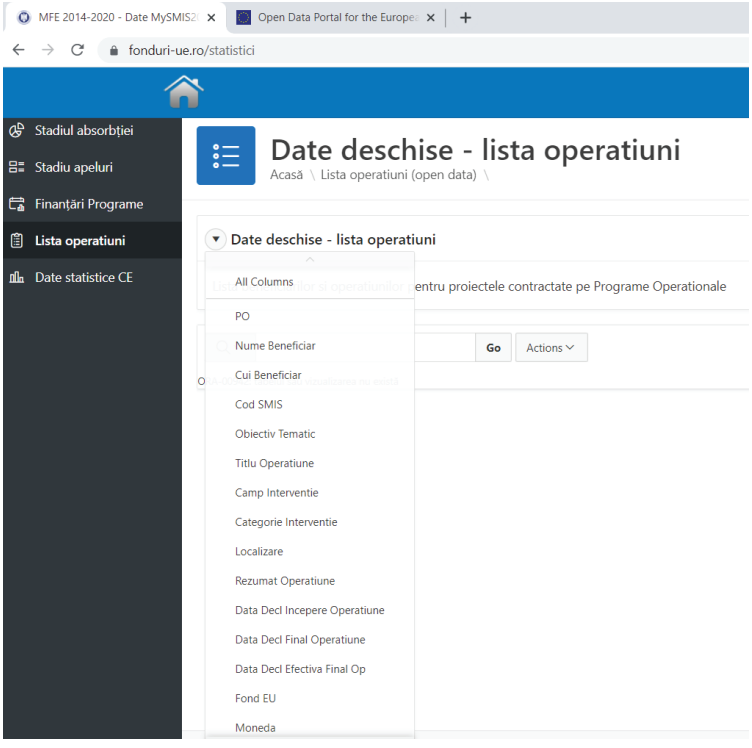
Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A. Breakdown of the Data Collection Procedure

From the open data published by the Romanian Government, the database "Open Data—List of operations/List of beneficiaries and operations for projects contracted on Operational Programmes" was accessed, where the term "operation" is understood as "funded project". When exporting the table in an Excel format, the information was filtered by thematic objective OT7 "Promote sustainable transport systems and remove bottlenecks in major network infrastructures", which automatically resulted in data on projects funded by the LIOP and the ROP.

For the "Location" dataset, an intervention was carried out to obtain a relevant structure for the eight development regions of Romania. Therefore, the information on the localities where the grants had been assigned was translated into the information on the corresponding development region. For example: Arad city, west Romania, became the west region; Targu Carbunești city, Gorj, became south-west Oltenia; Novaci city, Gorj, Romania, south-west Oltenia, became the south-west region, etc.

In order to group the information on the financial data of the projects by year, the data series "Date Decl[show] Start Operation" was used, where the start date of a project—which was expressed as dd/mm/yyyy—was summarized exclusively to the year (yyyy).



Appendix B. Analysis of the Largest Projects in Terms of Eligible Expenditure in Each Region

No	Region	Eligible Expenditure (RON)	Name of Project	Objectives and Results
1	South-East	221,283,406.21	Modernization and capacity development of the Port of Constanta—development of port infrastructure in development zone a, MOL II-s Port Constanta South, by extending the port platform, facilitating multimodal transport	Specific project objectives: - To develop the Port of Constanta by ensuring increased storage and handling capacities for RORO cargo; - To provide the necessary infrastructure to the Port of Constanta for the development of multimodal transport; - Modernization of the Port of Constanta in order to increase the volume of cargo transported. Results: - A total of 16 hectares of port platforms developed; - Development of water and electricity supply networks, both for supplying ships and for the operation of equipment and other facilities located on the port platforms; - Increase in the annual cargo volume to approximately 1,700,000 tons/year; - A total of 969,054 TEU in the volume of containerized cargo; - Reduction in CO_2 emissions by a minimum of 177,000 tons-equivalent per year in 2030 and a minimum of 240,000 tons-equivalent per year in 2049.

No	Region	Eligible Expenditure (RON)	Name of Project	Objectives and Results
2	Bucharest–Ilfov	5,268,325,335.9	Integrated infrastructure for the orbital area of Bucharest	Objective: The completion of the orbital road network of Bucharest in order to ensure an adequate interconnection between the three existing highways and national/European roads, highways, and European roads starting from km 0 in Bucharest. Results: Reduction in travel time, reducing vehicle operating costs by approximately 15%, reduction in the number of accidents by avoiding crossing urban areas, improvement of environmental conditions, reduction in the amounts of pollutant emissions, noise, and local air pollution, and construction of 51,195 km of a section of highway 2 × 2 (southern section of the ring road).
3	Center	313,179,154.52	Targu Mures bypass	Objective: Creation of a modern road transport network, with a view to the regional development of the area, improvement of traffic flow, and reduction in travel time, pollution, and the number of road accidents in the region. Results: Construction of 11,463 km of bypass, five bridges, two overpasses, one viaduct, two roundabout road junctions, and two car parks.
4	South Muntenia	3,315,689,879.31	Preparation of the Sibiu–Pitesti Highway project and construction of Sections 1, 4, and 5	Objective: Improvement of the economic efficiency of the transport network in Romania by shortening the travel time between Sibiu and Pitesti and implicitly improving the connectivity at the regional level. Results: Construction of 53.38 km of highway 2 × 2, including six intersections, 28 bridges and overpasses, 10 viaducts, one tunnel, a parking lot, two service areas, and three coordination and maintenance centers.
5	South Muntenia	353,734,274.55	Modernization of locks. Equipment and installations—Phase 2	Objective: Ensuring the availability and safety of navigation on the two channels, that is, the Black Sea Danube Canal and the White Gate Canal Midia Navodari, providing a sustainable alternative to road and rail transport along an important national and international transport route.
6	South-East	363,261,081.05	Construction of the Braila–Galati Expressway	Objective: The development of the road network by creating a modern way of communication that ensures an adequate connection to the TEN-T network, with implications in the regional development of the Braila–Galati area. Results: Construction of 10.77 km of new road, one bridge over the irrigation canal at km 6 + 620, and a bridge–viaduct–overpass structure at km 10 + 963; reduction in travel time on the TEN-T road network by a minimum of 4% in the first year of operation, from 43.34 min at the beginning of the project to 41.08 min by the end of the project, for cars, and from 47.87 min at the beginning of the project to 39.37 min by the end of the project for cargo.
7	West	1,620,299,408.8	Sebes–Turda Highway	The project aims to create a modern road transport network for the regional development of the area, improve traffic efficiency by reducing travel time, and reduce pollution and the number of road accidents in the region. This way, the project contributes to the promotion of a sustainable transport system in Romania, which will facilitate the safe, fast, and efficient transport of people and goods at European standards. Results: 70.00 km of newly built ten-T road; 66 bridges and overpasses; four short-term parking lots; four service spaces; one maintenance and monitoring center; one maintenance and coordination center; and reduction in travel time between Sebes and Turda from 85.83 min at the beginning of the project implementation period to 79.42 min by the end of the project implementation period for heavy traffic vehicles and 53.35 min for motor vehicles.
8.	South-West Oltenia	4,082,728,145.81	Express Road Craiova–Pitesti	Objective: Creating a modern communication route between the cities of Craiova and Pitesti, with implications for the regional development of the area; through the implementation of this project the connection between the two branches of the Ten-t Core Rhine–Danube corridor in Romania will be achieved.

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Article

Accelerator for Agglomeration in Sequencing Economics: "Leased" Industrial Zones

Akifumi Kuchiki

Institute for International Trade and Investment, Tokyo 104-0045, Japan; akichan8107@ab.cyberhome.ne.jp

Abstract: This paper identifies the importance of reducing fixed costs for establishing industrial zones as part of an agglomeration policy. China's economic growth has been driven by the agglomeration of manufacturing firms via industrial zones that attract foreign direct investment. This investment enables the export of products by importing intermediate capital goods. According to the new trade theory of spatial economics, the number of firms in an agglomeration is inversely proportional to the fixed costs. The main accelerator of agglomeration after the master switch is the formation of segments that reduce firms' fixed costs. Via a factor analysis of manufacturing agglomeration segments in sequencing economics, this paper finds that "leased" industrial zones are accelerator segments in the formation process of manufacturing agglomerations.

Keywords: accelerator segment; leased industrial zones; sequencing economics; manufacturing agglomeration; fixed costs; spatial economics

JEL Classification: L22; O21; R11

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1. Introduction

Industrial agglomeration policy refers to the creation of agglomerations via policy. According to Fujita et al. (1999), agglomeration means the clustering of economic activities that are created and maintained via some form of circular logic.

Industrial agglomeration policies have been adopted in East Asia since the 1980s. The development of industrial zones brings together economic agglomeration and industrial clusters of economic activity. The prototype of industrial zones in Asia is the export processing zone concept in Kaohsiung, Taiwan, established in 1965. This model was then introduced in Penang, Malaysia, in the 1970s and in Tan Thuan, Ho Chi Minh City, in the 1990s.

Fujita et al. (1999) established spatial economics—or the study of where economic activity takes place and why. According to Oqubay and Lin (2020), the number of industrial zones in Asia has increased dramatically since the 1980s, with the Asia-Pacific region alone accounting for over 65% of global employment and exports. UNCTAD (2019) notes that in China, special economic zones (SEZs) have a strong positive effect on foreign direct investment (FDI), with SEZs accounting for more than 80% of cumulative FDI. Oqubay and Lin (2020) showed, via a dynamic approach, that understanding industrial hubs is important for the production-centred paradigm.

As of 2018, there are approximately 6000 existing and planned industrial parks worldwide, nearly 90% of which are in developing countries, with Asia accounting for nearly 70% and Africa for 5% (see UNCTAD (2019)). Oqubay (2020) noted that industrial parks in Ethiopia have played an insignificant role in the past but could play a larger role in the overall industrial development strategy in the future.

Pietrobelli (2020) analysed cluster development policies in Latin American countries as follows: cluster development policies in the Latin American subcontinent began to be implemented in the 2000s, and most of them were financed by international donor agencies,

including the Inter-American Development Bank; for example, cluster results for São Paulo and Minas Gerais, Brazil, show positive and significant effects on employment, export probability, and export levels.

Prior to the 1980s, Hirschman (1958) recommended fostering domestic industry by protecting domestic firms, but his strategy of unbalanced growth was introduced under the liberalisation of international trade and investment after the 1980s. In "The East Asian Miracle," the World Bank (1993) called export-led policies adopted in Asia via export processing zones the "export push strategy". Markusen (1996) classified industrial districts into five categories, including Marshall industrial districts and Italian-type industrial districts. Oqubay and Lin (2020), in the introduction to "*The Oxford Handbook of Industrial Hubs and Economic Development*," introduce the sequence of economics defined by Kuchiki, i.e., the flowchart approach to industrial agglomeration, and use it as the foundation for empirical and case study evidence obtained in Asia, Latin America, and Africa.[1] However, the flowchart approach lacked theoretical background and quantitative analysis.

Agglomeration segments are classified into four categories: physical infrastructure, institutions, human resources, and living environment, as shown in Table 1. Kanai and Ishida (2000) emphasised the importance of the cumulative process because, in spatial economics, the construction of any segment of agglomeration takes "time" in addition to space. Kuchiki and Sakai (2023) reflected on the analysis of the accumulation process as follows. First, Fujita and Kuchiki (2006) applied the flowchart method to the construction of the cumulative process, as shown in Figure 1. Second, Kuchiki (2020) proposed an architectural theory in the economy of sequence with respect to accumulation to find the optimal sequence for efficient segment construction. "Economies of sequence" in sequencing economics is defined as the ordering of any two segments in the set of segments that make up an agglomeration to efficiently construct that agglomeration. Third, Kuchiki and Sakai (2023) used the fact that spatial economics models derive segments that satisfy the symmetry-breaking condition to find that segments related to transport costs are the "master switch" for ordering segments of urban agglomerations. When a stable symmetric equilibrium is broken, the construction of the segments of an agglomeration equilibrium begins. However, no study has examined what the accelerator segment next to the master switch is when constructing the segments of a manufacturing agglomeration.

Table 1. China's (i) industrial agglomeration policy and (ii) industrial policy.

	Period 1: Start of (i) Industrial Agglomeration Policy (IAP)	**Period 2: Start of (ii) Industrial Policy (IP)**
Period Classification	1978–1984 Introduction of market economy	1984–1992 Formation of market economy
Basic Idea	Elimination of supply shortage Industrial structure adjustment	Formation of unified markets (commodities, labour etc.)
Policy	**(i) "SEZ: Special Economic Zones 1979"**	**(i) ETDZ: State-level Economic and Technological Development Zones 1984**
Industry	Light industries by Township and Villege Enterprises Reform	Basic industries
	Textile Agriculture	Infrastructure Energy industry Steel and other materials industries
Regional Policy	**(i) "SEZ (Special Economic Zones): 4 locations" Shenzhen, Zhuhai, Xiantou, Xiamen (i)980**	(i) ETDZ: Dalian, Shanghai, Guangzhou, etc. 14 places (i) Economic Region in Southern China
Means	Direct control of quantity and price Allocation of capital and foreign currency System of distribution tickets of goods	**(i) ETDZ: FDI introduction policy** (ii) IP: Establishment of Industrial Policy Department 1988 (ii) IP: Announcement of the list of priority industries in 1989
Special note	**(i) SEZ: Industrial agglomeration policy 1979 Establishment of Special Economic Zones**	(ii) IP: Merger and reorganization of enterprises

Source: Prepared by Chen and Kuchiki (2000).

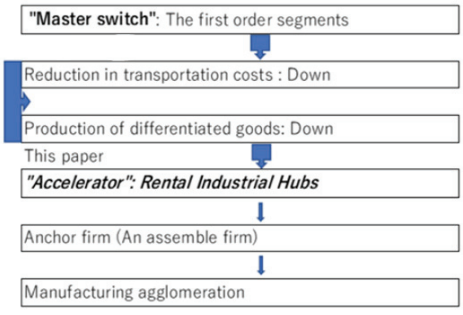

Figure 1. Manufacturing agglomeration policy.

The purpose of this paper is to find the accelerator segments that comprise an industrial agglomeration. An accelerator segment is defined as a segment that increases the number of firms in an industrial agglomeration.

Our research methodology is provided as follows. First, China is a country that has successfully pursued a policy of industrial agglomeration via the introduction of foreign capital. Therefore, we focus on the chronology of industrial agglomeration in China. The results of the Granger causality test for China reveal the process of industrial agglomeration formed by the introduction of foreign capital. We find that inward foreign direct investment (FDI) is associated with industrial agglomeration policy. Between 1987 and 2009 in China, the increase in the domestic investment to GDP ratio, according to Granger causality, resulted in rises in the rates of import, industrial, and GDP growth. Similarly, inward FDI, based on Granger causality, resulted in rises in the rates of import, industrial, and GDP growth. The inward FDI growth rate can explain the industrial growth rate and GDP growth rate, with the inward FDI growth rate having a positive regression relationship with both rates.

After the Plaza Accord of 1985, the exchange rates of countries such as Japan and South Korea were revalued. As domestic costs rose, these countries shifted their production bases overseas, and foreign direct investment in Asia surged. This paper focuses on the outward investment behaviour of Japanese firms. Using a study conducted by the Japan Bank for International Cooperation (JBIC), we use factor analysis to identify the factors that promote investment. The most promising factors are those that promote conditions for industrial agglomeration in each country. We find that factors related to incentives for foreign direct investment (FDI) include preferential tax policies for investment and stable policies to attract foreign investment.

Second, we apply a two-region model of the new economic geography in spatial economics to obtain a conclusion that the number of firms moving to a region is inversely proportional to the fixed costs of that region. This conclusion is the rationale for the fact that the accelerator segment is a fixed-cost factor of production.

Third, among the fixed costs, those related to the industrial agglomeration of labour-intensive manufacturing industries were identified via factor analysis using a survey conducted on Japanese companies by JETRO in 100 cities and regions in around 60 countries to determine investment-related costs when establishing operations in each city. We show that the rent of leased industrial zones was included in the same factor as the wages of workers in labour-intensive manufacturing industries. Therefore, we conclude that the establishment of leased industrial zones reduces fixed costs and increases the number of firms in industrial agglomerations.

As shown in Figure 1, the accelerator is the "leased" industrial zone, while the master switches of a manufacturing agglomeration policy are the reduction in transportation costs and the production of differentiated products.

The analysis in this paper suggests measures for successful industrial agglomeration policies. A consideration of the economies of sequence in sequencing economics is essential

to the implementation of such policies. The construction of accelerators will increase the efficiency of policy implementation. Further research in sequencing economics will be completed in the future.

The section structure is organised as follows. Section 2 explains the chronology of an industrial agglomeration policy. Section 3 describes the role of economic development zones as industrial zones from the perspective of spatial economics. Section 4 provides statistical analyses of industrial agglomeration policy. The factor analysis on investment-related costs in industrial zones is shown in Section 5, and the last section provides a summary and conclusions.

2. Chronology of the Chinese Industrial Agglomeration Policy

Here, the economic development zones as industrial zones include special economic zones (SEZs), economic and technological development zones (ETDZs), hi-tech industrial development zones (HIDZs), and pilot free-trade zones (PFTZs).[2]

The timeframe of an "industrial agglomeration policy" can be divided into seven main periods of the reform and opening-up policies, as shown in Tables 1–3.

Table 2. China's (i) industrial agglomeration policy and (ii) industrial policy.

	Period 3: Coexistence of (i) Industrial Agglomeration Policy and (ii) Industrial Policy	**Period 4: Emphasis on (i) Industrial Agglomeration Policy**
Period	1992–1997	1997–2004
Classification	**(i) Industrial agglomeration policy and (ii) Industrial policy**	(i) Industrial agglomeration policy
Basic Idea	Emphasis on international competition Industrial structure rationalization	Globalization: Competition with multinationals
Policy	**(i) HTDZ: State-level High-Tech Development Zones 1992: 52 locations** **(ii) IP: Protection policy for infant industry**	**(i) "WTO Accession in 2001"**
Industry	**(ii) Industrial Policy Outline 1994: Four Major Pillar Industries** **(ii) IP: Automobile Industry Policy 1994**	**(i) Emphasis on international competitiveness**
	(ii) IP: Four Major Pillar Industries: "Automobile, Machinery & Electronics, Petrochemicals, Construction"	**(ii) Information Communication Industry** New materials, Biotechnology
Regional Policy	**(i) "Yangtze River Economic Region"**	(i) Bohai Sea Rim Economic Region (i) Western Great Development 2000
Means	**(i) FDI introduction through development zones: ETDZ, HTDZ** **(ii) Industrial policy**	**(i) Joint venture, technical cooperation** **(ii) Merger and restructuring of enterprises**
Special note	**(i) IAP: Deng Xiaoping's "Southern Tour Speech 1992"** **(i) IAP: Announcement of "Industrial Policy" Priority industries for foreign investment 1997** **(ii) IP: 'Industrial Policy Outline' and 'Automobile Industry Policy' 1994**	**(i) Asian currency crisis 1997** **(ii) Zhu Rongji:** **IP: Reform of state-owned enterprises 1998**

Source: Prepared by Chen and Kuchiki (2000).

(1) Establishment of "Special Economic Zones": the start of industrial agglomeration policy (1978–1984) (see Table 1).

The first period was dominated by a planned economy and the introduction of a market economy. A feature of this period was the establishment of "Special Economic Zones" in 1979 as a policy move toward the introduction of foreign direct investment (FDI) and industrial agglomeration. "Economic development zones," or (i) in Tables 1–3,

became centres of growth resulting from the introduction of foreign investment in industrial estates via preferential policies. There were three specific types (i): special economic zones (SEZs), state-level economic and technological development zones (ETDZs), and state-level high-tech industrial development zones (HIDZs).[3]

Table 3. China's (i) industrial agglomeration policy and (ii) industrial policy.

	Period 5: Emphasis on Harmonious Society	**Period 6: New Start of (i) IAP and (ii) IP**	**Period 7: Integration of (i) IAP and (ii) IP**
Year	2004–2010	2010–2013 Rebalancing	2013–2022
Classification	Harmonious Society	Change in pattern of economic development	Socialist Market Economy with Chinese Characteristics (i) (ii)
Basic Ideology	Scientific View of Development Passing the "turning point"	Escape from the "Trap of Middle-income Countries"	**(i) (ii) Domestic Circulation: Target 2035**
Policy	Reduction of disparities Environmental conservation	**(i) PFTZ: Shanghai Pilot Free Trade Zone 2013** **(ii) IP: Strategic Emerging Industries 2010**	**(i) (ii) SEI: Strategic Emerging Industries** **(i) (ii) PFTZ: Beijing Pilot Free Trade Zone 2021** One Belt, One Road Joint Construction 2013
Industry	**Upgrading industrial structure:** **(ii) High-tech industries** **(ii) Biomedicine** **(ii) High-tech informatization**	**(ii) IP: 7 major industries:** **Environmental protection,** **Information Communication, New energy, New energy automobiles, etc.**	**(i) IP: Modern Service Industries 2013** **(ii) IP: Strategic Emerging Industries** Post COVID-19 Green economy and Digital economy
Regional	(i) Western Development	(i) Northeast Regional Development Plan (2016–2020)	**(i) (ii) PFTZ: 21 Pilot Free Trade Zones 2021**
Means	**(ii) Creation of independent technology**	New rural construction	(i) (ii) New infrastructure construction 2020
Special note	Increase in minimum wage Three-farm problem Lehman Shock 2008	Reduction of corruption Emphasis on green industry China's GDP 2nd in the world 2010	**(i) (ii) 1st in the world: Fortune's World 500 largest companies:** 124 companies 2020

Source: Prepared by Chen and Kuchiki (2000).

First, SEZs served as pilot zones for economic reforms and encouraged the introduction of foreign capital as part of the policy of opening up to the outside world via preferential systems. These preferential systems included preferential taxation, such as corporate tax exemptions and tariff exemptions for equipment imports, as well as preferential treatment in terms of management autonomy and foreign currency management for foreign companies. The cities designated in 1980 were Shenzhen, Zhuhai, and Shantou in Guangdong and Xiamen in Fujian. Guangdong was identified as a region-specific SEZ, while ETDZs and HIDZs were later adopted in other regions, as explained below.

Second, ETDZs aimed to further open China up to the outside world, following the lead of SEZs in 1984, by granting the same preferential policies as those of SEZs. The State Council designated 14 such zones in 12 coastal open cities.[4]

Third, in the second period, HIDZs were implemented in 1988 with the aim of developing emerging industries. The Beijing Hi-Tech Industrial Development Zone was approved by the State Council and is the predecessor of the "Zhongguancun Science and Technology Park". This led in part to the establishment of the "Beijing Pilot Free Trade Zone" in 2020 (see State Council of China (2020a)).

Hence, the special economic zone approach became the prototype for China's "industrial agglomeration policy".

(2) The beginning of industrial policy (1984–1992) (see Table 1).

The second period, from 1984 to 1992, was a transitional period between the first period, characterised by a planned economy, and the third period, characterised by a market economy. During this period, China developed its market economy and formed a "unified market".

(3) The coexistence of industrial agglomeration policy and industrial policy (1992–1997) (see Table 2).

The third period, from 1992 to 1997, saw the coexistence of two economic policies: (i) the policy of introducing foreign capital and industrial agglomeration and (ii) the policy of protecting domestic and infant industries.

In 1992, Deng Xiaoping delivered his "Southern Tour Speech," calling for reform and promoting an opening-up of the economy and policies of industrial agglomeration via introducing FDI. The policy was implemented in a number of coastal cities, starting with the Shanghai Pudong development.[5]

After Shanghai, the development mechanism based on the industrial agglomeration policy via the introduction of FDI saw subsequent success in Tianjin and Chongqing[6] High-tech enterprises are knowledge- and technology-intensive enterprises that utilise advanced technology. The Beijing HTDZ (a state-level high-tech industrial development zone) was approved in 1988 and was the precursor of the Zhongguancun Science and Technology Park. The number of HTDZs thereafter increased to 27 in 1990 and 52 in 1992.

(4) Industrial agglomeration policy with an emphasis on international competitiveness of enterprises (1997–2004) (see Table 2).

In preparation for its "World Trade Organisation (WTO) Accession" in 2001, China modified its domestic legal system by enacting the Anti-Monopoly Law and amending the Foreign Trade Law and the Export Commodities Inspection Law, among others, to improve the investment environment. In addition to the successful South China Economic Region, which had previously been centred on Guangdong and Shenzhen, this led to the introduction of foreign capital into the Yangtze River Economic Region, including Shanghai, and later the Beijing–Tianjin–Hebei Economic Region, including the Beijing, Tianjin, and Hebei provinces. This policy resulted in China's industrial agglomeration.

(5) Scientific View of Development after the turning point (2004–2010) (see Table 3).

China passed the turning point around 2004.[7] The country managed its economy properly, achieved high economic growth via the Five-Year Plan and the National People's Congress, and changed its development pattern by focusing on "Scientific Development".[8]

(6) "Strategic emerging industries" as an industrial policy to escape from the middle-income-country trap (2010–2013) (see Table 3).

China sought to escape from the "middle-income country trap" during this period.

Regional industrial agglomeration policies were further expanded, and the emphasis shifted to the Great Western Development policy centred on the Chengdu–Chongqing Economic Zone and the promotion of the Northeast region.

(7) Industrial agglomeration policy via "pilot free trade zones" (2013–2022) (see Table 3).

Pilot free-trade zones are the basis for the formation of industrial "agglomerations". The first pilot free-trade zone was established in Shanghai in 2013 to explore new growth in tertiary industries. By attracting foreign capital in consumer-related service industries, China aimed to develop (i) "modern service industries".[9] In 2017, the focus was expanded from "Modern Service Industries" to "advanced manufacturing industries". In 2020, pilot free-trade zones were established in three provinces—Beijing, Hunan, and Anhui—bringing the total to 21 (see State Council of China (2020b)).[10]

As described above, following the reform and opening-up policies, China has continued to implement industrial agglomeration policies since 1978. In the next section, we will show that the industrial agglomeration formed has led to China's economic growth. We apply factor analysis to identify segments that should be of priority in constructing labour-intensive manufacturing agglomerations.

3. The Role of Economic Development Zones as Industrial Zones

Table 4 shows the segments of the economic development zones. The segments related to transportation costs consist of infrastructure, such as transportation; institutions, such as one-stop services; and human resources, such as skilled labour. Figure 1 illustrates the role of economic development zones as master switches in introducing industrial agglomeration policies. The master switches in the agglomeration policy are reductions in transportation costs and initiating the production of differentiated goods with low values of elasticity of substitution between any two types of goods and services. This will be clarified below using a theoretical model of spatial economics.

Table 4. The segments of economic development zones.

Segments		
Capacity	1. Infrastructure	(1) Water
		(2) Electricity
		(3) Communication
		(4) Transport (Transport costs)
	2. Institutions	(1) One-stop services (Transport costs)
		(2) Deregulation
		(3) Preferential treatments (tax incentives, etc.) (Transport costs)
		(4) Laws and regulations (bankruptcy laws and intellectual property right)
	3. Human resource	(1) Unskilled labor
		(2) Skilled labor
		(3) Professionals
	4. Living conditions	(1) Housing
		(2) International schools
		(3) Hospitals
		(4) Entertainment

Source: Prepared by Kuchiki.

Helpman and Krugman (1985) provided a new trade theory in spatial economics, in which the equilibrium number of firms is derived based on a general equilibrium model (this model is described in "The model" in Appendix B). The economy consists of two countries, 1 and 2. In this model, the two sectors are the manufacturing sector and the agricultural sector, the population, L_k of country k, is constant, and the Cobb–Douglas utility function is used. The model adopts the Dixit and Stiglitz (1977) monopolistic competition model framework and assumes that many firms produce a variety of differentiated goods in both country 1 and country 2.

The model assumes that there is free entry and exit of firms based on profits and losses. Thus, based on the zero-profit condition, the number of firms is

$$n_k = (\mu/\sigma)[y_k L_k/(F_k - \varphi F_s) + \varphi y_s L_s/(\varphi F_k - F_s)],\ k = 1, 2,\ s = 1, 2,\ s \neq k,$$

where L_k is the population number, μ is the elasticity of differentiated goods in the Cobb–Douglas utility function, σ is the elasticity of substitution between any two of the varieties of goods, $\varphi \equiv \tau^{(1-\sigma)}$, τ is the "iceberg" form of transport costs, and F_k is the fixed cost. We obtain the following equations:

$$\partial n_k/\partial F_k = -(\mu/\sigma)\,[y_k L_k/(F_k - \varphi F_s)^{\,2} + \varphi^2\, y_s L_s/(\varphi F_k - F_s)^{\,2}] < 0,$$

$$\partial n_k/\partial F_s = (\mu\varphi/\sigma)\,[y_k L_k/(F_k - \varphi F_s)^{\,2} + y_s L_s/(\varphi F_k - F_s)^{\,2}] > 0.$$

Thus, the above equations reveal that the number of firm agglomerations is inversely proportional to the fixed cost F_k and that reducing fixed costs, such as by establishing leased industrial bases, leads to an increase in the number of firm agglomerations.

4. Statistical Analyses of Industrial Agglomeration Policy

This section statistically examines the processes of (i) foreign direct investment (FDI) agglomeration, (ii) intermediate goods import, (iii) increases in industrial output, and (iv) growth in GDP. China's economic growth involved importing capital goods and raw materials, producing products, and exporting them. This can be seen in the statistics in Tables 5 and 6.

Table 5. Structure of export and import (Unit: million$,%).

	1997		**1998**		**1997**		**1998**	
	Export	**Share**	**Export**	**Share**	**Import**	**Share**	**Import**	**Share**
Machinery, Transport equipment	488.16	26.7	564.21	30.7	578.66	40.6	620.89	44.3
Machinery: machinery, appliances, electrical equipment and parts, recorders and playback equipment, equipment for recording and reproducing video images and sound, and parts and accessories.	382.7	20.9	436.29	23.7	467.58	32.8	509.09	36.3
Vehicles: Aircraft, ships and related transport equipment	52.73	2.9	63.96	3.5	55.54	3.9	55.9	4.0
Railway and tramway locomotives, rolling stock and parts, railway and tramway fixtures and accessories, various mechanical (electrical), traffic signalling equipment	11.95	0.7	18.21	1.0	1.19	0.1	2.24	0.2
Vehicles and their parts and accessories, excluding railways and trams.	21.57	1.2	22.72	1.2	18.96	1.3	20.03	1.4
Aircraft, spacecraft and parts thereof	2.91	0.2	4.4	0.2	32.35	2.3	31.75	2.3
Ships and floating structures	16.3	0.9	18.63	1.0	3.04	0.2	1.88	0.1
Optical, photographic, cinematographic, measuring, testing, medical or surgical instruments, precision instruments and apparatus, clocks and watches, musical instruments, and parts and accessories thereof	63.21	3.5	65.64	3.6	46.72	3.3	49.26	3.5
Total	1827.92	100.0	1837.57	100.0	1423.7	100.0	1401.66	100.0

Source: Prepared by Kuchiki based on (National Bureau of Statistics of China 2008, 2019).

Table 6. Structure of export and import (Unit: million $,%) (Export(FOB)).

Classification	2008 Value	Share	2009 Value	Share	2017 Value	Share	Value	2018 Share
Industrial products	1,352,736	94.5511	1,138,564	94.74903	2,145,813	94.79974	2,352,021	94.6
Machinery, Transport equitment	673,329	47.06314	590,427	49.13416	1,082,905	47.84159	1,208,055	48.6
Textile, rubber and mineral products	262,391	18.34013	184,775	15.37661	368,054	16.26024	404,753	16.3
Chemicals and related products	79,346	5.545984	62,048	5.163511	141,329	6.243765	167,525	6.7
Miscellaneous products	335,959	23.48226	299,670	24.93794	547,767	24.19976	565,814	22.7
Unclassified other products	1710	0.119522	1645	0.136894	5758	0.254382	5873	0.2
Primary products	77,957	5.448898	63,099	5.250973	117,709	5.200259	135,086	5.4
Total	1,430,693	100	1,201,663	100	2,263,522	100	2,487,401	100

Import (CIF)

Classification	2008 Value	Share	2009 Value	Share	2017 Value	Share	2018 Value	Share
Industrial products	770,167	68.00219	716,353	71.2	1,263,918	68.65456	1,434,025	67.1
Machinery, Transport equitment	441,765	39.00581	407,999	40.6	734,846	39.91598	839,524	39.3
Textile, rubber and mineral products	107,165	9.462175	107,732	10.7	135,075	7.337117	151,452	7.1
Chemicals and related products	119,188	10.52375	112,124	11.2	193,744	10.52395	233,683	10.9
Miscellaneous products	97,641	8.62125	85,192	8.5	134,175	7.28823	143,759	6.7
Unclassified other products	4409	0.389294	3306	0.3	66,079	3.589334	75,607	3.5
Primary products	362,395	31.99781	289,202	28.8	577,064	31.34544	701,613	32.9
Total	1,132,562	100	1,005,555	100	1,840,982	100	2,135,637	100

Source: Prepared by Kuchiki based on (National Bureau of Statistics of China 2008, 2019).

Meanwhile, regarding exports, the contribution of machinery and transport equipment to total exports rose from 26.7% in 1997 to 47.1% in 2008. This stayed at the same level in 2017, at 47.8 %. On the other hand, regarding imports, the contribution of machinery and transport equipment to total imports was 40.6% in 1997, 39% in 2008, and the same in 2017, at 39.9%. Machinery is used here to refer to machinery, appliances, electrical equipment and parts, recorders and playback equipment, and equipment for recording. We hereafter examine whether these imports have led to industrial growth and subsequent GDP growth.

As shown in Tables 7 and 8, we tested Granger causality and correlations between the domestic investment rate as a percentage of GDP, inward FDI, and imports (See "Table A1. Data from Granger Causality Analysis" in Appendix A).

The results of the Granger causality tests in Table 7 show that, between 1987 and 2009, the increase in the domestic investment/GDP ratio caused an increase in the import growth rate with a 1-year lag (the data used are presented in Appendix A). The increase in import growth rate led to an increase in industry growth rate with a 5-year lag, and the increase in industry growth rate led to an increase in the GDP growth rate with a 3-year lag. Therefore, based on Granger causality, the increase in the domestic investment/GDP ratio caused a rise in the rates of import, industrial, and GDP growth, in that order, with domestic investment having a positive effect on GDP growth in the first period examined.

Table 7. Granger causality tests on domestic investment and foreign direct investment.

Hypothesis	Lag Years	F-Test	*p*-Value	Period
(i) domestic investment—GDP ratio causes (x) export growth rate	3	3.186	0.03905 *	1987–2009
(i) domestic investment—GDP ratio causes (g) industy growth rate	2	5.7014	0.007324 ***	1987–2009
(i) -> (x), (i) -> (g)				
(f) foreign direct investment causes (m) import growth rate	2	3.5913	0.0346 *	1987–2018
(f) -> (m) -> (g) -> (y) (1987–2009)				

Source: Prepared by Kuchiki. * Significant at the 5 percent level. *** Significant at the 0 percent level.

Table 8. Linear regression on growth rate of foreign direct investment.

	Coefficients	*p*-Value	Adjusted R-Squared	Period
(g) industry growth rate				1987–2018
Intercept	9.23654	4.61×10^{-16} ***		
(a) growth rate of foreign direct investment	0.08552	2.24×10^{-6} ***		
			0.5157	
(y) GDP growth rate				1987–2018
Intercept	8.379637	2.750743×10^{-20} ***		
(a) growth rate of foreign direct investment	0.040663	0.000148 ***		
			0.3655	
(Δf/f) = (a) <-> (g) <-> (y)				

Source: Prepared by Kuchiki (See Appendix A Data Table). *** Significant at the 0 percent level. Note: a(n) = 100 × [f(n) − f(n − 1)]/f(n − 1).

Between 1987 and 2018, inward FDI caused import growth with a two-year lag. Thus, between 1987 and 2009, similarly to the case of the investment/GDP ratio, FDI caused a rise in the rates of import, industrial, and GDP economic growth. In the second period, FDI also had a positive effect on GDP growth.

The results of the regression analyses in Table 8 show that the FDI growth rate significantly regressed with the industry growth rate at a significance level of 0%, which also significantly regressed with the GDP growth rate at a significance level of 0%. Thus, it can be reconfirmed that FDI has had a positive effect on GDP economic growth.

The above findings show that from 1987 to 2009, both domestic investment and FDI were effective in promoting GDP growth until period 5.

5. Factor Analysis

Factor analysis is used to extract common factors latent behind observed variables. Here, the observed data are the explained variable x_i, the common factor is the explanatory variable f, and the part that cannot be explained by the common factor is the error term u_i, which is the unique factor. The coefficient b_{ij} of the explanatory variable that represents the common factor is the factor loading ($x_i = b_{ij}\, f + u_i$); here, the factor loadings are obtained by multiplying the square root of the eigenvalues of the factor loading matrix by the eigenvector.

The number of common factors is determined, and each common factor is interpreted in terms of the factors it has in common. In this paper, manufacturing labour wages and industrial park rents are included in the same common factor. This implies that they are correlated in the formation of industrial agglomeration in the manufacturing sector.

(1) FDI-led agglomeration as an incentive for foreign direct investment

JBIC (2022) conducted a study to examine in detail the main drivers of investment that countries experience, presented in the *Report on Survey of Overseas Business Expansion of Japanese Manufacturing Companies*. The top 10 most promising countries from 2007 to 2022 include the following six: India, Vietnam, Indonesia, Thailand, the U.S., and China. The factor analysis in this paper presents the main drivers of investment.

The first factor, ML1, of promising factors, includes those that promote industrial agglomeration. As shown in Figure 2, factors related to reductions in transportation costs in the broadest sense include (o) well-developed local logistics services and (n) the development of local physical infrastructure. Physical infrastructure includes transportation, electricity, and telecommunications. Their factor loadings are 1.1 and 1, respectively (factor loadings are shown in parentheses below). One factor related to the institutional aspect of soft infrastructure is (r) stable political and social conditions (1). Others are (l) the profitability of the local market and (m) product development zones (0.9 and 0.7, respectively).

The above points indicate that there is investment potential in areas where industrial agglomeration is possible.

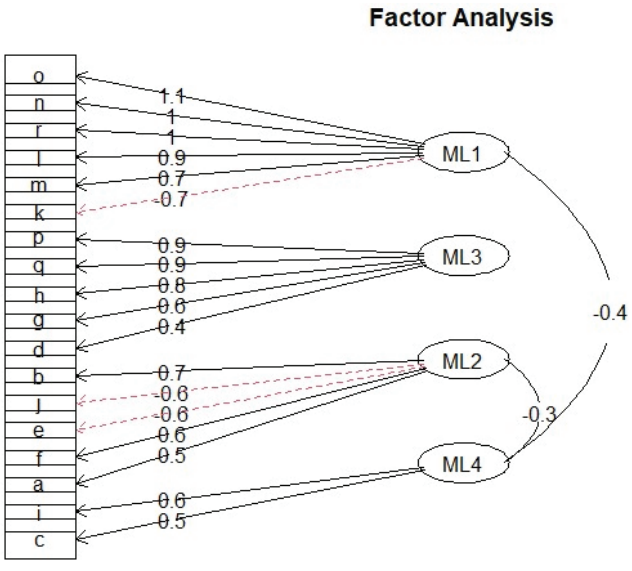

Figure 2. FDI-led agglomeration. ML1: Agglomeration: (o) Local logistics services (1.1). (n) Local physical infrastructure (1). (r) Stable political and social conditions (1). (l) Profitability of local market (0.9). (m) A base for product development (0.7). ML2: Human Resources: (b) Low-wage labor (0.7) (a) Excellent human resources (0.5) (f) Risk diversification receptacle for other countries (0.6). ML3: Export processing zone: (p) Preferential tax incentives for investment (0.9). (q) Stable policies to attract foreign investment (0.9). (h) An export base to Japan (0.8). (g) An export base to third countries (0.6). (d) A supple base to assemble makers (0.4). ML4: Raw material procurement: (i) Advantage in procurement of raw materials (0.6) (c) Cheap parts and raw materials (0.5). (): Factor loading. Red line means insignificant factor. Source: author.

The third factor, ML3, related to incentives for foreign direct investment includes (p) preferential tax incentives for investment (system) and (q) stable policies to attract foreign investment (both 0.9). Factors related to export-processing zones are (h) an export base to Japan and (g) an export base to third countries (0.8 and 0.6, respectively). In addition, the second factor, ML2, relates to human resources: (b) cheap labour and (a) high-quality human resources. The fourth factor, ML4, relates to materials, i.e., (i) advantages in terms of raw material procurement and (e) low-cost parts and raw materials.

Hence, the first factor, ML1, represents "industrial agglomeration" and the "stability of policies to attract foreign investment."

(2) Accelerators of agglomeration policies

The theory of spatial economics supports the conclusion that reduced fixed costs promote industrial agglomeration. Land and buildings account for a high proportion of the fixed costs occupied by foreign investment in the manufacturing sector. Therefore, the establishment of industrial zones reduces firms' fixed costs. In particular, "leased" industrial zones significantly reduce the fixed costs of the occupying companies compared to purchased industrial zones.

The Japan External Trade Organization (JETRO) surveys Japanese companies operating in 100 cities and regions in about 60 countries around the world to determine the investment-related costs of setting up operations in each city. This is shown in JETRO (2010; 2022) for companies' overseas expansion (data used are shown in "Table A2. Data for Factor

Analysis" in Appendix A). In conclusion, the relationship between "manufacturing workers (general engineering workers: W1)" and "leased industrial zones: Z2" is important for the introduction of foreign investment due to the reduction in fixed costs, as shown in "Table A3. Loadings of Factor Analysis" in Appendix A. Factor analysis indicates that the reduction in fixed costs is an accelerator for expanding the number of firms attracted to foreign countries.

The survey cities used in this paper are listed in Table 9. Table 10 also shows the segments of investment-related costs corresponding to the segments in Table 4. The investment-related costs in Table 10 include wages for manufacturing workers (W1), wages for engineers (W2), purchased rents for industrial zones (Z1), leased prices of industrial zones (Z2), commercial electricity rates (P1), and container transportation to Japan (C1).

Table 9. List of survey cities for factor analysis.

Survey Cities for Factor Analysis	
China	1. Chengdu
area	2. Dalian
Year	3. Guangzhou
2021	4. Qingdao
	5. Shanghai
	6. Shinzhen
	7. Wuhan
	8. Chongqing
	9. Beijing
	10. Hong Kong
	11. Taiwan
India	12. Ahmedabad
2022	13. Bengaluru
	14. Chennai
	15. Munbai
	16. New Delhi
Asia	1. Beijing
Year	2. Shanghai
2010	3. Guangzhou
	4. Dalian
	5. Shenyang
	6. Qingdao
	7. Shinzhen
	8. Bangkok
	9. Jakarta
	10. Manila
	11. Sebu
	12. Bengaluru
	13. Colombo

Table 9. *Cont.*

Survey Cities for Factor Analysis		
Mexico	17. Irapuato	
Year 2022	18. Mexico City	
	19. Monterrey	
	20. Queretaro	
	21. San Luis Potosi	
	22. Tijuana	
	23. Aguascalientes	
South	24. Asuncion	Paraguay
America	25. Buenos Aires	Argentina
2022	26. Campinas	Brasil
	27. Manaus	Brasil
	28. Rio de Janeiro	Brasil
	29. San Paulo	Brasil
	30. Santiago	Chile
ASEAN	31. Bangkok	Thailand
2022	32. Jakarta	Indonesia
	33. Kuala Lumpur	Malaysia
	32. Jakarta	Vietnam
	35. Danang	Vietnam
	36. Hanoi	Vietnam
	37. Hochiminh	Lao
	38. Yangon	Myanmer
	39. Bientian	Cambosia
	40. Punon Phen	Cambosia

Source: Prepared by Kuchiki.

(2)-1 Fixed-cost reduction factors for manufacturing industrial agglomeration in 2010 (regions covered: Beijing, Shanghai, Guangzhou, Dalian, Shenyang, Qingdao, Shenzhen, Bangkok, Jakarta, Manila, Cebu, Bangalore, and Colombo).

The number of factors depends on the number of eigenvalues greater than or equal to one. As shown in Figure 3, the fourth factor of investment-related costs in 2010 consisted of "human resources"-related factors (W1, W2, and W3) for workers (general engineers), engineers (mid-level engineers), and middle managers, and "industrial zone"-related factors (Z1, Z2, and Z3) for industrial zone (land) purchase prices, industrial zone rental rates, and office rent. The relationship between "W1 and Z1, W1 and Z2" is particularly important. Cities with high scores in the four factors are Beijing, Shanghai, Shenzhen, and Bangkok.

Table 10. Investment-related costs.

		City: Dalian, China
		Survey Period: November 2022~January 2023 Exchange Rate: 1US$ = (1 November 2022, Interbank) Including VAT
	Survey items	US$
W1	worker (general laborer) (per month) (manufacturing)	506
W2	engineer (intermediate technitian) (per month) (same as above)	822
W3	middle management (section chief) (per month) (same)	1268
W4	staff (general office work) (per month) (non-manufacturing)	1037
W5	manager (section chief) (per month) (same as above)	2185
Z1	industrial zone (land) (purchase price) (per square meter)	96
Z2	industrial zone rent (per square meter, per month)	2.97
Z3	office rent (per squre meter, per month	22
P1	commercial electricity rates (pre 1 kWh)	0.095
P2	commercial water rates (per cubic meter)	0.68
P3	commercial gas rates (per 1 kg)	0.46
C1	container transport to Japan (40 ft)	804
C2	container transport to the third country (40 ft)	13,915

Source: Japan External Trade Organization (JETRO 2022).

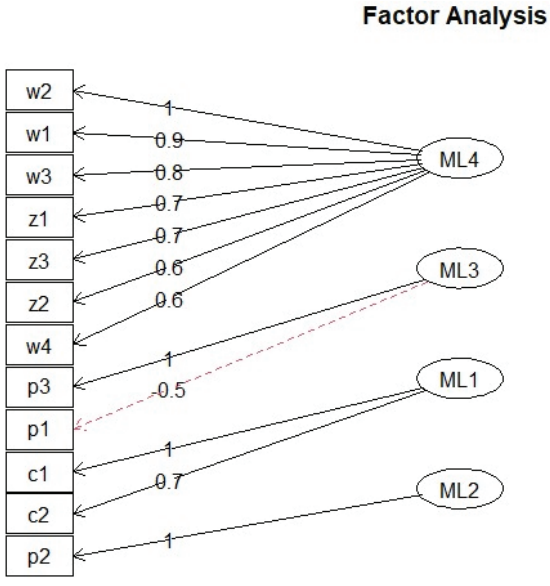

Figure 3. Investment cost comparison for 2010. Source: authors. Red line means insignificant factor.

The second factor is "gas prices," the third is "container transportation charges for exports to Japan and exports to third countries," and the fourth factor is "water prices".

(2)-2 Fixed-cost reduction factors for manufacturing industrial agglomerations in 2021–22.

The first factors of investment-related costs in 2021 are "human resources"-related factors (W1, W2, and W3) for workers (general engineering workers), engineers (mid-level technicians) and middle managers, and industrial zone rental rates (Z2). The relationship between W1 and Z2 is particularly important.[11] The cities with the highest scores for factor

1 are Shanghai, Beijing, Hong Kong, Taiwan, Buenos Aires, and Sao Paulo, as shown in "Table A4. High score cities of Factor Analysis" in Appendix A.

Manufacturing workers are related to both leased and purchased industrial zones, with the former being particularly effective in reducing fixed costs for firms occupying these zones.

Factor 2 is related to "human resources," namely the wages of office workers in the manufacturing industry and managers (section managers) in the non-manufacturing industry, as well as electricity and gas prices. Factor 3 is water rates, container transportation rates, and engineers' wages.

(2)-3 General engineering workers and leased industrial zones in the same factor.

The results of the factor analysis in Figure 4 showed that manufacturing worker wages and rental rates for leased industrial zones were included in the same factor, indicating that leased industrial zones contribute to increasing the agglomeration of manufacturing industries. The fact that the rental rates for leased industrial zones are included in the same factor suggests that these zones are important cost and economic factors for the manufacturing industry. The use of leased industrial zones allows manufacturing firms to engage in production activities without having to invest capital and provides flexibility and reduces risk.

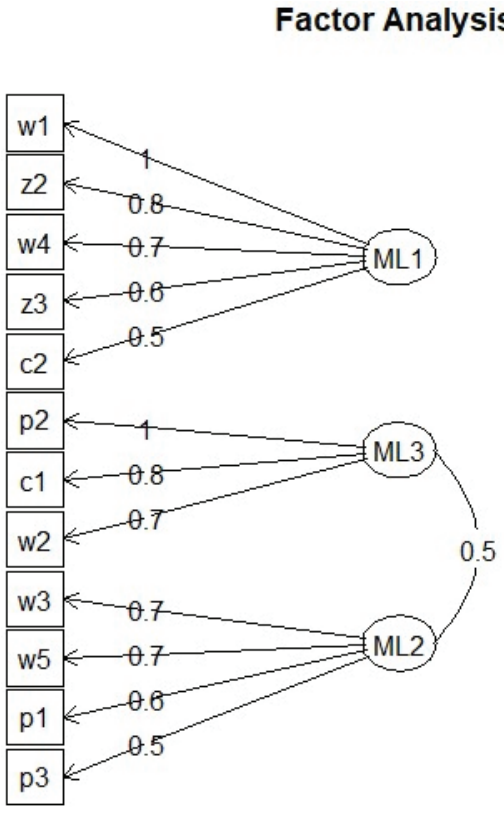

Figure 4. Investment cost comparison for 2021–22. Source: authors.

Therefore, it is effective to establish "leased" industrial zones (Z2) to utilise existing workers (W1) when building manufacturing agglomerations.

6. Summary and Conclusions

The segment that satisfies the breaking condition represents the master switch in the first sequence of the agglomeration policy. Following the master switch, the construction of the main driver segment is the next stage in the agglomeration sequence. The agglomeration of manufacturing firms is enhanced by reducing fixed costs. Land costs represent a large share of fixed costs. Leased industrial zones, compared to purchased ones, contribute significantly to reductions in fixed costs. This paper found that the segment of the manufacturing industry linked to labour wages is "leased" industrial zones. In other words, in a manufacturing agglomeration policy, "leased" industrial zones represent the accelerator segment of the sequence following the master switch.

Choosing to purchase an industrial zone requires greater fixed costs and capital investment. There are also higher sunk costs (costs already invested) after the purchase. This also increases risk. Risks such as future fluctuations in demand and contractions of the manufacturing sector are assumed. For these reasons, the use of leased industrial zones is important for risk avoidance and flexibility in manufacturing agglomerations.

The analysis in this paper has led to the identification of key considerations for the implementation of successful industrial agglomeration policies. First, it is essential to take into account the economies of sequence in the implementation of such policies. Second, the construction of an accelerator, which this paper finds as an example of economies of sequence, enhances the efficiency of policy implementation. Third, the construction of an industrial zone for rent is particularly recommended as a policy.

The following are the remaining tasks to be examined. First, the effectiveness of industrial parks in reducing fixed costs identified in this paper requires empirical evidence from other cases. Second, human capital is considered an important fixed-cost item that should be reduced. Instead of the new trade theory of spatial economics adopted in this paper, a model that considers human resource wages as a fixed cost in the new economic geography of spatial economics could be used. There remains room to apply other spatial economics models to sequence economics. Third, the "master switch" and "accelerator segments" were analysed theoretically and empirically as an economy of sequence in the segment construction process. In addition, there may be "stop" segments, i.e., segments that halt the segment construction process. One example is the institutional segment. If institutions are not in place or the operation of the institutions is not clear, firms may stop investing.

The World Bank (1993) and Wei (2020) concluded that industrial policies can only be applied to other countries if they satisfy certain conditions, although those conditions vary from country to country and are not easy to meet. Industrial agglomeration policies have been generally applied in many East Asian countries since the 1980s, and, although it cannot be denied that there have been many failures, they have achieved a certain degree of success and led to high economic growth in Asia, as has been widely reported.

However, Oqubay (2020) concludes that it is important to note that unevenness and divergence have been key features of the development of industrial zones, implying that there is no standard prescription. Oqubay and Lin (2020) encourage future research on industrial zones, and the editors emphasise the importance of interdisciplinary research and knowledge sharing. It should be noted that further research is needed on sequencing economics for industrial agglomeration policies from a more applicable regional development perspective.

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Data Availability Statement: Publicly available datasets were analyzed in this study. This data can be found here: http://www.stats.gov.cn/tjsj/ndsj/2021/indexch.htm (Accessed on 9 June 2022).

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Appendix A

Table A1. Data from Granger Causality Analysis.

r	y	g	i	x	m	f	F22	a
1987	10.9	13.7	39.7	34.9	4.3	23	23	4.5
1988	11.3	14.5	39.6	18.2	27.4	32	32	39.1
1989	4.3	3.8	36.8	5.3	5.3	34	34	6.3
1990	3.9	3.2	35.2	19.2	−13.3	35	35	2.9
1991	9.3	13.3	34.7	14.4	18.5	44	44	25.7
1992	14.2	21.7	36.2	18.1	28.3	110	110	150
1993	13.5	20.7	43.4	8.8	34.1	275	275	150
1994	11.8	17.4	40	35.6	10.4	337	337	22.5
1995	10.2	13.6	41.2	24.9	15.5	375	375	11.3
1996	9.7	12.3	39.6	1.5	5.1	416	416	10.9
1997	9	11.1	39.8	10	15.5	417	417	0.2
1998	7.8	8.9	37.7	3.3	0.5	454	454	8.9
1999	7.1	8.1	37.4	2.1	6.1	403	403	−11.2
2000	8	9.4	36.3	1.9	27.9	407	407	1
2001	7.5	8.4	38.5	1.5	6.8	468	468	15
2002	9.1	9.8	37.9	22.4	21.3	527	527	12.6
2003	10	12.7	41.2	34.6	39.8	535	535	1.5
2004	10.1	11.1	43.3	35.4	35.8	606	606	13.3
2005	10.4	11.7	43.6	28.5	17.6	724	724	19.5
2006	11.6	13	43.6	27.2	19.7	727	727	0.4
2007	13	14.7	41.7	25.8	20.3	835	835	14.9
2008	9.6	9.8	42.5	17.6	18.7	1083	1083	29.7
2009	8.7	9.5	45.8	−16.1	−11.2	940	940	−13.2
2010	10.4	12.3	0	31.4	39.1	1147	1147	22
2011	9.3	10.3	0	20.4	25.1	1239	1239	8
2012	7.9	8.4	0	9.2	5.2	1210	1210	−2.3
2013	7.8	8	0	8.9	7.7	1239	1239	2.4
2014	7.3	7.4	0	4.4	1.1	1285	1285	3.7
2015	6.9	6.2	0	−4.5	−13.4	1355	1355	5.4
2016	6.7	6.3	0	−7.2	−4.2	1337	1337	−1.3
2017	6.8	5.9	0	11.4	16	1363	1363	1.9
2018	6.6	5.8	0	9.1	16.2	1349	1349	−1

y: GDP growth rata. g: Industry growth rate. i: domestic investment ratio (to GDP). x: export growth rate. m: import growth rate. Source: Asian Development Outlook, various years. Available online at https://www.adb.org/publications/series/asian%E2%88%92development%E2%88%92outlook (Accessed on 9 June 2022). f: inward foreign direct investment. a: growth rate of inward foreign direct investment. China Statistics Yearbook, National Bureau of Statistics, Available online at http://www.stats.gov.cn/tjsj/ndsj/2021/indexch.htm (Accessed on 9 June 2022).

Table A2. Date for Factor Analysis.

	w1	w2	w3	w4	w5	z1	z2	z3	p1	p2	p3	c1	c2
1	636	984	2000	891	1782	103	3.09	20.5	0.075	0.76	0.48	1855	20,000
2	506	822	1268	1037	2185	96	2.79	22	0.095	0.68	0.46	804	13,915
3	669	1239	1865	1155	2530	218	6.96	29	0.095	0.75	0.61	1000	16,500
4	705	868	1435	1022	1928	46	3.53	20	0.15	0.83	0.53	750	3092
5	1124	1304	2509	1441	2973	203	6.49	43	0.1	0.59	0.5	900	24,000
6	595	1122	1601	1499	2968	660	2.18	28	0.15	0.58	0.68	900	16,000
7	572	903	1606	1240	2300	73.5	3.48	17.5	0.1	0.54	0.48	911	18,089
8	669	1125	1811	1001	1613	59	4.63	12	0.09	0.7	0.37	1546	20,000
9	1389	1856	3161	1576	3199	199	5.8	106	0.12	1.43	0.47	1250	16,000
10	2199	2138	4027	2506	4366	16035	25.5	80.5	0.15	0.995	1.8	880	19,000
11	1363	1725	2419	1658	2802	4152	9.83	14	0.1	0.355	0.37	900	16,000
12	225	483	1401	655	1437	47	2.73	5.02	0.05	0.57	1.12	1490	12,600
13	424	538	1320	572	1415	57	3.64	24	0.105	1.05	1.18	2500	12,200
14	277	546	1270	576	1440	51	3.38	10	0.09	1.46	1.21	1940	11,680
15	469	768	1677	722	1584	27.8	4.76	30.1	0.54	0.77	0.64	1420	12,450
16	281	516	1194	585	1644	49	5	26	0.08	0.18	1.18	1860	13,850
17	395	1335	3454	1390	3108	48	4.24	8.71	0.09	0.71	5.3	2300	1750
18	406	1804	7119	1660	6407	483	6.1	21	0.9	0.55	5.3	2770	2300
19	434	1969	3351	1588	3016	180	4.91	19	0.08	0.71	5.38	3070	850
20	480	1969	5083	1505	4575	113	4.88	16	0.09	0.55	5.3	2680	1650
21	357	1588	1742	928	1568	47	5.03	13	0.08	1.52	5.3	3320	1550
22	590	1866	4021	765	3619	105	6.44	12	0.05	7.26	11	5000	950
23	351	1412	3237	1340	2914	62	4.88	14	0.93	3.38	5.3	3130	1700
24	348	1297	1433	478	1720	200	2.6	11.55	0.021	0.38	1.5	2584	1800
25	923	2857	3780	1002	4716	108	4.25	25.89	0.06	0.34	0.007	2200	2600
26	542	3043	3650	591	3386	612	2.65	14.9	0.1045	4.02	0.6367	3900	2400
27	482	2807	3514	528	3240	122.01	3.67	1.67	0.11	10.211	0.5145	4200	3700
28	535	3028	3672	584	3386	200.32	3.06	22.52	0.1311	11.2213	0.8155	4400	2900
29	1270	3089	6491	1203	6491	124	9.49	23	0.09	0.8	0.68	1300	1100
30	567	3221	3921	619	3619	1009	4.14	35.66	0.095	9.37	0.63	3900	2400
31	385	663	1884	744	1642	181	6.07	24.5	0.145	2.37	0.57	1764	4554
32	407	614	1353	590	1470	208	5.1	20.13	0.07	4.42	0.38	2300	4500
33	430	818	1649	941	2076	139	4.56	14	0.65	0.46	0.23	1244	2144
34	294	495	1051	516	1863	157	4.74	31	0.2	1.605	1.405	1450	2100
35	1905	2681	4195	2692	4722	32	2.64	71	0.16	1.93	0.16	800	1500

Source: See Table 7.

Table A3. Loadings of Factor Analysis.

JBIC 2007~2022	MR1	MR3	MR2	MR4
a	0.147	0.136	0.531	−0.126
b	−0.374	0.282	0.699	0.274
c	−0.336	0.191		0.482
d	−0.134	0.435	−0.398	0.252
e	0.42	0.455	−0.605	
f	−0.134	0.424	0.571	−0.346
g		0.644	0.218	
h	−0.25	0.824		
i	0.208			0.595
j	0.404	−0.314	−0.618	
k	−0.702	−0.417		0.13
l	0.855	−0.124		
m	0.749	−0.191		0.207
n	1.008	0.28	−0.1	0.143
o	1.055			0.148
p	0.203	0.949		
q	0.292	0.858	0.134	−0.103
r	0.968	−0.115	0.483	

Table A3. *Cont.*

	MR1	**MR3**	**MR2**	**MR4**
SS loadings	5.736	3.867	2.336	1.002
Proportion Var	0.319	0.215	0.13	0.056
Cumulative Var	0.319	0.533	0.663	0.719
JETRO 2010 Asia	**MR4**	**MR3**	**MR1**	**MR2**
w1	0.866	−0.188	−0.223	0.293
w2	0.999			
w3	0.807	0.296	0.186	0.116
w4	0.56			−0.3
z1	0.735		0.378	−0.141
z2	0.568	0.498	0.146	
z3	0.683	−0.244	−0.326	
p1	−0.262	−0.525	0.261	−0.394
p2	−0.127		0.173	0.974
p3	−0.288	1.029		−0.111
c1			0.961	0.175
c2		−0.287	0.655	0.654
	MR4	**MR3**	**MR1**	**MR2**
SS loadings	4.215	1.869	1.811	1.792
Proportion Var	0.351	0.156	0.151	0.149
Cumulative Var	0.351	0.507	0.658	0.807
JETRO 2021–22 World	**MR1**	**MR3**	**MR2**	
w1	1.007	0.111	−0.111	
w2	0.447	0.717	0.175	
w3	0.382	0.292	0.716	
w4	0.725	−0.289	0.398	
w5	0.48	0.201	0.687	
z2	0.833			
z3	0.639		−0.183	
p1	−0.109	−0.262	0.565	
p2		0.96	−0.293	
p3	−0.18		0.477	
c1	−0.323	0.812		
c2	0.508	−0.268	−0.303	
	MR1	**MR3**	**MR2**	
SS loadings	3.627	2.471	1.945	
Proportion Var	0.302	0.206	0.162	
Cumulative Var	0.302	0.508	0.67	

Note: fa (p33, nfactors = X, fm = "ml", rotate = "promax") by Program R. X = Number of eigne values greater than 1. Source: Author's calculation.

Table A4. High score cities of Factor Analysis.

2010 Asia	**ML4**
1. Beijing	1.758
2. Shanghai	1.1933
7. Shinzhen	0.693
8. Bangkok	0.8087
12. Bengaluru	0.5813
2021–22 World	**ML1**
5. Shanghai	1.3888
9. Beijing	1.9823
10. Hong Kong	3.9729
11. Taiwan	1.8993
25. Buenos Aires	0.8725
29. San Paulo	1.8692

Source: Author's calculation.

Appendix B

The Model

First, the model obtains the first−order condition of the following problem:

$$\text{Minimise } \sum_{s=1}^{2} \int_0^{n_s} p_{sk}(i) m_{sk}(i) di,$$

$$\text{subject to } M_k = \left[\sum_{s=1}^{2} \int_0^{n_s} m_{sk}(i)^{\frac{\sigma-1}{\sigma}} di \right]^{\frac{\sigma}{\sigma-1}}, \text{ for } k = 1, 2,$$

where M_k is a substitution function defined over a continuum of varieties of goods consumed, m_{sk} is the consumption of goods, and the parameter σ describes the elasticity of substitution between any two of the varieties of goods. The number of differentiated products, or firms, in country k is given as n_k.

The utility function of a representative skilled worker in country k is given as

$$U_k = {M_k}^{\mu} {A_k}^{1-\mu}, \qquad \text{for } k = 1, 2, \tag{A1}$$

where A_k is the agricultural consumption for a skilled worker living in country k. The respective income constraints for representative skilled workers in country 1 and country 2 are

$$y_k = \sum_{s=1}^{2} \int_0^{n_s} p_{sk}(i) m_{sk}(i)\, di + A_k, \; k = 1, 2, \tag{A2}$$

where p_{sk} (i) is the price of the goods i produced in country s and consumed in country k.

Then, by maximising the utility (A1), the model obtains

$$m_{sk}\,(i) = (p_{sk}\,(i)^{-\sigma} / {P_k}^{1-\sigma})\, y_k\, \mu, \text{ for } k = 1, 2, s = 1, 2, \tag{A3}$$

where the price index is

$$P_k = \left[\sum_{s=1}^{2} \int_0^{n_s} p_{sk}(i)^{1-\sigma}\, di \right]^{1/(1-\sigma)}, \text{ for } k = 1, 2.$$

Next, consider a particular firm producing a specific variety of goods in country k (=1, 2). The firm trades one specific type of goods and incurs variable costs c and a fixed cost F_k. A firm producing variety i in country k maximises profits as follows:

$$\pi_k\,(i) = (p_{kk}\,(i) - c)\, m_{kk}(i)\, L_k + \left(p_{ks}\,(i) - \tau c\right) m_{ks}\,(i)\, L_s - F_k, \text{ for } k = 1,\ 2,\ s = 1,\ 2,\ s \neq k, \tag{A4}$$

where τ is the "iceberg" form of transport costs. The first−order condition gives the following equilibrium price:

$$p_{kk}\,(i) = p = \sigma c/(\sigma - 1),\ p_{ks}\,(i) = \tau p, \text{ for } k = 1,\ 2,\ s = 1,\ 2,\ s \neq k. \tag{A5}$$

The price index is

$$P_k = p(\, n_k + n_s \varphi)^{1/(1-\sigma)}, \text{ for } k = 1,\ 2,\ s = 1,\ 2,\ s \neq k, \tag{A6}$$

where $\varphi \equiv \tau^{(1-\sigma)}$.

Substituting (A3), (A5), and (A6) into (A4) obtains the firm's profits in regions 1 and 2:

$$\pi_k(i) = \pi_{kk}(i) + \pi_{ks}\,(i) - F_k = (\mu/\sigma)\left[(y_k L_k)/(n_k + \varphi n_s) + \left(\varphi y_s L_s\right)/(\varphi n_k + n_s)\right] - F_k.$$

Notes

1 See Oqubay and Lin (2020) at p. 10 and p. 28. Kuchiki (2020) defined the concept of "economies of sequence.".

2 According to Kou and Zhang (2020), by the end of 2018, there were 2447 industrial hubs in China, including 218 national ETDZs, 153 national HIDZs, and 110 other national development zones.

3 See Council of Local Authorities for International Relations (2003).

4 It should be noted that here, for example, the corporate tax rate was reduced from 30% to 15% in "state−level" development zones but not in "provincial−level' development zones.

5 The "industry−specific" and "region−specific" policies were implemented during this period (Hong Kong Grand Gazette, 19 June 1992).

6 The government emphasised the importance of Shanghai, with three major projects implemented in the 1990s. The first was the development of Pudong in Shanghai; the second was the construction of the Three Gorges Dam; and the third was the development of high−tech industries via HTDZs.

7 We provide an explanation of the conditions for what we refer to as the "turning point"' in the Chinese economy. Consider the industry sector and the agriculture sector in China, with a fixed wage regarded as a subsistence−level wage. Suppose that there is surplus labour in the agriculture sector. A firm can employ an unlimited number of people on the subsistence−level wage, and this situation is regarded as an unlimited labour supply. However, as the industry sector develops, it hires labour from the agriculture sector and the surplus labour in the agriculture sector disappears. Thus, it becomes impossible to hire at subsistence−level wages. The industrial sector can only hire at higher than subsistence−level wages and the minimum wage starts to rise. The point at which the industry sector can no longer hire at subsistence−level wages without restriction so that wages start to rise is called the "turning point".

8 This scientific development perspective is a guiding ideology launched in 2004 by the Hu Jintao Government of China, which took office in 2003. It aims for all−round, balanced, and sustainable development from a scientific and rational perspective, with people as the fundamental factor. It also involves a unified five−point plan on the basic premise of high economic growth, comprising urban and rural development, regional development, economic and social development, development in harmony with people and nature, and domestic development and opening−up to the outside world. The Chinese Government changed the central issues from a growth−oriented approach to one that sought to narrow the income gap and solve environmental problems while upgrading industrial infrastructure.

9 In the first phase, the Shanghai Pilot Free−Trade Zone aimed to act as a base at which to agglomerate various modern service industries (Tang Wenhong, Director General, Foreign Investment Bureau, Ministry of Commerce of China, Xinhua, 29 May 2019). Six industries were designated as "Modern Service Industries", with the financial industry the major one, followed by the aviation and transport service industry, commerce and trade services, professional services, culture and content, and social services. It is a bonded zone that is exempt from import duties on equipment and raw materials.

10 In the second phase, pilot free−trade zones were established in three regions in 2015—Guangdong, Tianjin, and Fujian—and in seven regions in 2017—Liaoning, Zhejiang, Henan, Hubei, and Sichuan, and Shaanxi provinces, and Chongqing. As part of the third phase, implemented in 2018, Hainan Province was designated as the 12th pilot free−trade zone; with pilot free−trade zones later established in six provinces and autonomous regions in 2019—Shandong, Jiangsu, Guangxi, Hebei, Yunnan, and Heilongjiang.

11 Note that industrial zones are not sold but rented in Cambodia, Vietnam, and Myanmar.

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The Effect of the Entrepreneurial Ecosystem of Universities on the Innovative Activity in Russian Regions

Olga A. Myzrova *, Tatyana V. Goryacheva, Olga V. Sysoeva and Victor V. Sysoev *

Socio-Economic Institute, Yuri Gagarin State Technical University of Saratov, 410054 Saratov, Russia; tvgsgtu@rambler.ru (T.V.G.); ovzaytseva@mail.ru (O.V.S.)
* Correspondence: olga_myzrova@mail.ru (O.A.M.); vsysoev@sstu.ru (V.V.S.)

Abstract: The entrepreneurial ecosystem of universities is frequently recognized to have a key influence on the innovative activity of the related regions. However, these relationships have not been explored in the scientific literature regarding Russia. Therefore, the current study aims to determine and identify the contours of the entrepreneurial ecosystem of domestic universities in terms of the innovative activity of subjects in Russian regions. The methodological toolkit covers methods for information processing such as monographic desk research, hierarchical cluster and correlation analyses, and comparative analysis. Applying a hierarchical cluster analysis, we grouped universities according to the level of entrepreneurial activity with the allocation of the average value in order to determine the existing correlations and elucidate the problems in involving university innovations in the ratings of innovative activity of regions. The results contribute to the development of existing approaches toward the study of the entrepreneurial ecosystems of universities through a deeper understanding of their role in stimulating the innovative activity of regions and transformation processes.

Keywords: innovative activity; entrepreneurial ecosystem; interaction contours; innovative component; hierarchical cluster analysis; rating

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1. Introduction

Currently, the development of national economies has to deal with fast changes in the external environment. It requires meeting future challenges with the efficient use of the available resource capabilities of the system. It is extremely important to strengthen the impact of university entrepreneurial activity on the innovative activity of regions by building the interactions between education, science, and business.

In Russia, there is high competition in the market of educational services, which is combined with reduced direct funding from the state budget. Therefore, the priorities for the functioning of higher education institutions require modification to meet the challenges of the socioeconomic system. The best practices of the world's leading universities highlight entrepreneurial activity as a key factor in their dynamic and successful development, capable of providing an adequate response to the threats and opportunities of the external environment. In this context, understanding the essence of an entrepreneurial university as a form of "education–science–business" integration within the framework of the creation and development of multilevel entrepreneurial ecosystems is of particular importance for the promotion of innovative activity in regions, among other things. From this viewpoint, all areas of a university's activities that characterize its major resources and contribute to the transfer of research outputs to objects of intellectual property, commercial products, and economic development together contribute to forming an entrepreneurial university that is a growth point for an ecosystem.

So far, the relationship between the evolution of entrepreneurial ecosystems and the priorities of universities in terms of creating opportunities for their interaction and

influence on the innovative activity of regions is not studied in detail. Therefore, in this study, we aim to narrow this gap using an approach that consists of analyzing the contours of the influence of the entrepreneurial ecosystems of universities in regions in Russia and identifying their interconnections. As the objects of our study, universities with a technical profile in the Povolgie region of Russia were chosen, which are most equipped to develop innovations and participate in the innovative processes of the domestic regions.

Currently, the Russian practice is dominated by studies that consider the innovative activities of the domestic regions and their underlying factors. However, the following problems are not addressed regarding the influence of the entrepreneurial ecosystem of universities on the innovative activity of regions in Russia: (i) methodological approaches have not been developed for clarifying the indicators of innovative activity of the regions and generating the entrepreneurial ecosystem of universities and (ii) domestic universities have low efficiency in terms of innovation activities.

This research is based on a complex application of complementary, cluster, and ecosystem approaches to identify the areas for intensifying innovative activity in regions. To this end, the following analyses were performed: (1) A content analysis was carried out regarding the definition of "entrepreneurial university" using two scientific databases, namely Scopus and the Russian Citation Index (RCI). Such an analysis was considered due to the need to (i) quantify the publication activity among Russian and international researchers in terms of this terminology in order to consider the degree of unidirectional/opposite views, (ii) identify the level of elaboration of theoretical and practical issues in scientific research, and (iii) consider approaches and distinctive features in understanding the essence of an entrepreneurial university among domestic and international researchers. (2) The contours of the influence of the entrepreneurial ecosystem of universities were analyzed in terms of the innovative activity of the Russian regions. (3) The need to increase the innovative activity of the regions was validated based on the ecosystem approach and the development of entrepreneurial activities of universities. These analyses underline the structure of this study.

Thus, the approach proposed in this study expands the study of entrepreneurial ecosystems of universities through a deeper understanding of their role in creating and stimulating opportunities for transformational processes in Russian regions. The hypothesis of the study is that one of the major directions toward enhancing the innovative activity of a region should be the entrepreneurial ecosystem of universities in that region. As a result, an effective and dynamic "flow" of innovative development, from the sphere of science to the real sector of the economy, could be ensured, which would directly promote the level of innovative activity of regions and their socioeconomic development. The limitation of scientific research is still the insufficiency of analytical, statistical, and empirical data characterizing the efficiency of the entrepreneurial ecosystems of universities.

2. Literature Review

The emergence of new requirements for universities is a natural response to the challenges of the current stage of economic development for universities to be primarily directed toward advancement in their transition to the next technological paradigm. Particularly, this results in emerging universities that are actively involved in rather new entrepreneurial activities. In the mid-1980s, for the first time, publications in the United States (Etzkowitz 1983) followed by other countries (Van Dierdonck and Debackere 1988; Hisrich and Smilor 1988) considered the fundamentals and development of entrepreneurial educational organizations. Furthermore, the concept of an entrepreneurial university has been well articulated and advanced in numerous studies (see, for instance, Golubev 2010; Konstantinov and Filonovich 2007; Röpke 1998; Kauffeld-Monz and Fritsch 2013; Bae et al. 2014; and Nabi et al. 2017). Among others, we should highlight the seminal research dealing with the transformation of classical universities into entrepreneurial ones (Clark 1998; Isenberg 2010, 2011; Fernández-Nogueira et al. 2018). In this context, Clark (1998) put forward and elaborated a hypothesis according to which universities can implement

entrepreneurial activities without compromising the "traditional university values" such as an educational process and scientific research. At the same time, a university started to be considered as an ecosystem that includes clusters, platforms, incubators, and networks, thus creating the basis for developing entrepreneurship in different regions (Mazzei 2018). For these reasons, some authors think that the growth of the entrepreneurial potential in the university allows one to identify the university not just within an ecosystem (Adner 2017; Jacobides et al. 2015) but rather within an entrepreneurial ecosystem (Fuster et al. 2019).

Interest in entrepreneurial ecosystems has increased enormously in recent years (Spigel and Harrison 2018; Ritala and Gustafsson 2018; Barnard et al. 2019; Colombelli et al. 2022; Corazza and Saluto 2021). This trend is noted both by researchers (Venkataraman 2004; Cohen 2006; Abreu et al. 2016; Hoffman 2020; Uslu et al. 2019; Fischer et al. 2022) and politicians, as well as international and national organizations. For example, Fritsch et al. (2018) investigated Eisenberg's ideas about the entrepreneurial ecosystem with a research scope focused on highlighting its major components. In general, the World Economic Forum defined the essence of the entrepreneurial system as a set of "inter-related components that determine the opportunities and rates of creation and scaling of new sustainable businesses by entrepreneurs" (World Economic Forum 2014). Stam (2015) went even further and proposed a synthetic model of such a system. However, questions remain that are outside the scope of research performed thus far on the identification of the factors that affect the elaboration of entrepreneurial ecosystems.

In some works by domestic authors, the entrepreneurial ecosystem of universities in Russia is noted to be mainly focused on increasing the number and survival of startups created by university students (Korotkov and Zobnina 2019). However, this view is rather limited, in our opinion, for the development of entrepreneurial activities of universities. Shapovalov et al. (2020) considered the university ecosystem as a space for a set of subjects attributed to an educational process, where their interaction with an external environment is realized. As a result, the individual personality traits of a social entrepreneur are revealed. Here, an important feature of the environment of socioentrepreneurial education as a system is that the student is considered a subject of the educational process and therefore is also a system. Thus, the student in the ecosystem of socioentrepreneurial education shows the active nature of knowledge, which is ultimately expressed in the mutual influence between the subject and the environment.

By 2025, a significant proportion of value chains, according to the forecasts of McKinsey specialists (McKinsey & Company 2022), will unite into several dozen ecosystems, which do not exhibit clearly defined borders among their individual sectors. The developed connections could be revealed only by monitoring the activity of the entrepreneurial ecosystem of universities and assessing their impact on the rating indicators of regional R&D and the country as a whole. The Russian Ministry of Science and Higher Education annually reviews 1286 higher educational institutions in order to assess the efficiency of their activities. It is ordinarily conducted by evaluating more than 70 indicators in the following areas (Information and Analytical Materials Based on the Results of Monitoring the Activities of Educational Institutions of Higher Education (2022)):

- Educational activities (15 indicators);
- Research activities (16 indicators);
- International collaboration (13 indicators);
- Financial and economic activities (8 indicators);
- Staffing (5 indicators).

The assessment includes two sections: (i) indicators reflecting the role of the university in the system of personnel training for the region and (ii) additional indicators for its extended characteristics. The major target for monitoring is "preparing information and analytical materials about educational institutions of higher education and their branches based on performance indicators" (*Portal of Federal State Educational Standards of Higher Education* (2023)), which, in our opinion, does not reflect the real efficiency of universities,

their entrepreneurial potential, or market rating but only demonstrates the actual value of university performance indicators.

Regarding the concept of entrepreneurial universities, two major approaches could be distinguished, in our opinion, as follows:

(1) Entrepreneurial universities are elements of the "triple helix" model that provide interaction for science (universities), business, and the state; universities play a leading role in this model (Etzkowitz et al. 2019; Budyldina 2018; Thursby and Thursby 2002; Ulhøi et al. 2012).

(2) Entrepreneurial universities commercialize scientific advances at the international level and transition to an innovative development model (Astebro and Bazzazian 2011; Gianiodis et al. 2016; Meissner 2017).

As noted above, the term "entrepreneurial university" was introduced in 1998 by B. Clark, who highlighted its features in his book *Creating Entrepreneurial Universities*, as summarized in Figure 1.

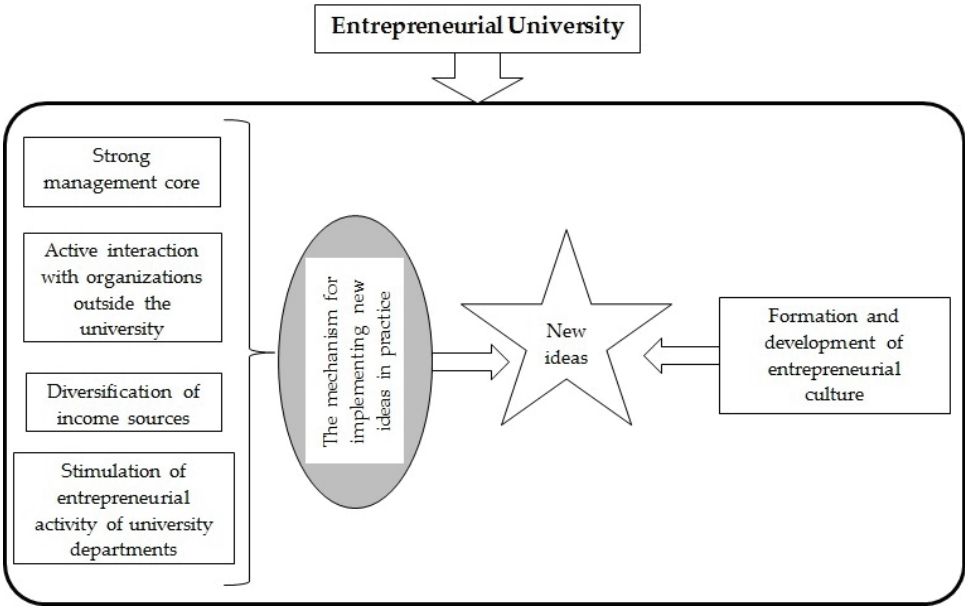

Figure 1. Characteristics of an entrepreneurial university.

As can be seen from Figure 1, there are five basic features that classify the university as an entrepreneurial one. The presence of a strong managing "core", capable of independently directing the development of the university and quickly and adequately responding to emerging changes, makes it possible to respond to external challenges. The second indicator reflects the presence of subdivisions with highly professional employees, which firstly leads to the development of external associations to transfer knowledge, attract new sources of financing, interact with industry, and develop continuing education and intellectual property; and, secondly, facilitates the interaction of interdisciplinary project-oriented research centers in universities and the external environment. The diversification of income sources, as a hallmark of an entrepreneurial university, is important in the context of declining budgetary funding and reflects the ability of the university to expand its funding base through grants, legal entities, regional funding, charitable foundations, royalties from the use of intellectual property licenses, and income from the provision of paid services. Stimulating the entrepreneurial activity of departments enables their transformation into entrepreneurial units that interact with the external environment, implement the results of

scientific research, attract additional sources of income, and lead to the acceptance of new values by employees.

The abovementioned features together form a mechanism for implementing new developments via the integration of an entrepreneurial culture with university-wide activities, as well as the dissemination and sustainable consolidation of ideas. In terms of the characteristics inherent in entrepreneurial universities, their areas of activity are education and research, which are accompanied by a transfer of knowledge that underlies the need for interaction with the external environment. Consequently, the activities of an entrepreneurial university must meet the needs of the market in educational services, high-tech developments, and labor (Lankin et al. 2011). According to some domestic authors (Andryushkevich and Denisova 2014; Buniak 2016; Podborodnikova 2019; Yudkevich 2014), entrepreneurial universities in Russia are characterized by a reduced dependence on state institutions; susceptibility to global trends; flexibility; adaptive management structure; integration of education, science, and business; interaction with investors; the training of competitive specialists for entrepreneurial and innovative thinking; the development of infrastructure adapted for research and entrepreneurial activities (development centers, technology parks, business incubators, etc.); an effective system for the motivation and stimulation of scientific and teaching staff; a focus not only on fundamental science but also on applied research; competitive and selective selection of students; a high degree of information openness; and the organization of scientific communities and business environment in the region (or scientific, technical, and economic realms surrounding the university).

Thus, the distinctive function of entrepreneurial universities is highlighted in the literature (Digital/McKinsey 2017) as the commercialization of R&D outputs, which is defined in a sequence as follows: Universities conduct scientific research, the result of which is new knowledge. Then, the commercial attractiveness of the invention is assessed by formalizing an intellectual property to be claimed through patenting. Finally, a business plan is detailed to promote the product and the corresponding licenses. One can agree with the opinion that entrepreneurial universities should function as commercial organizations, while university staff and students should behave and think like entrepreneurs. Moreover, universities should be closely linked to the region and support local businesses. However, the mechanisms of the triple helix used in the development of Russian universities are still in their infancy. In our opinion, to accelerate this process and advance their competitiveness, an effective rating assessment is required.

The history of university rankings goes back to 1997, when universities were assessed by the *Asia Week* magazine. In 2003, the staff of Shanghai University compiled the Academic Ranking of World Universities (ARWU) according to 13 criteria, which reflect "the academic mobility of students and teachers, the number of international scholarship programs, the efficiency of scientific research, the citation of scientific articles, the quality of educational services, etc." (Primina 2018; Lin and Chen 2021). In 2004, Britain began to annually publish a list of the world's top universities, titled "The Times Higher Education", and since 2010, they have been reporting the reputation rating of world universities (World Reputation Rankings) and the ranking of the world's leading universities (World University Rankings) (Velitchenko 2020; Bowman and Bastedo 2011). Currently, one of the commonly recognized rankings is the ranking of 500 leading world universities regarding Poverty Reduction Strategy Papers (PRSPs), according to criteria that reflect the volume of research activity calculated by taking the number of published scientific articles. Because many national policies necessitate the presence of universities in such rankings, there is permanent competition between universities according to the criteria involved. Therefore, the indicators that assess the results of scientific activity are extremely important. For example, objective data such as the number of inventions, patent applications, granted patents, active licenses, the number of scientists, etc., could be included in such an analysis.

3. Methodology

In the course of this study, a complex analysis was employed to cover a number of aspects related to forming the objective key indicators in order to characterize the scientific and entrepreneurial potential of universities. Furthermore, a system analysis was performed which allowed us to investigate the relationship and interdependence of the indicators and identify the opportunities of the entrepreneurial ecosystem of the university within the international knowledge environment. The concept of the rational behavior of market actors was considered to formulate the indicators of entrepreneurial activity in universities according to best practices. To evaluate the contribution of scientists to the practice in formulating the indicators and criteria for their evaluation, we used the method of monographic desk research. The comparative analysis conducted allowed us to assess the degree to which the problem of entrepreneurship formation can be solved in Russia relative to the international context. The method of hierarchical cluster analysis was employed to obtain a comprehensive assessment and grouping of universities according to the level of their innovative activity in Russian regions, while correlation analysis was carried out to identify the relationship between university rankings and innovative activities in these regions.

The experimental case study was the entrepreneurial ecosystem of technical universities in the Povolgie region of Russia.

To comprehensively assess the entrepreneurial ecosystem of universities, we proposed a methodology taking into account the indicators in the major areas of their activities. In our opinion, this approach could allow one to quantitively determine (i) the efficiency of universities in implementing the opportunities and available resources for entrepreneurial activities, and (ii) their ability to move into the category of an entrepreneurial university. The state-of-the-art concepts indicate that the entrepreneurial ecosystem of universities should be considered within the framework of the basic university activities, namely their educational, research, financial, and economic endeavors. Therefore, the indicators in the rating assessment were combined into three blocks according to the functions and areas of activities. These blocks are listed in Table 1, considering the Russian university practice.

All the indicators for evaluating the entrepreneurial ecosystem of universities were determined using the index method with coefficients, which allowed us to rate universities both in single directions and integrally. For each block, the average indicators were derived by estimating a final output rating as follows:

$$I = \sqrt[3]{0.45I_e \cdot 0.35I_r \cdot 0.2I_{fr}},$$

where I_e, I_r, and I_{fr} are the final coefficients of the rating related to educational activity, scientific activity, and financial/economic results; and the coefficients of 0.45, 0.35, and 0.2 are weighting coefficients that were revealed using an expert assessment as the major qualitative method. As experts, qualified specialists and university scientists were considered.

The overall university's rank was determined using hierarchical cluster analysis, in which universities were grouped into the following three categories:

- Low, if the university rank was less than the average;
- Average, if the university rank was equal to the average;
- High, if the university rank was greater than the average.

The method of hierarchical cluster analysis was chosen for grouping universities because it has no restrictions on the number of selected indicators. Additionally, it allowed us to obtain real results of university classification based on a multivariate assessment of a set of initial data, including situations when the distribution of random variables deviated from a normal (Gaussian) value. The grouping of universities using this method was

carried out by considering a matrix in which the raw values belong to the indicators of the indexes given in Table 1 as follows:

$$I = \left(I_{e1}\ I_{e2}\ \ldots\ I_{ej}\ I_{r1}\ I_{r2} \ldots I_{rj}\ \ I_{fr1}\ I_{fr2}\ \ldots I_{frj} \right)$$

Such an approach facilitates the grouping of universities with not only ranking levels but also the identification of the reserves for developing the efficiency of the entrepreneurial ecosystem of universities in the region.

Table 1. Ranking matrix for the estimation of the entrepreneurial ecosystem of universities.

Activity Areas in University	Functions	Indicators
Educational process	- Teaching according to entrepreneurial-type programs; - Promoting appearing and developing spin-off companies; - Assisting regional development; - Inter-regional and international cooperation.	$I_{e1} = \frac{Q_{1t}}{Q_1}$ Q_{1t}—the number of undergraduate students admitted to the first year of full-time education in higher education programs under sponsorship by companies; Q_1—the total number of students admitted to the first year of full-time study in higher education programs. $I_{e2} = \frac{Q_{ol}}{Q_l}$ Q_{ol}—the number of trainees who improved their qualifications or underwent professional retraining from third-party organizations; Q_l—the total number of trainees who improved their qualifications or underwent professional retraining. $I_{e3} = \frac{Q_{tt}}{Q_t}$ Q_{tt}—the number of students studying under the sponsorship of companies in engineering and technical areas of higher education; Q_t—the total number of students enrolled in engineering and technical areas of higher education. $I_{e4} = \frac{Q_{fs}}{Q}$ Q_{fs}—number of foreign students enrolled in higher education programs; Q—the total number of students enrolled in higher education programs. $I_{e5} = \frac{Q_{fg}}{Q_g}$ Q_{fg}—the number of foreign students who graduated from the university in higher education programs; Q_g—the number of students who graduated from the university in higher education programs. $I_{e6} = \frac{Q_{sa}}{Q_s}$ Q_{sa}—the number of full-time students who have studied abroad for at least a semester in higher education programs; Q_s—total number of full-time students who completed higher education programs. $I_{e7} = \frac{Q_f}{Q_t}$ Q_f—the number of scientific/teaching staff from abroad; Q_t—the total number of scientific/teaching staff. $I_{e8} = \frac{Q_{phdf}}{Q_{phd}}$ Q_{phdf}—the number of PhD students coming from abroad; Q_{phd}—the total number of PhD students.

Table 1. *Cont.*

Activity Areas in University	Functions	Indicators
Research activities	- Knowledge generation; - Promoting installing and developing spin-off companies; - Promoting regional development; - International cooperation.	$I_{r1} = \frac{V_{oi}}{V_{ui}}$ V_{oi}—the volume of income from in-house R&D; V_{ui}—university income from R&D. $I_{r2} = \frac{V_{iia}}{V}$ V_{iia}—the amount of income generated from using the results of the intellectual activity of the university; V—university income.
Financial and economic results	- Implementing the educational process according to entrepreneurial-type programs; - Knowledge generation; - Promoting and appearing and developing spin-off companies; - Assisting with regional development; - International cooperation.	$I_{fr1} = \frac{V_{R\&D}}{V}$ $I_{fr2} = \frac{V_{R\&Df}}{V_{R\&D}}$ $V_{R\&D}$—the amount of funds received from foreign legal entities and individuals for performing R&D. $I_{fr3} = \frac{V_{fm}}{V_m}$ V_{fm}—the amount of funds received from foreign legal entities and individuals for educational activities; V_m—the total amount of funds received from educational activities. $I_{fr4} = \frac{V_{iga}}{V_{ti}}$ V_{iga}—the amount of funds from income-generating activities; V_{ti}—the amount of income from all types of financial support. $I_{fr5} = \frac{V_{ef}}{V}$ V_{ef}—the amount of income derived from non-budgetary sources. $I_{fr6} = \frac{V_{iea}}{V_m}$ V_{iea}—the amount of income derived from non-budgetary sources regarding educational activities. $I_{fr7} = \frac{V_{ie}}{V_{ird}}$ V_{ie}—the amount of income from non-budgetary sources regarding R&D; V_{ird}—the total amount of income from R&D.

4. Results

4.1. University Entrepreneurial Ecosystem

The literature analysis shows that there is still no unified, generally accepted, approach for defining the essence of the concept of "entrepreneurial university" despite its widespread use. This rather complicates the development of practical recommendations for the transformation of universities into entrepreneurial ones. Many authors also do not consider the fact that the development of entrepreneurial activities of such universities in all areas—educational, scientific, international cooperation, etc.—extends beyond the horizon of research, which highlights the practical need for creating an entrepreneurial ecosystem of universities. However, only the emergence of such ecosystems will make it possible to properly ensure the association of universities with an external environment. Accordingly, there is no unified system of indicators for assessing the entrepreneurial ecosystem of universities that could allow one to evaluate their rating and control the pace of development as an economic agent. Thus, in our opinion, an entrepreneurial university as a core of the ecosystem should be understood as a university in which teaching is performed in areas of interest in the labor market, taking into account the prospects for the innovative development of the economy, and scientific/technology research is conducted that has a commercialized output while actively interacting with the environment considering the regional, state, and global economy to gain a profit.

Based on this approach, the following major functions of the entrepreneurial university were identified:

- The implementation of entrepreneurial-type programs in an educational process, including innovative methods of student and postgrad teaching, the participation of students in research projects, and training and retraining specialists according to the requests of companies;
- Knowledge generation (scientific research, business incubators, technology parks, and spin-offs);
- The commercialization of scientific outputs (technology transfer centers);
- The promotion of the formation and development of companies (training of specialists, small businesses, and strategic partnerships with companies in the industry and the financial sector);
- The facilitation of regional development (training specialists for the regional economy, the integration and implementation of federal and regional programs, and interaction with local authorities on entrepreneurship development) (D'Este and Patel 2007; Salomaa 2019);
- International cooperation in education and research.

Altogether, the functioning of an entrepreneurial university is implemented in three areas of activity: educational, research, and financial and economic areas. In general terms, the contours for the interaction of an entrepreneurial university with the external environment are shown in Figure 2, as part of the corresponding ecosystem.

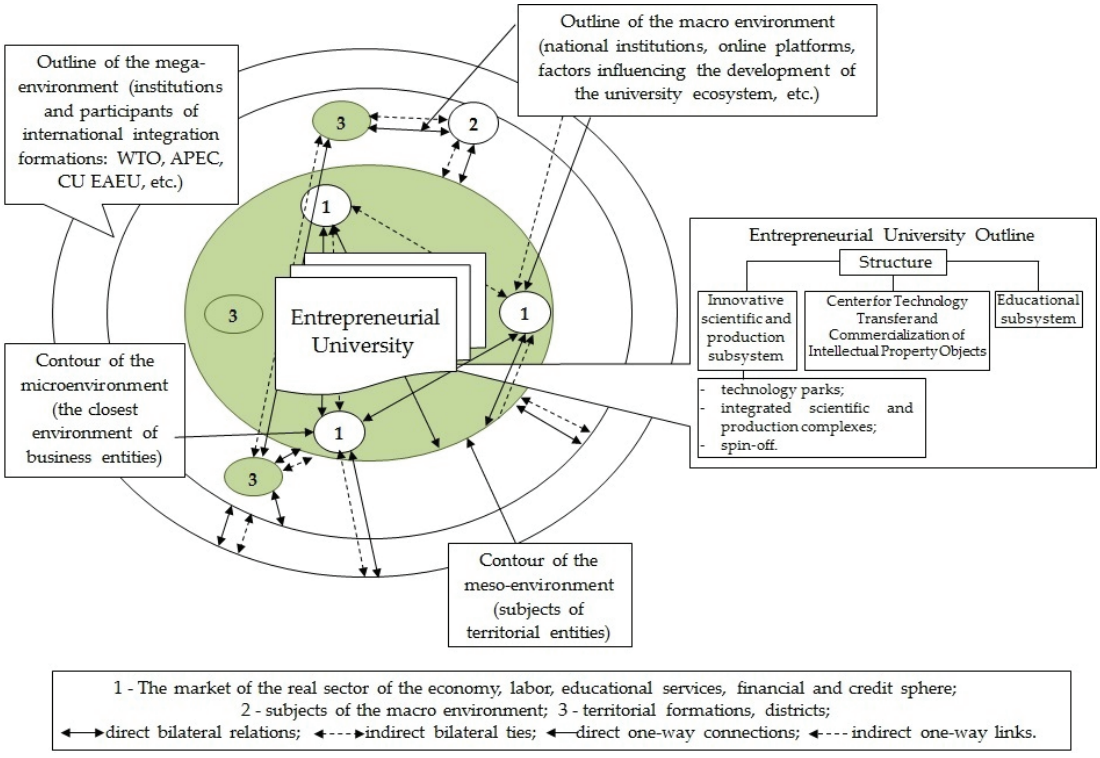

Figure 2. Contours of interaction between the entrepreneurial ecosystem of universities and the external environment.

In Russia, the entrepreneurial ecosystem of universities is still not so developed to be considered in the triple helix paradigm. We may note some university entrepreneurial ecosystems existing in large cities; however, many continue to maintain traditional ties

while introducing only elements of entrepreneurship. In our opinion, this situation is a result of several factors:

- A continued dependence of universities on primary funding from the federal budget;
- The instability of economic development;
- An insufficient interaction between universities and businesses in the framework of training and scientific/applied research;
- Problems in the commercialization of the results of innovation activity;
- A lack of developed infrastructure for a technology transfer;
- A weak entrepreneurial culture in universities;
- A lack of consideration of the basic elements to form the upper level of infrastructure;
- The insufficient activity of large businesses in technological innovations.

4.2. Validation of the Methodology

The proposed methodology was validated using the examples of 17 technical universities located in the Povolgie area of Russia, and the results were found to be quite consistent with the entrepreneurial model: They perform the educational process, participate in research grants to advance R&D, and create new technologies that have market potential. Many of these universities have technoparks as a part of their structure. For the purpose of this study, open access sources containing information on the activities of these universities during 2017–2021 were considered. The results of the rating assessment of the surveyed universities are given in Table 2.

Table 2. Rating assessment of the entrepreneurial ecosystem of universities in the Povolgie region of Russia.

University	2017	2018	2019	2020	2021
Nizhny Novgorod State Engineering and Economic University (NGIEI)	0.0647	0.0693	0.0622	0.0769	0.0771
Nizhny Novgorod State University of Architecture and Civil Engineering (NNGASU)	0.0989	0.0989	0.0465	0.0888	0.0836
Nizhny Novgorod State Technical University n.a. R.E. Alekseev (NNSTU n.a. R.E. Alekseev)	0.0863	0.0836	0.0787	0.0872	0.0880
Penza State Technological University (PenzGTU)	0.0695	0.0218	0.0771	0.0907	0.0915
Penza State University of Architecture and Construction (PGUAS)	0.0889	0.0704	0.0800	0.0727	0.0749
Perm National Research Polytechnic University (PNRPU)	0.0917	0.0945	0.0954	0.0902	0.0986
Perm State Agro—Technological University (PSATU)	0.0569	0.1387	0.0891	0.0869	0.0751
Ufa State Aviation Technical University (USATU)	0.0775	0.0900	0.0823	0.0941	0.0929
Ufa State Petroleum Technological University (USPTU)	0.0906	0.0865	0.0811	0.0890	0.0872
Volga State University of Technology (VSUT)	0.0861	0.0934	0.0908	0.0901	0.08011
Kazan State University of Architecture and Engineering (KSUAE)	0.1060	0.1073	0.1047	0.0994	0.1007
Kazan National Research Technical University named after A.N. Tupolev—KAI (KNRTU-KAI)	0.0838	0.0769	0.0908	0.0778	0.0780
Kazan National Research Technological University (KNRTU)	0.1023	0.0832	0.1229	0.0858	0.0937
Samara State Technical University (SamSTU)	0.0887	0.0922	0.0852	0.0699	0.0891
Yuri Gagarin State Technical University of Saratov (SSTU)	0.0820	0.0764	0.0732	0.0795	0.0658
Kalashnikov Izhevsk State Technical University (Kalashnikov ISTU)	0.0900	0.1197	0.0968	0.0956	0.0897
Ulyanovsk State Technical University (ULSTU)	0.1035	0.0922	0.0981	0.0987	0.1002

The results of the grouping carried out using hierarchical cluster analysis are shown in Figure 3.

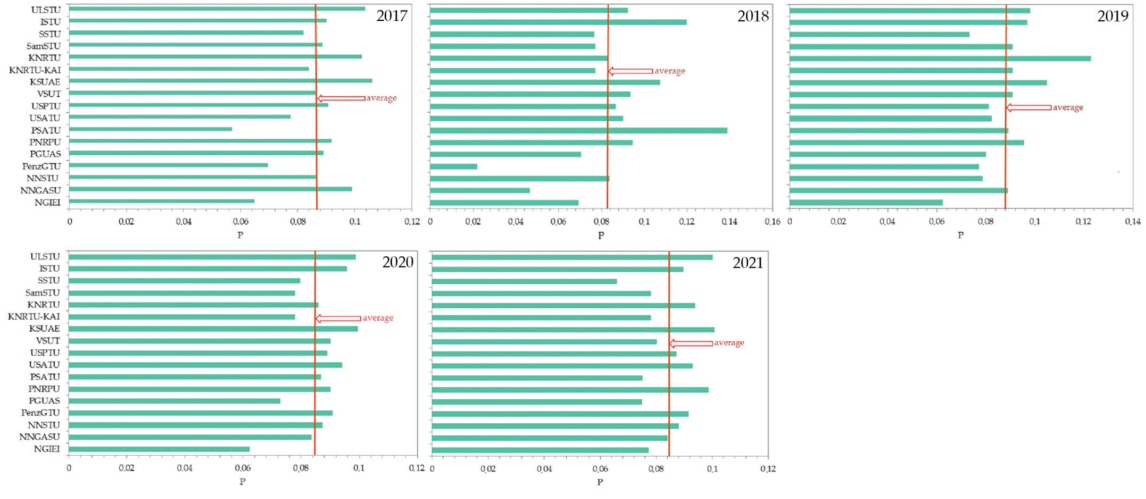

Figure 3. Rating assessment of the entrepreneurial ecosystem of universities in the Povolgie region of Russia at various years during the 2017–2021 period.

Considering the data in Figure 3, we may highlight some findings. In 2017, 9 of the 17 universities had a rating above the average, compared with 8 universities in 2021. It should be noted that the results of research and out-of-budget activities had a major impact on the ranking of universities. The most favorable conditions for developing the entrepreneurial ecosystem of universities were in 2019 and 2020, but the remote format of activities in 2021 led to a decline in the ratings of universities. For comparison, the share of high-rank universities in the total number of surveyed universities was 52.9% in 2017 and even increased to 58.8% in 2019 and 2020, whereas it was only 35.29% in 2021. The maximum increase in the rating was observed at the PenzGTU, with a gain of 31.7%, increasing its ranking from low to high; for instance, the university had the lowest rating in 2018. A maximum rating reduction was observed in SSTU, by 19.4 %, which went down from the average level in 2017 to a low level in 2021.

Figure 4 shows a summary of changes in ranks among the universities under study from 2017 to 2021. The most remarkable growth was observed for PenzGTU, due to a large gain in educational activities: its rating of educational activities increased by more than 4 times, while the rating of its research activities increased by more than 3.5 times.

The results obtained for the surveyed universities made it possible to finally assess the development of the entrepreneurial ecosystem of universities in the Povolgie region. For this purpose, we grouped the universities in the various areas of the Povolgie region according to the index for the development of the entrepreneurial ecosystem. The data are presented in Figure 5. The best development was observed in the Republic of Tatarstan, while the Perm region deteriorated. However, the general trend indicates the development of the entrepreneurial ecosystem in the Povolgie region as a whole, although there was certain unevenness across its various regions.

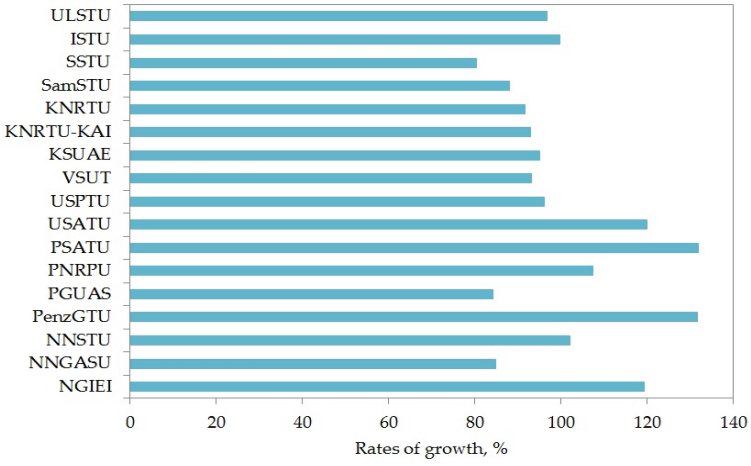

Figure 4. The change in the ratings of universities in the Povolgie region of Russia in 2021 in relation to those observed in 2017 (taken as 100%).

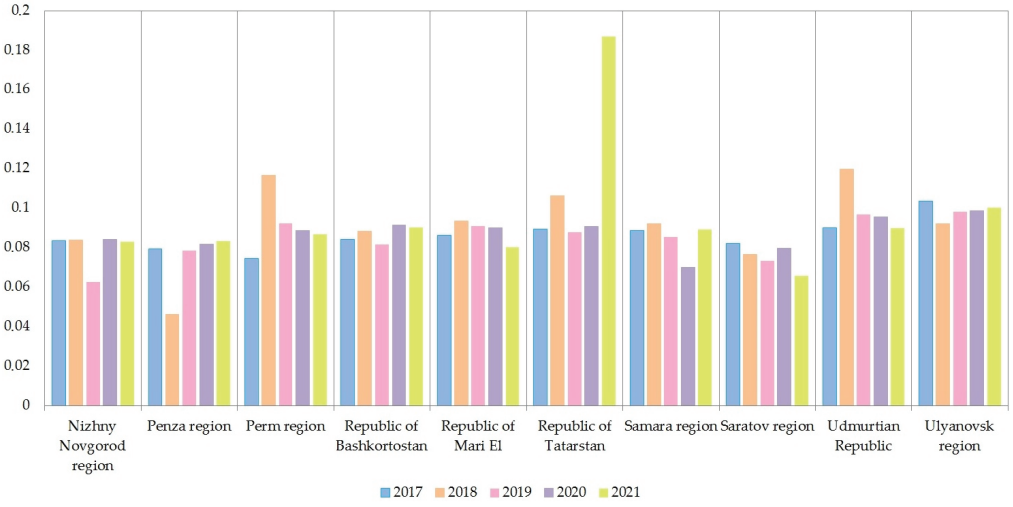

Figure 5. The index of the entrepreneurial ecosystem of universities across various regions in Povolgie (Russia).

4.3. Assessing the Influence of the Contour of the Entrepreneurial Ecosystem of Universities on the Innovative Activity of the Regions in Povolgie (Russia)

We analyzed the inter-relationship and impact of the entrepreneurial ecosystem of universities on the innovative activity of the regions using the method of correlation analysis. Methodological approaches for assessing the rating of innovative activities of regions are presented in the *Rating of Innovative Development of Subjects of the Russian Federation* (2021) and the National Research University Higher School of Economics (2019). As a criterion for the level of regional development, the index of innovative activity of the region (IIAR) developed by the Higher School of Economics (Russia) was adopted. This index is built on the basis of 53 quantitative and qualitative indicators that characterize (1) the socioeconomic conditions of a region's innovative activity, (2) its scientific and technical potential, (3) the level of innovation and export activity, and (4) the quality of innovation policies. These indexes are summarized in Table 3.

Table 3. Index of innovative activity of the regions (IIAR) in Povolgie (Russia).

The Povolgie Regions of Russia	2017	2018	2019	2020	2021
Nizhny Novgorod region	0.50	0.48	0.47	0.50	0.54
Penza region	0.43	0.46	0.44	0.40	0.50
Perm region	0.43	0.39	0.37	0.40	0.50
Republic of Bashkortostan	0.44	0.42	0.42	0.49	0.41
Republic of Mari El	0.30	0.31	0.34	0.34	0.33
Republic of Tatarstan	0.56	0.55	0.56	0.58	0.54
Samara region	0.41	0.41	0.39	0.40	0.42
Saratov region	0.37	0.35	0.34	0.33	0.36
Udmurtian Republic	0.29	0.32	0.29	0.28	0.38
Ulyanovsk region	0.47	0.45	0.41	0.39	0.39

Correlation analysis makes it possible to visually identify the forms of connections between the level of development of the entrepreneurial ecosystem of universities, denoted as a factor feature (F), and IIAR, considered a result feature (R). For this purpose, a correlation plane was built as a set of points with F and R values, which allowed us to put forward a hypothesis for the general population about the linear nature of the relationship between F and R values (Figure 6).

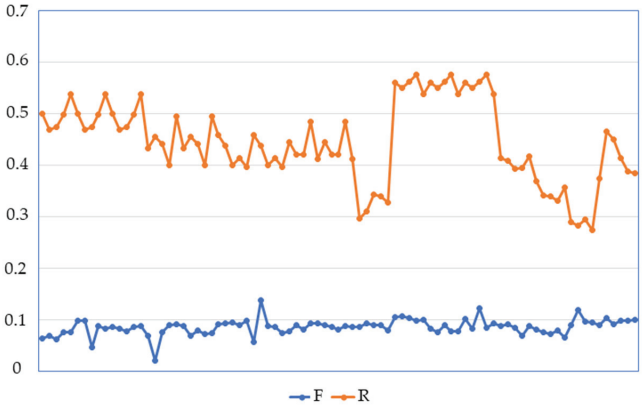

Figure 6. Dependence of the entrepreneurial ecosystem of universities (F) and the level of innovative activity in the regions (R) of Povolgie.

The developed function allows for the estimation of both the specific and general impacts of the entrepreneurial ecosystem of universities on innovative activities in regions of Povolgie. Still, it is worth noting that using multiple linear regression might lead to a multicollinearity effect, i.e., the emergence of linear relationships between variables due to their high correlation. This reduces the accuracy of the estimated regression parameters and may yield regression coefficients that cannot be used for interpreting the degree of influence. Therefore, the exogenous indicators selected as a result of the correlation analysis were checked for multicollinearity to exclude the mutual influence of exogenous variables.

The parameters of the linear regression were estimated via the least squares method. Here, the first regression coefficient shows the predicted IIAR level but only if R(X) = 0 is close to the sampled values. The second regression coefficient characterizes the average value of IIAR as a result of changing (increasing/decreasing) the magnitude of the development of the entrepreneurial ecosystem of universities. Thus, we conducted a paired linear

regression analysis based on empirical data with the noted parameters, and the extent of the dependence was assessed using the empirical correlation ratio. The data are presented in Table 4.

Table 4. Empirical regression equations between the development rating of the entrepreneurial ecosystem and IIAR in Povolgie (Russia).

Year	Regression Equation	Empirical Correlation
2017	R = 0.03158 F + 0.07205	0.18802
2018	R = 0.06537 F + 0.11670	0.20273
2019	R = 0.03709 F + 0.06939	0.16884
2020	R = −0.00134 F + 0.08726	0
2021	R = 0.01152 F + 0.08103	0.08854

These calculations indicate a lack of a unified relationship between the ratings of the entrepreneurial ecosystem of universities and IIAR in Povolgie. At the same time, in every year, except for 2020, there was a direct relationship between the indicators under consideration. The empirical correlation ratio had the highest value in 2018 but remained at a rather insignificant level. We suggest that this is primarily attributed to the level of socioeconomic development of the regions under study.

The correlation dependence between the rating of the entrepreneurial ecosystem and IIAR across the regions of Povolgie also did not exhibit an unambiguous direction, which is clearly seen in Figure 7. The largest impact of the entrepreneurial ecosystem on innovation activities was observed in the Samara region (0.68) and the Republic of Bashkortostan (0.29). A negative correlation between these two indicators was observed for the Perm, Penza, Ulyanovsk, and Saratov regions, as well as for the Udmurtian Republic. In other regions of Povolgie, there was a positive dependence, with the average value equal to 0.10835. Still, the negative relationship between the development of the entrepreneurial ecosystem of universities and the innovative activities of the regions of Povolgie in 2020 is associated, in our opinion, with a decline in economic development indicators due to the COVID-19 pandemic, when universities operated under a remote format, and many enterprises were suspended or even terminated their activities.

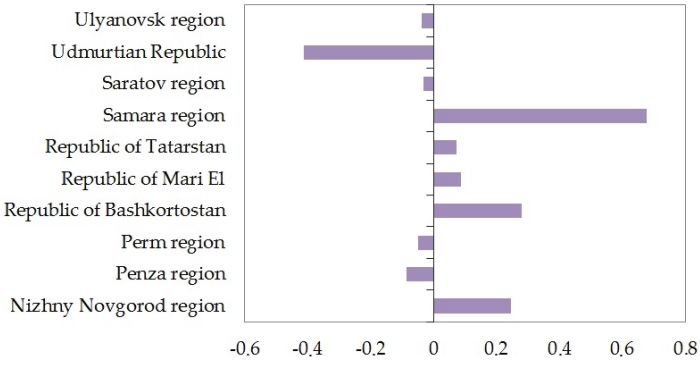

Figure 7. Correlation dependence between the ratings of the entrepreneurial ecosystem and IIAR in Povolgie (Russia) during 2017–2021.

As a result, there was a decrease in the volume of the gross regional product and the innovative activities of enterprises and organizations. This is reflected in the curves shown in Figure 8.

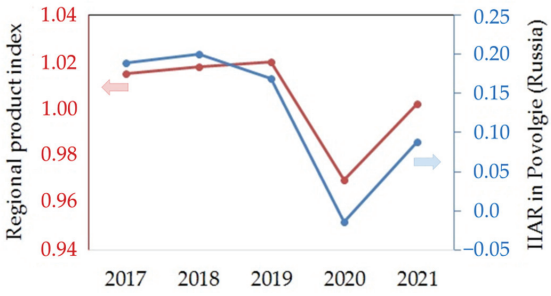

Figure 8. The gross regional product index and IIAR in Povolgie (Russia) during 2017–2021.

5. Discussion

The results of the conducted research indicate a rather low level of development of the entrepreneurial ecosystem of universities and its insignificant impact on the innovative activity of the regions in Povolgie (Russia). In our opinion, one of the reasons is the shortcomings of the existing methods for assessing the innovative activities of regions, which account only for the information provided by enterprises to statistical authorities but do not utilize the results of research and innovation activities of universities. However, many local universities, as shown here, carry out innovations; introduce their results into educational, administrative, and managerial activities; successfully develop technology parks; and interact with enterprises.

A contradiction is that the indicators taken in the global innovation index (GII) consider the results of universities, while they are not counted when assessing innovative activities in Russian practice. However, the products and services produced by universities play a significant role in the innovative activities of regions and local markets of labor, goods, and services, including educational services, small innovative enterprises, and start-ups.

Still, many domestic and foreign experts note the low efficiency of innovation activities of domestic universities in Russia. This is ordinarily explained due to the lack of entrepreneurial thinking among scientists–inventors, the existing gaps in the innovation commercialization chain, and the lack of key elements in the innovation ecosystem of universities (Efremova and Romanova 2020). Therefore, attempts to commercialize technologies have not yet been crowned with tangible success. As rightly noted in another research (Kiseleva et al. 2022), the level of regional development in Russia varies greatly. Moscow, St. Petersburg, and Tatarstan are leaders in the ratings of innovative development of regions, which account for about 57% of the total volume of innovative goods shipped and innovative works and services carried out, while the remaining 76 regions account for only 43% of the results of innovative activities. This indicates a need for further analytical research to identify the factors for the development of entrepreneurial ecosystems in regions as an element of the growth of innovative activities.

Many studies agree that innovations are the major instrument for increasing the competitiveness of regions and the country as a whole. Therefore, to advance the level of socioeconomic development and promote innovative activities and competitiveness among regions, it is necessary to develop a reasonable strategy that allows one to achieve a long-term effect. In turn, this necessitates the facilitation of new methods and tools to build regional strategies that take into account quantitative and qualitative assessments of a dynamically changing environment and the current challenges. Despite a growing number of studies regarding the innovative activities of regions and rating assessments of universities, methodological approaches using indicators that properly reflect the innovative activities of regions in Russia and the development of the entrepreneurial ecosystem of universities are still insufficiently developed. Some studies devoted to this problem note that universities should make a significant contribution to the development of regional and local innovations (Cervantes 2017). However, it is not enough only to increase the innovative activities of a region; other components must be also taken into account. These include the investment

climate, a regulatory framework, and an infrastructure for innovations (Cuaresma et al. 2013). The most comprehensive approach involves the assessment of the various aspects of regional innovation systems, which could be carried out by employing the triple helix concept for the analysis and evaluation of the existing strategies (Etzkowitz and Zhou 2017). However, this concept does not sufficiently take into account the impact of demand on the creation and implementation of new knowledge, technologies, and products. To a certain extent, the extrapolation of the three-tier model to a four-tier one could help in eliminating this issue (Volodin et al. 2020) as an integral approach for the assessment of the results obtained at the regional level and the development of effective mechanisms for introducing innovations.

Improving the monitoring and evaluation system at the regional level requires employing multilevel methods that consider chronological and spatial dynamics. The current study proposes a comprehensive assessment of the entrepreneurial ecosystem of universities that is universal in nature because a significant portion of the indicators were considered while taking into account international standards. This method can be used for regions with varying degrees of economic activity in order to identify "bottlenecks" in promoting their innovative activity. The complex nature of the developed methodology involves an assessment in three directions, which reflect the components of the activities of universities from different perspectives. Each block was evaluated from a quantitative and qualitative standpoint by particular criteria, resulting in a complex value for calculation. The weakness of the proposed methodological approach is the absence of a unified scale for assessing the level of development of the entrepreneurial ecosystem of universities for all regions in terms of innovations because it is based on the values of weight coefficients. Weight coefficients are individual for each region and were determined using an expert method. In addition, the results of the study are presented for only 10 out of the 89 regions of Russia, which indicates the need for further analysis and assessment of the association of the entrepreneurial ecosystem of universities with innovative development in other regions.

6. Conclusions

Following the objective of this study, we determined and analyzed the degree of influence of the contours of the entrepreneurial ecosystem of universities on the innovative activities of subjects of economic development, taking the example of the Povolgie region in Russia. This allowed us to demonstrate the relationship between the degree of development of the entrepreneurial ecosystem of universities and the innovative activities of the corresponding regions in Povolgie.

Our study shows that the major features of an entrepreneurial university are the dissemination of knowledge, the generation of knowledge, the promotion of education and development of companies, regional development, and international cooperation in order to adequately commercialize the complex of "education–science–entrepreneurship". The entrepreneurial ecosystem of universities lies at the core of the region's innovative activities. Promoting the entrepreneurial potential of universities is impossible without a quality training process, a high level of qualification and competitiveness of graduates, the stimulation of innovations, and the development of new forms of educational and scientific activities covering all levels of management.

The rating assessment of the entrepreneurial ecosystem of universities was based on multilevel hierarchical and integrated indicators using quantitative and qualitative methods. The identification of weighted criteria, established for each region accounting for its socioeconomic development, would help to improve the verification of the rating. Their use will allow one to consider regional factors, as well as the individual characteristics of each area of university activities. In our opinion, such an approach facilitates the identification of weaknesses and strengths of a university within the framework of its entrepreneurial and innovative activities and determines the vector of its further development to positively influence the functioning of socioeconomic systems.

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Article

Relevance of Territorial Identity in the Rural Development Programs—The Case Study of Tajo-Salor (Extremadura, Spain)

Francisco Javier Castellano-Álvarez [1,*] and Rafael Robina-Ramirez [2]

[1] Economy Department, Faculty of Business, Finance and Tourism, University of Extremadura, 10071 Cáceres, Spain
[2] Business Management and Sociology Department, Faculty of Business, Finance and Tourism, University of Extremadura, 10071 Cáceres, Spain; rrobina@unex.es
* Correspondence: fcocastellano@unex.es

Abstract: Since their origins, rural development programs have considered the county level as the axis on which to implement their development strategies. Taking Tajo-Salor County (Extremadura, Spain) as a reference, this research analyzes the assessment that some of the agents directly involved in the implementation of these programs make of the suitability of the configuration of their territorial scope, as well as the achievement of their objectives. For it, the case study methodology is used, in which fieldwork is carried out where the main source of information will be interviews with promoters of tourism projects. The results show that Tajo-Salor County can be considered as a paradigmatic example of an "artificial" configuration of the territory, showing that, among those interviewed, there is no feeling of county. This has consequences on the assessment that local actors make of the implementation of the development program: those areas that do not feel part of the county have a much more negative assessment of the results obtained than the rest. This is a lesson that this case study offers; the political and technical managers of these programs should bear in mind in the future definition of the territories that apply this type of development strategy.

Keywords: endogenous development; economic diversification; territorial identity; tourism promoters

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1. Introduction

1.1. The Study of the Configuration of the Territory as a Key Factor in Rural Development Strategies

Various documents published by the European institutions in the 1980s pointed to the need to strengthen the European rural milieu in view of the imminent adjustments to the Common Agricultural Policy (CAP) (European Commission 1981, 1985, 1988). In this context, at the beginning of the 1990s, the European Commission (EC) began to apply, on an experimental basis, endogenous rural development strategies based on the Leader I Initiative (Comisión Europea 1991). From then until now, this type of program has not ceased to be applied, although the way in which it has been implemented has evolved over time. Given the success of the first call for proposals, in the second half of the 1990s, the Leader II Initiative (Comisión Europea 1994) was approved, and at the beginning of the 2000s, the Leader+ Initiative (Comisión Europea 2000) was approved, which would be the last programming period in which this type of program would be implemented through a Community Initiative. Since then, they have constituted another axis of the funds corresponding to the so-called Second Pillar of the CAP, and their application is regulated by the corresponding regulations. In its origins, the response of the European rural environment to the Leader Initiative calls was such that some countries complemented this Initiative with the approval of development programs which, inspired by it, allowed them to meet the development needs of those territories that were excluded from the selection processes inherent in the Leader calls. This is the case of Spain and the two editions of the Rural Development Program (Proder I and Proder II) applied in the second half of the 1990s and the first half of the 2000s (MAPA 1996, 2002).

It was in the second half of the 1990s, with the announcement of the Leader II Initiative (Comisión Europea 1994), that the territorial implementation of the Initiative acquired notable relevance. This was despite the fact that it was not a major investment program but an Initiative of an experimental nature with regard to the viability of modest investments which, being implemented in rural areas, were to be characterized by their innovative nature (Castellano-Álvarez et al. 2020b, 2020c). Therefore, the key to understanding the success of the Leader Initiative lies not so much in the resources committed as in the method inherent in its implementation (González Regidor 2006), a method that is embodied in the so-called "Leader Approach" and that is common to the different calls under both the Leader Initiative and the aforementioned Proder Program.

The European Association for Information and Local Development (AEIDL) defines this approach on the basis of seven characteristics which, for the purposes of this research, include the following: (a) a territorial dimension in which the county is the sphere of action for implementing development strategies; (b) a bottom-up approach, ensuring the participation of the population in the implementation of the program; and (c) the system of governance, where the Local Action Group (LAG) is the highest decision-making body and will be made up of representatives of employers, social groups and local councils in the county.

The characteristics of the Leader Approach show the importance that the different editions of the Initiative attach to a correct definition of the territory; a territory which, following Esparcia Pérez and Tur (1999), must be understood not as a mere continent of resources and population, but as a critical element for the successful implementation of these program. In turn, this territorial approach is materialized in a specific sphere of action: the county. As opposed to a local (too small) or regional (too wide) sphere, the county is defined by Guiberteau Cabanillas (2002), p. 95, as "a territorial area that is sufficiently homogeneous to share problems and solutions".

The territorial approach has been widely studied by the Leader Observatory. In order to assess the potential of a territory, this Observatory considers that factors such as the following must be taken into account: (1) physical resources and their management; (2) its culture and identity; (3) human resources; (4) available know-how and capacity to extend it; (5) quality of the governance system; (6) activities carried out in the territory and characteristics of the companies that carry them out; (7) markets and external relations; and (8) the image and perception (both internal and external) of the territory (AEIDL 1999). Along the same lines, Esparcia Pérez and Tur (1999), when referring to the elements that condition the competitiveness of a territory, point to human resources, the products obtained, economic resources, etc., but also highlight other less tangible factors such as the identity of the population with its territory, the feeling of belonging to it. The aforementioned authors warn of the risks that an incorrect definition of the territory can have for the implementation of a development strategy and point out that, in certain cases, the application of the Leader Initiative has forced the artificial configuration of certain territories.

The handicap of many of these factors that define the territory on which development strategies are based is, precisely, their intangible or immaterial nature; this fact adds even more complexity to their measurement or valuation. Among many others, Navarro Valverde et al. (2012), Esparcia (2001) and Delgado et al. (1999) recognize the difficulty of this endeavor and stress that systems of analysis that go beyond those usually used by institutions and consultancies in the evaluation of the impacts of rural development program are necessary; they are often focused on the strictly material and quantifiable.

Although this question has been approached from different points of view at a theoretical level, there is still a lack of examples, methodological proposals and practical cases that define measurement systems for these intangible aspects and study their consequences. In fact, this is the gap that this research aims to fill and which has already aroused the interest of the authors of this work in previous studies (Castellano-Álvarez et al. 2020a). Therefore, starting from the case of Tajo-Salor County (Extremadura, Spain), the aim of this

research is to study the dimension of the territorial approach and the consequences that can be derived from it for the implementation of the development program. In order to achieve this objective, the following research questions have been formulated: (1) Does a sense of county identity exist in this territory? (2) How does its existence or non-existence influence the assessment of the program implementation by local actors? Finally, based on the results of the research, it is also intended to formulate practical proposals for action for the case of Tajo-Salor County.

1.2. Literature Review

As Castellano-Álvarez et al. (2022) point out in their methodological proposal for analyzing the long-term effects of rural development programs, the interest in evaluating the method is an alternative line of research to that which, for the most part, focuses on measuring the impacts derived from the application of these programs.

Based on their studies of La Vera County (Extremadura, Spain) and using a methodology similar to that applied in this research, Castellano-Álvarez et al. (2020a) study the assessment of the promoters involved in the implementation of the program with respect to the management system, the participatory approach or the territorial dimension inherent to the "Leader Approach". The results of this work show a recognition of the capacity of rural development programs to strengthen county identity and indicate that actions such as tourism promotion campaigns, the county management system itself or investments in the recovery of heritage have contributed to this purpose (Castellano-Álvarez 2018; Castellano-Álvarez et al. 2021). However, it should be noted that, in general, interviewees also admitted that, in the case of La Vera, the county identity or the sense of belonging to the territory was an issue that already existed before the implementation of the program. Without leaving aside the case of La Vera, Castellano-Álvarez and Robina-Ramírez (2023b) return to the analysis of the territorial approach in rural development programs and conclude that, for the mayors of this county, the assessment of the implementation of the development program is clearly higher at the county level than at the strictly municipal level; in the opinion of the aforementioned authors, this would reflect the deep-rooted county dimension inherent in the implementation of this type of program.

The previous research attempts to evaluate something as intangible or immaterial as the perceptions of local actors on certain issues related to the development of their territory. In this effort, the aforementioned authors follow a similar methodological line to that used in other works (Castellano-Álvarez and Robina-Ramírez 2023a) or to that followed by many other researchers such as Gogitidze et al. (2023), Muresan et al. (2019), Harun et al. (2018), Oroian et al. (2017) and Dumitras et al. (2017).

Pérez Rubio (2007) studies the immaterial factors that condition the development of rural areas, and to do so, he employs a cross-cutting vision that emphasizes questions related to social capital. Also focusing on immaterial elements linked to social capital, Pérez Rubio and Gascón (2010) analyze the characteristics and motivations of neo-rurals in Extremadura (Spain). The analysis of social capital and its interrelations with endogenous rural development is an important line of research to which authors such as Esparcia et al. (2016), Saz-Gil and Gómez-Quintero (2015), Buciega (2012), Camagni (2003), Shucksmith (2002), Moyano Estrada (2001), Woolcock (1998), Putnam (1995) and Granovetter (1985) have made valuable contributions. Other works, such as those by Garrido Fernández and Estrada (2002), try to define indices that serve to quantify the impact of the application of the Leader II Initiative and the Proder I Program on the social capital of rural areas of Andalusia (Spain).

The interest in the study of social capital comes from the very characteristics of the Leader approach. Together with the territorial issue, the beginning of this section points out two other characteristics of the Leader methodology: the bottom-up approach and the governance system. In the implementation of rural development programs, the active participation of the population is key as a dynamizing element of the social capital of rural areas. Therefore, it is understandable that the bottom-up approach, the quality of the

participatory processes implemented at the county level, is also a subject that has attracted the interest of many researchers. Ramos and Garrido (2014) fully address this issue when they try to relate the territorial differentiation strategies of the different LAGs with the involvement of local actors in the development strategies undertaken. Quaranta et al. (2016), Navarro Valverde et al. (2014), Navarro Valverde et al. (2016) and Alberdi Collantes (2008) are just some of the authors who have devoted efforts in this line.

After outlining the research approach and the theoretical framework, the following section deals with methodological issues; the third section shows the results of the research, and finally, the most relevant conclusions and some proposals for action are presented.

2. Methodology

2.1. Geographical Scope of the Research: Tajo-Salor County as a Case Study Object

Yin (2018) defends the usefulness of the case study methodology when the element to be studied is interdependent with its environment. In Tajo-Salor County (Extremadura, Spain), the definition of the territory, the active participation of its population in the development process conditions, without a doubt, the execution of the development program itself.

Coller (2000), as a prior condition to the application of this methodology, points out that it is necessary for the case under study to have its limits clearly defined. Leaving aside the skill with which it has been done, in the development strategy of Tajo-Salor County, the scope of action is made up of 15 towns that represent 2176.04 km^2 of a territory characterized by its aridity (despite the fact that the rivers that give rise to the name of this LAG flow through it). Figure 1 represents the location and municipalities that make up Tajo-Salor County, delimited to the east by the municipal area of Cáceres (which completely surrounds Aliseda), to the west by the border with Portugal, to the north by the Tajo River and to the south by the Sierra de San Pedro (TAGUS).

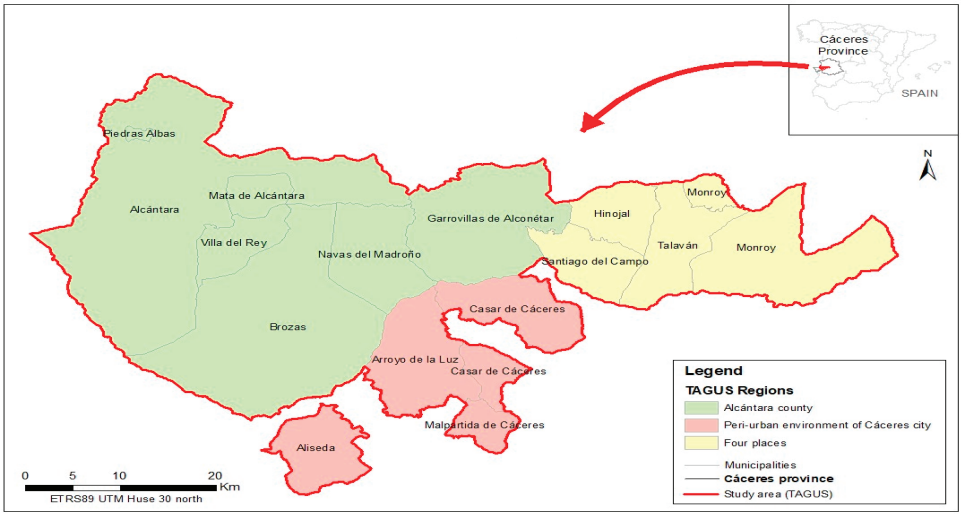

Figure 1. Location and municipalities that make up Tajo-Salor County. Source: own elaboration.

As shown in Table 1, the temporal scope of the research refers to the execution of three programs (Proder I, Leader+ and Leader Approach) executed from the mid-nineties and the 2000s. Given that the current configuration of Tajo-Salor County is a consequence of the different projects developed by the towns of the area to opt for the management of rural development programs in their various calls, it is necessary to clarify that the Proder I Program (MAPA 1996) is executed by the Association for the Integral Development of Salor-Almonte (ADISA), composed of the municipalities belonging to the peri-urban

environment of Cáceres City (Casar de Cáceres, Malpartida de Cáceres, Arroyo de la Luz and Aliseda), plus the so-called "Four Places" (Hinojal, Talaván, Santiago del Campo and Monroy). Subsequently, for the application of Leader+ (Comisión Europea 2000) and Leader Approach (Comisión Europea 2006), the TAGUS Association will be the result of the sum of the towns that made up ADISA and the municipalities that, within the Association for the Development of the Alcántara County (ADECA), they had managed, the first two calls for the Leader Initiative (Alcántara, Brozas, Navas del Madroño, Villa del Rey, Piedras Albas, Garrovillas and Mata de Alcántara). This sum of "realities" (not always coincident) may be one of the factors from which the absence of regional identity that currently afflicts the Tajo-Salor region is derived (Diputación de Cáceres 2016). Figure 1, while representing the set of municipalities that make up the region, also tries to differentiate the three subareas that compose it.

Table 1. Sample of tourism projects in the Rural Tourism measure. Tajo-Salor County.

Program	Private Projects	Sample Projects	Private Investment Sample Projects	% Sample Investment Projects with Respect to Total Investment
Proder I	7	5	731,509.26	89.03
Leader+	15	12	2,018,857.20	84.35
Enfoque Leader	16	6	1,294,216.23	71.60
Total	38	23	4,044,582.69	80.53

Source: (Castellano-Álvarez et al. 2023).

In research based on case study methodology, it is essential to justify why the chosen case is relevant to the issue to be studied (Coller 2000). The "forced" configuration of the TAGUS LAG is, ultimately, the cause of the problems of territorial identity of this county; it is, therefore, an object case, referring to a specific territory, but also an exemplary case, insofar as it represents a paradigmatic example for studying the difficulties and consequences derived for the application of rural development strategies from the absence of a territorial identity for the whole of the area over which the same strategy is implemented.

2.2. Fieldwork: Phases of the Research, Sample Selection and Interviews Conducted

The methodological approach of this work is very similar to that used by Castellano-Álvarez et al. (2023). In this case, this research raises new concerns, but, in relation to the methodology, the research phases and sources used are very similar.

The fieldwork was differentiated into three stages: in the first one, the LAG technicians were contacted, and the documents related to the development strategy of the region and the executed projects were accessed; in the second phase, based on the selection of a sample of the projects executed under the measure to promote rural tourism, the promoters were interviewed in person. These interviews are the main source of information for this research; they allowed the assessment of the aforementioned promoters regarding the cohesion of the territory and the level of the overall execution of the program; in the final stage, the results obtained in the interview phase were triangulated with the assessment of privileged actors in the territory.

In the aforementioned second stage of fieldwork, the sample of projects was carried out following three conditions: (1) the funds for the projects had to be mostly private; (2) the support of the public funds received must amount to at least EUR 12,000; and (3) the public aid received in the form of a subsidy must represent a minimum of 20% of the total investment made. These criteria are in line with those used by Castellano-Álvarez et al. (2023) and Castellano-Álvarez et al. (2019) and allow us to select a sample of projects representative of the execution of said measure, as shown in Table 1.

Of the 23 projects selected in the sample, 5 had ceased their activity and 1 had been transferred, so it was not possible to contact the initial promoters. As a consequence, fieldwork interviews were carried out with 17 promoters. In order to optimize the interpretation

of the answers and to understand the objective of the projects carried out, the interviews were conducted at the place where their investments were implemented.

Regarding the interview model, it was decided to carry out semi-structured interviews. This type of interview facilitates the processing of the information and allows the incorporation of any opinion of interest that the interviewee may have, even if this, in principle, had not been foreseen by the interviewer. Yin (2016), in his considerations on qualitative research, justifies the validity of this interview model as a research tool and source of information. According to this author, this research tool allows one to interact with the person interviewed and contextualize his or her evaluations, thus promoting an optimal understanding of the answers of the person interviewed.

The structure of the interviews was divided into two phases referring to each of the research questions formulated at the end of Section 1.1. The first phase is concerned with the respondents' sense of belonging to Tajo-Salor County. To this end, by means of a double open question, the promoters were asked the following: Do you believe that there is an idea of a county, do you feel you belong to the county? In the second phase, the assessment of the promoters regarding the contribution of the development program to their general objectives in Tajo-Salor County was obtained. For this purpose, the seven closed questions listed in Table 2 were defined. Regardless of the considerations that the promoters wished to make, in order to measure their evaluations, a Likert scale was used for each of the questions, whereby the interviewees had to rate from 0 to 10 the degree to which they believed that the development program had fulfilled the objective in question.

Table 2. Closed questions asked of the promoters interviewed.

	Question: To What Extent do You Think That the Development Program. . .
1	Has promoted the development of the county?
2	Has contributed to the diversification of the economy?
3	Has contributed to the maintenance of the population?
4	Has contributed to increasing income?
5	Has improved the social well-being of the population?
6	Has contributed to preserving the environment?
7	Has reinforced the identity of the county?

Source: own elaboration.

The final indices result from calculating the simple arithmetic mean of the scores received; in the event that any of the interviewees, for some of the questions, chose not to answer, their response for that specific question did not receive any score and was not taken into account in the calculation of the simple averages.

3. Results

3.1. Feeling of Belonging or Identity in the County

As Figure 1 shows, in Tajo-Salor County three areas can be differentiated: (1) the peri-urban environment of Cáceres City; (2) the four municipalities known as "Four Places" located to the east of the county, between which there has historically been a close connection, although they lack the necessary entity to be able to manage a development program on their own; and (3) Alcántara County, with its own identity and whose municipalities managed the first two calls for the Leader Initiative. Being fully aware of this heterogeneous reality, the first objective of this research takes its entire meaning.

Regarding the first research question, 15 of the 17 promoters considered that there is no such feeling of belonging to Tajo-Salor County. If the responses of the interviewees are analyzed based on their belonging to some of the indicated subareas, it is detected that the most negative evaluations are offered by the promoters of the "Four Places" and the peri-urban area of the city of Cáceres. The five interviewees belonging to the "Four Places",

while denying the existence of a real connection with the rest of the region, recognize that this feeling of identity does exist among the population of the "Four Places". For their part, the seven interviewees from the peri-urban environment of Cáceres justify the non-existence of this feeling of county identity with three reasons: (1) their proximity to the city of Cáceres: "we are so close to Cáceres that we are detached of the county" argues one of the promoters while recognizing that, in her municipality "people feel like they belong to their town and the surroundings of Cáceres"; "We depend on Cáceres, which is the head of our county" justifies another; (2) a localist feeling: "don't talk to me about the county; tell me about municipalities" responds one of the promoters; "here people are very closed in to their town," another recognizes with a critical spirit; and (3) the absence of a "county tourism product" or "a county line of argument."

Even those interviewed who, at first, responded that this sense of county did exist, when asked to define what Tajo-Salor County means to them, were not even aware that the municipalities of the "Four Places" also make up Tajo-Salor County. Some of them even went so far as to deny it ("for us the Four places are another place"), and they identified the idea of a county with their nearest municipalities.

As in the case of the "Four Places" promoters, among those interviewed from Alcántara County, a majority acknowledge a feeling of identity only with their closest area. Among this group of promoters, both those who offer more positive assessments and those who are more critical of this issue, it is common for them to justify the difficulty for this feeling of county identity to flourish on the basis of the great distances between the municipalities integrated into the Tajo-Salor LAG. One of the five promoters of this area is the only one who considers that this feeling of belonging does exist in the entire Tajo-Salor County "but. . . in a very relative sense" (he clarifies); there are also those who do not respond openly to the question but consider that this feeling "is being created".

3.2. Assessment of Program Execution by the Local Promoters

Having addressed the first objective of the research, the study turns to how the absence of this feeling of belonging to the entire region and how this territorial heterogeneity may have influenced the evaluation of the promoters regarding the achievement of the objectives set by the development programs. In this regard, Figure 2 represents the aggregate assessment of the promoters regarding the main objectives that, in general, endogenous rural development programs propose.

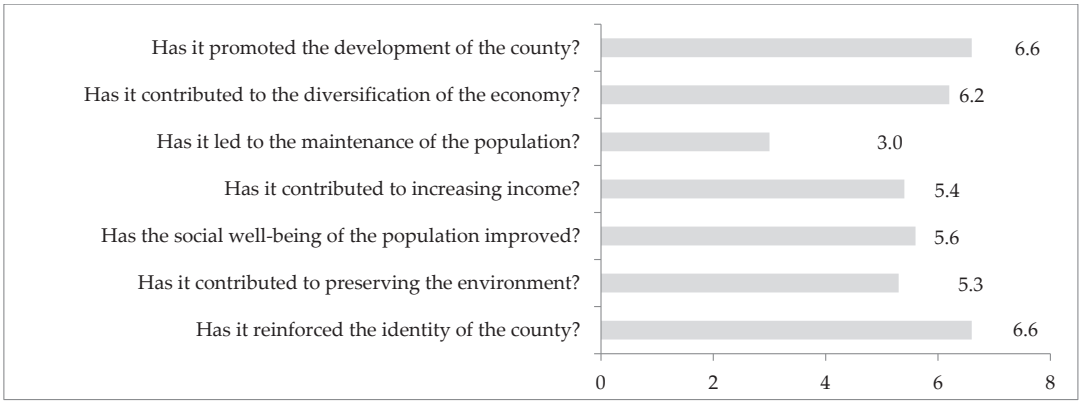

Figure 2. Evaluation of the program's objectives by the promoters of Tajo-Salor County. Source: own elaboration.

As Figure 2 shows, with the exception of the program's capacity to retain the population, in the rest of the matters raised, the aggregate rating exceeds 5 points. As is well known, depopulation and the aging of the rural population are two of the major challenges

that many developed countries face with regard to their rural areas. These issues are, therefore, a fundamental objective of rural development programs; according to the results, it does not seem that those interviewed have a positive assessment of the role that the implementation of these programs is playing in this area in Tajo-Salor County. It is true that, in their answers, many of them also recognize that the economic resources allocated to this type of program are insufficient to meet such a challenge.

The results of the interviews show that the three areas in which the implementation of the program is most highly rated are its contributions to the development of the county, to strengthening the identity of the territory and to the diversification of its economy. Starting with the latter, this may be logical given that the interviewees are tourism promoters; they are therefore one of the best examples of the program's contribution to the diversification of the economy. In the interviews, the order of the questions is the same as that given in Figures 2 and 3; this was intended to go from the general to the most specific. Therefore, the local actors' assessment of the program's contribution to county development could be considered as the closest thing to an overall assessment of its implementation.

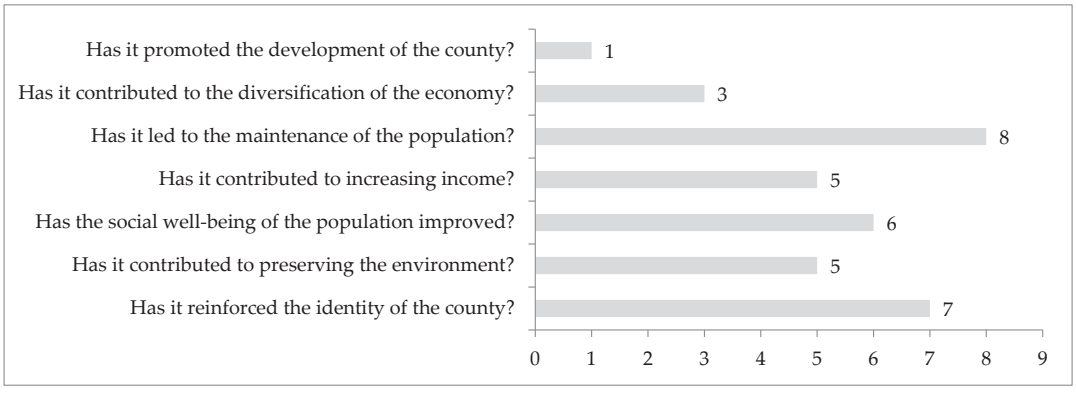

Figure 3. Promoters who do not value the program's contribution to some of its objectives. Source: own elaboration.

For its part, the positive assessment of the program's capacity to reinforce county identity may seem paradoxical. In this regard, is worth clarifying that (1) these data must be assessed regarding the conclusions of the previous section where the lack of a feeling of belonging is recognized but, at the same time, paradoxically, the promoters also positively evaluate the effort made by the program in this matter. To such an extent is this the case that, with the exception of the interviewees belonging to the "Four Places", most of the interviewees (11 out of 17) consider that the program has reinforced the county identity. The LAG's own performance, its county logic of operation, is one of the factors that may have contributed to this ("TAGUS is a reference in the county and, with this, reinforces that identity", says one of the interviewees). It should also be noted that, among the promoters who positively value the role of the LAG in this matter, there are those who critically qualify their response given the efforts made by the LAG in promoting Casar cheese, a product that, in their opinion, does not represent the entire county but only one of its towns. And (2) there is a methodological issue: the evaluations collected in Figure 2 are the average resulting from those offered by those who felt capable of giving their opinion on each of the questions raised. Figure 3 shows the number of interviewees who do not value some of the objectives in which the interviews are interested, and, after the demographic question, the role of the program in reinforcing the identity of the population with the territory is, precisely, the question for which the fewest evaluations are made.

This research aims to study the relevance of the articulation of the territory in the implementation of rural development programs. Having analyzed the feeling of belonging

and the assessment that the promoters deserve for the execution of the program, it is now worth asking whether, given this territorial heterogeneity, this global assessment is homogeneous within the region or whether there are appreciable differences depending on the area of the county that is treated. Table 3 compares the assessment offered by the promoters of the entire county regarding the fulfillment of the program's objectives with that offered by those same promoters but with their responses differentiated depending on the subarea of the county to which they belong.

Table 3. Comparison by areas of the assessment of compliance with objectives.

	Tajo-Salor	Cáceres Surroundings	Alcántara County	Four Places
Development of the county	6.6	6.7	6.6	6.5
Diversification of his economy	6.2	6.8	7.0	4.5
Population maintenance	3.0	3.8	6.0	0.0
Income increase	5.4	6.4	6.0	4.2
Social welfare	5.6	7.8	6.7	2.8
Environmental conservation	5.3	6.4	7.3	2.5
Reinforcement of identity of the county	6.6	7.0	7.8	0.0

Source: own elaboration.

As Table 3 shows, the capacity of the program to promote the development of the region and the capacity of the program to contribute to the diversification of its economy are two objectives in which the execution of the program is highly valued and, as Figure 3 shows, are the two issues that the promoters who feel qualified to offer their opinion believe could be an example of the visibility of the program in these matters. Regarding the sectors with which this economic diversification has been promoted, although references to tourism are frequent (the interviewees are tourism promoters), it is no less true that many promoters generalize their answers, referring to the training sector, livestock, etc.

The contribution of the program to the maintenance of the population is the subject that obtains the lowest rating in the county as a whole. To explain these results, it is necessary to return to Figure 3 which shows that almost half of the promoters do not value the role of the program in stopping demographic regression. However, both among those who did and among those who preferred to abstain, a feeling of discouragement in this matter is evident, and among a certain number of interviewees, there is also a feeling of understanding towards the limited resources of the program and the ambitious nature of this purpose. This is shown by some promoters when, regarding this question, they considered that "every day more people leave but TAGUS is not to blame for this" and "this problem is beyond the ability of TAGUS to act".

The analysis of the data presented in Table 3 shows that the evaluations of the promoters around Cáceres and the Alcántara area are similar and, in both cases, higher than the average for Tajo-Salor County as a whole. However, in the case of the promoters of the "Four Places", despite a positive assessment of the program's contribution to the development of the county, the rest of the aspects raised have a much more negative perception. Examples of this would be the assessment of the program's contribution to the maintenance of the population (0.0), reinforcement of identity of the county (0.0), environmental conservation (2.5) or social well-being (2.8); somewhat less unfavorable are the assessments of this group of promoters regarding the program's contribution to economic diversification (4.5) or the increase in the population's income (4.2).

The assessment of the promoters of the "Four Places" regarding the program's contribution to reinforcing the feeling of belonging to the county could not be more negative. This could be a consequence of the uprooting of this area with respect to the territory with which it shares a development strategy, and ultimately, it could be the reason why the promoters of this area make a much more pejorative assessment of the implementation of the development program than the rest.

4. Discussion

Aside from the objectives of the research and the answers to the questions asked, this work constitutes an effort to try to measure what are known as intangible aspects of rural development. The aforementioned Navarro Valverde et al. (2012), Esparcia (2001) and Delgado et al. (1999) have already spoken about the difficulty and the need to face this task.

This work is in line with others carried out by Castellano-Álvarez et al. (2020c) on the intangibles of rural development in which an attempt is made to evaluate the characteristics of the Leader approach in the application of rural development programs. In line with the good assessment in Tajo-Salor of the program's contribution to cross-cutting issues such as the development of the county or economic diversification, the results of the aforementioned work also showed a positive assessment of the role of the LAG. However, with regard to the contribution of the program to the identification of the population with its territory, there are differences between the results obtained by both studies; it is true that, in their analysis of the intangibles of rural development, Castellano-Álvarez et al. (2020a) take as a reference La Vera County in which, prior to the implementation of development programs, there was a deep-rooted sense of belonging and identity of the population with its territory. Be that as it may, both works show (a) that the suitability with which the territory is defined conditions the assessment of local agents regarding the results obtained with the execution of the development strategy and (b) that this conditions it structurally. That is to say, issues such as territorial identity are difficult to resolve in the short or medium term, despite the fact that, as concluded by Castellano-Álvarez et al. (2021), in the development strategy of Tajo-Salor County, an important part of the resources committed to non-productive measures have been directed to recovering heritage and cultural elements that strengthen that identity.

The results of this research show that the territorial definition of the Tajo-Salor co-brand can be considered forced, if not artificial. In relation to this issue, Guiberteau Cabanillas (2002) was already critical of the articulation of the LAGs in Extremadura and of the existence of a real participation of the population in them. Previously, Esparcia et al. (2000) argued their misgivings that the structures linked to the implementation of rural development programs were used as tools of legitimization and power by politicians, technicians or even some of those involved in the operation of these groups; this is not a trivial issue because, just as the territory is alive, the LAGs that implement development strategies should be flexible and creative; to what extent can the structures denounced by Esparcia et al. (2000) become elements that hinder or encourage the redefinition of the LAGs' scope of action, the disappearance of some or the enlargement of others?

In their analysis of local people's perceptions of tourism development, Gogitidze et al. (2023) and Baloch et al. (2022) argue that the tourism development of a territory depends, among other factors, on the specific characteristics of the area and its cultural heritage. Frînculeasa and Chiţescu (2018) understand that the absence of territorial identity, or of an adequate integration of its tourist resources, conditions the tourist development of the territory and, therefore, the evaluations that this type of promoter makes regarding tourism promotion strategies promoted by rural development programs. In line with the positions of all these authors, the research results show how many interviewees, to deny the existence of a regional identity, alluded to the absence of a "common tourist product" or "a line of argument that built the county".

For their part, authors such as Saz-Gil and Gómez-Quintero (2015) or Garrido Fernández and Estrada (2002) have highlighted the relevance that social capital or the interactions of the local population can have in rural development processes and hence the importance of an optimal territorial configuration of LAGs to enhance the involvement of local agents. In relation to tourism development, Gursoy et al. (2019) consider that the lack of identification of the local population with the idea of the county would represent a handicap for the development of the territory; these authors emphasize the importance of LAGs actively involving the local population in the tourism planning and development of the territory as a way of promoting greater perception by them of the benefits of tourism. In fact, the

results of the research show that in those areas of Tajo-Salor County where there is no sense of belonging to the territory, the interviewees' assessment of the results obtained by the program is significantly more negative than in the rest.

5. Conclusions

Tajo-Salor County is a paradigmatic example of an artificially designed territory. There is no sense of county identity; in fact, the current configuration of the county is the result of the sum of different territorial realities in which the perception of the territory itself is not homogeneous: in the "Four Places" or in the peri-urban area of Cáceres city, the idea of a county is practically non-existent. The considerable distances between the different municipalities, or the fact that some of the areas integrated within the current county have historically had, and still have today, their own territorial identity, are two factors that make it even more difficult to construct the idea of a county territory.

The research shows that the lack of a sense of county identity has consequences for the assessment that local promoters make of the implementation of the development program. Those areas of the county that do not feel a sense of belonging to the county have a much more negative assessment of the results obtained with the implementation of the development program than the rest. The best example of this is the "Four Places".

Therefore, territorial cohesion in the configuration of LAGs has a decisive influence on the assessment that local agents make of the implementation of development strategies. This is an interesting lesson that the case study of Tajo-Salor County offers, and that the political and technical managers of these programs should bear in mind in the future definition of the territories that apply this type of rural development strategy.

Regarding the limitations of the research, those linked to the methodology used and, in particular, the low number of interviews carried out (especially when the region is divided into subareas) should be noted. The results should be considered as an approximation to the subject matter under analysis and always interpreted in the context of the chosen case study. In future research, it could be interesting to extend the interview phase to the promoters of the rest of the productive measures; this could allow researchers to contrast whether the results obtained in the case of the "Four Places" show a certain feeling of uprooting from this area of the region or are a consequence of the bias introduced by the interviewees, given that in all cases, these are tourist projects with limited economic viability (as recognized by most of the promoters).

6. Proposals for Action in the Case of Tajo-Salor County

Perhaps, the linking of the "Four Places" with the area of influence of the Monfragüe National Park could make it advisable to reconsider the current composition of the county so that these municipalities would be incorporated in future programming periods into the Association for the Development of Monfragüe and its Environment (ADEME). In fact, three of these four towns border municipalities already integrated into the aforementioned ADEME. The "Four Places" could benefit the region's economy, environment and development given the following:

(1) Linking the "Four Places" to Monfragüe's area of influence could boost eco-tourism and related economic opportunities. Monfragüe received over 300,000 visitors in 2021, benefiting hotels, restaurants, guides and artisans (Junta de Extremadura 2022). Incorporating the "Four Places" could extend this success; Talaván and Hinojal both have castle ruins that could attract cultural tourists (Diputación de Cáceres 2021).

(2) The "Four Places" share Monfragüe's exceptional biodiversity. They exhibit similar habitats like open oak woodlands, rocky slopes, river valleys and pastures (WWF España 2020). Annexing them could expand conservation for endangered species like the Spanish imperial eagle, black stork and black vulture (SEO BirdLife 2021).

(3) Third, linking these areas would support Monfragüe's sustainable development goals. Eco-tourism, artisanal food production, renewable energy and sustainable agriculture are priorities in addressing depopulation and unemployment (ADEME 2023). The

"Four Places" face similar challenges to those faced by rural areas adjacent to these protected areas.

(4) Grouping these municipalities could improve access to EU and regional development funding. Monfragüe municipalities receive over EUR 9 million annually for business support, training, infrastructure upgrades and environmental stewardship (Junta de Extremadura 2020). Access could aid projects in eco-businesses, heritage restoration, nature education and rural innovation in the "Four Places".

(5) Residents of the "Four Places" identify more with Monfragüe based on geography, landscape, history and culture (Ayuntamiento de Mirabel 2021). Incorporating them into ADEME could give them an amplified voice in local policies affecting daily life.

In turn, the relationship of Aliseda with the Sierra de San Pedro, or of the municipalities belonging to Alcántara County with the Portugal border, could make a merger of TAGUS with the Association for the Development of the Region of the Sierra de San Pedro-Los Baldíos advisable, placing the headquarters of the LAG in a locality intermediate to what would be the new territorial reality of this Group. There are several reasons that would justify these changes:

(1) Aliseda and other municipalities bordering the Sierra de San Pedro have strong geographic, economic and social ties with the area that could warrant grouping them together (Vázquez 2021). Similarly, the Alcántara area depends on cross-border trade, tourism and transit with Portugal (Mérida 2020). Merging TAGUS with the Association for the Development of the Sierra de San Pedro Region could benefit both sides through increased funding, political visibility and administrative efficiency.

(2) A merged entity could better access EU and regional grants for rural business support, training, infrastructure, nature conservation and cultural heritage programs (Moreno and López 2022; Sánchez-Oro Sánchez et al. 2021). The TAGUS municipalities already benefit from the Leader Approach for locally designed initiatives (TAGUS 2020). Joining forces under the same LAG would amplify these resources. It could fund priority projects like village repopulation, micro-enterprise assistance, renewable energy transitions, sustainable forestry and preserving dryland agriculture (ASPS 2021).

(3) Combining these LAGs could also raise the political profile of rural priorities for depopulated areas struggling with unemployment and inadequate services (Diputación de Cáceres 2022; Leal-Solís and Robina-Ramírez 2022). A merged Association would cover one-third of Cáceres Province. Having a larger constituency could increase lobbying clout for budget allocations and decision-making input (González 2023).

(4) Administratively, housing both associations under a single LAG structure would improve operational efficiency. Joint technical, administrative and management staff could reduce overhead costs (Sánchez 2020). Digital tools and shared offices could also streamline project approvals, monitoring, grant distribution and fiscal compliance (Villalba 2021). Strategically locating the headquarters between the TAGUS and Sierra de San Pedro territories would symbolize the equitable merger and facilitate access for residents of both areas (Pulido and Barrios 2022). Centrally situating leadership could support genuinely balanced development that addresses the needs of all communities being supported under the expanded Group (López and Gómez 2021).

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Border Proximity, Ports, and Railways: Analyzing Their Impact on County-Level Economic Dynamics in Hungary, 2001–2020

Roman Fedorenko [1,*], Galina Khmeleva [2] and Marina Kurnikova [2]

[1] Heat and Power Department, Samara State Technical University, 443100 Samara, Russia
[2] Institute of National and World Economy, Samara State University of Economics, 443090 Samara, Russia
* Correspondence: fedorenkoroman1983@gmail.com

Abstract: In this research, our primary objective is to dissect the influence of specific locational elements—proximity to international borders, substantial ports, and significant railway junctions—on the economic vitality of Hungary's counties from 2001 to 2020. The aim is to reveal how these factors individually contribute to economic disparities and to demonstrate their compounded effect on regional prosperity. This analysis is particularly timely and pertinent as regional inequalities are becoming more pronounced globally, making understanding such disparities crucial for effective policy formulation and regional planning. Utilizing GDP per capita as a fundamental indicator of economic health, we meticulously categorized counties, revealing a clear correlation between these locational advantages and economic performance. We innovatively employed Python to script a unique code, creating a matrix that enriches the presentation of our results, thereby facilitating a more nuanced understanding of these correlations. Our findings are significant in the current socio-economic climate, highlighting the need for tailored strategies considering unique regional attributes. This study is instrumental for policymakers and stakeholders in formulating informed, targeted strategies to harness these locational advantages, fostering balanced development, and narrowing the economic divide within the nation. The actuality of our research lies in its immediate relevance, offering insights critical to current discussions and decisions in regional development planning.

Keywords: gross domestic product per capita; growth rate; border regions; ports; railroads

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1. Introduction

In an era characterized by intricate interconnections and global dynamics, the complexities of regional economic development have taken center stage in both research and policy discourse. Our analysis will focus on Hungarian counties as the geographical unit of interest, corresponding to the Nomenclature of Territorial Units for Statistics—Level 3 (NUTS-3), a sub-national administrative division. By meticulously dissecting the principal factors that exert influence, we embark on a journey to unravel the intricate tapestry that defines economic trajectories within these regions. Through this exploration, we aim to cultivate a deeper comprehension of the intricate forces at play, shedding light on the diverse mechanisms steering the economic destinies of individual subnational entities.

While numerous factors collectively shape the economic development of subnational regions, it is essential to isolate and study individual influences. In this article, the authors focus on examining the impact of specific factors on the economic growth rate of NUTS-3 regions. These factors include the proximity to international borders and the presence of significant ports or railway networks. Although various factors, such as skilled labor availability, natural resources, government policies, investment incentives, and the presence of educational institutions, are pivotal, our study concentrates on disentangling the influence of these particular elements. By doing so, we aim to gain a deeper understanding of how these factors uniquely contribute to the economic development of subnational areas. The

complex interplay of these elements ultimately determines the level and pace of economic growth in these regions.

In light of the increasing importance of the chosen factors and their impact, it is vital to consider the evolving logistics landscape in our modern world. The COVID-19 pandemic has accelerated the integration of modern logistics technologies, such as IT, telecommunications, and automatic contactless delivery (Börjesson and Eliasson 2019). Continuous improvement in the efficiency of the logistics chain that combines the production, transportation, and storage of goods, is necessary to maintain a place in the world market (Rymarczyk 2020). The development of logistics infrastructure plays a critical role in facilitating the movement of goods and materials within a region. This can provide numerous benefits for local businesses, including accessing imported resources and exporting their products. Access to foreign markets seriously impacts domestic economic development (Di Berardino et al. 2022). Foreign trade activity develops local markets both due to the emergence of new goods and technologies and by increasing the technological level of local enterprises (Elekes and Lengyel 2020).

In this paper, using the example of Hungary, we will examine such factors as the presence of major railway and water routes and the proximity to international borders. The main object of our research is the Hungarian subnational regions—the counties. The Hungarian economy is significantly oriented towards the markets of more developed partners in the European Union. Various researchers have repeatedly noted that Hungary is significantly increasing its foreign trade potential (Vámos 2022). The successful inclusion of Hungary in the pan-European markets has become a key driver of its economic success in the post-socialist period (Radosevic 2002; Resmini 2010). In their economic development, Hungary's border regions largely depend on efficiently delivering goods to the more capacious markets of developed neighbors. While various factors influence regional development, this paper presents a focused investigation into the impact of specific factors, such as proximity to borders and the presence of port and railway infrastructure, on the economic development of Hungarian counties.

The central hypotheses of this article are formulated as follows:

Hypothesis 1. *Counties with significant major railway or water routes exhibit superior economic development and display notably accelerated growth in GDP per capita compared with counties lacking such transportation networks.*

Hypothesis 2. *Counties close to international borders exhibit enhanced economic development and manifest swifter growth rates in GDP per capita compared with counties located farther away from these borders.*

Hypothesis 3. *Counties positioned at a considerable distance from international borders and devoid of substantial railway or waterway infrastructure experience relatively lower levels of economic development and present slower growth patterns in GDP per capita than counties benefiting from closer border proximity and robust transportation networks.*

In this paper, we acknowledge the multitude of factors that influence regional development. However, our research takes a specific and focused approach by examining the influence of proximity to international borders and the presence of major port and railway infrastructure on the change and growth rate of GDP per capita in Hungary's NUTS-3 regions. We recognize that regional disparities are multifaceted and influenced by a wide range of factors, from population distribution to economic activities. While our analysis provides valuable insights into the relationship between certain transportation-related factors and economic development, it is just one piece of the larger puzzle of Hungary's regional dynamics. Our methodology will help us gain a better understanding of how these specific factors contribute to economic growth at the regional level, even though it may not comprehensively address all aspects of regional development. We aim to contribute to the empirical basis for understanding these dynamics, with the recognition that policies

may not be able to alter Hungary's political map but can benefit from a more nuanced understanding of regional economic drivers.

The rest of the paper is organized as follows: Section 2 presents the theoretical framework and the literature review. Section 3 presents the methodology. The results are presented in Section 4, and are discussed in Section 5. In Section 6, we draw conclusions.

2. Theoretical Framework and Literature Review

The foundational theories guiding this article are deeply rooted in the principles of Regional Economic Development, New Economic Geography (NEG), Endogenous Growth Theory, Infrastructure-Based Development Theory, and Spatial Interaction Theory. These theories collectively frame the development of our central hypotheses:

Hypothesis 1. *Drawing from Infrastructure-Based Development Theory, we posit that counties with substantial railway or water routes are likely to demonstrate superior economic development, exhibiting accelerated growth in GDP per capita. This hypothesis aligns with the theory's assertion that robust infrastructure is a critical driver of economic progress. Calderon, C. and Servén, L. examined the impact of infrastructure development on economic growth and income distribution using a large dataset of countries (Calderon and Servén 2004). Esfahani, H. and Ramírez, M. explored the interplay between institutions, infrastructure, and economic growth, arguing that the quality of institutions can significantly influence the productivity of infrastructure investments (Esfahani and Ramírez 2003).*

Hypothesis 2. *Informed by New Economic Geography and Spatial Interaction Theory principles, we hypothesize that counties proximate to international borders will experience enhanced economic development, reflected in swifter GDP per capita growth rates. These theories support the idea that geographical positioning relative to borders can significantly impact economic activities and growth. Anderson, J. and van Wincoop, E. provided insights into how borders significantly affect trade patterns, emphasizing the role of geographical positioning in economic activities (Anderson and Wincoop 2003). Fujita, M., and Thisse, J. offered a comprehensive view of the spatial economy, emphasizing how location relative to borders and centers of economic mass can impact economic activities (Fujita and Thisse 1996).*

Hypothesis 3. *Synthesizing insights from Regional Economic Development Theory and NEG, we propose that counties far from international borders and lacking significant railway or waterway infrastructure will experience lower economic development levels and slower GDP per capita growth. This hypothesis underscores the role of spatial disparities and infrastructure in regional economic outcomes. Stimson R. et al. analyzed regional growth and local development theories, exploring how economic actors choose their locations and the impact of these decisions on regional economic development (Stimson et al. 2006). Pinder, D. provided a survey of major theories of regional economic development, guiding strategic planning and policy-making processes in the European Union (Pinder 2017). Krugman, P. launched the foundations of NEG theory, explaining the formation of highly concentrated industrial hubs and the impacts of transportation costs and economies of scale on this process (Krugman 1991). Baldwin, R. et al. discussed NEG in the context of globalization, analyzing how it impacts regional economies and shapes global economic geography (Baldwin et al. 2001).*

Today, more than 70% of traded goods traverse global supply chains (Zábojník et al. 2020). Ensuring competitiveness in the international markets is imperative for fostering economic growth. Paul Krugman emphasized the necessity for individual countries to exhibit competitiveness in foreign markets, drawing a parallel between competition among countries and that among corporations (Krugman 1996). Venturing into foreign markets imposes additional requisites on exporters, simultaneously leading to enhanced efficiency gains. Battisti et al. postulated that firms engaged in international markets typically demonstrate higher productivity levels than their domestic counterparts (Battisti et al.

2021). The success of penetrating global markets depends significantly on the adaptability of the domestic market to external demands (Wang et al. 2022).

Even within the scope of a unified market like the European Union, competition prevails among individual countries vying for sales opportunities. Lomachynska I. et al. dissected the influence of well-developed European markets on the competitive landscape of new EU member states (Lomachynska and Podgorna 2018). Jarosz-Angowska A. et al. highlighted that integrating new EU members into the single European market subjects them to intense competitive pressures from fellow Community members and third-party nations (Jarosz-Angowska et al. 2022). Competition is observed both in individual enterprises and across industries (Grzegorzewska and Stasiak-Betlejewska 2021). Research has extensively explored the experience of Eastern European countries in the broader pan-European market. Lomachynska et al. scrutinized the impact of foreign direct investment on the export dynamics of Hungary, Poland, Slovakia, and the Czech Republic (Lomachynska et al. 2020). Pawera et al. delved into the nuances of effective collaboration between Slovakia and Austria (Pawera et al. 2020).

A pivotal determinant influencing successful forays into foreign markets is the status of the logistics infrastructure. The intricacies of global logistics infrastructure development and its implications for national progress were explored by Šakalys and Batarlienė (2017) and Seo et al. (2017). The imperative to modernize logistics infrastructure for international trade was underscored in works by Otsuka et al. (2017), Liao (2017), and earlier contributions by the authors themselves (Fedorenko et al. 2021; Fedorenko and Khmeleva 2021).

The impact of railway infrastructure on the European economy has been scrutinized in various contemporary articles. Schumann T. et al. analyzed Europe's high-speed freight train initiative (Schumann et al. 2018). Bukvic et al. investigated the application of game theory for optimizing transportation costs among Eastern European countries (Bukvić et al. 2021). Minarik M. et al. evidenced the positive influence of importing transport services from EU countries to Slovakia, Czechia, and Poland (Minárik et al. 2022). Kalman B. et al. explored the interplay between competitiveness and logistics performance within the Visegrád Group (Kálmán and Tóth 2021). Additionally, the logistics infrastructure of Visegrad Group countries has been analyzed by other researchers (Tóth 2019; Włodarczyk and Mesjasz-Lech 2019).

Distinct attention has been directed toward the economic development of Hungary and its potential integration into the global economic framework by scholars such as Nagy et al. (2018) and Oláh et al. (2017a, 2017b), among others. Kano et al. analyzed the intricacies of Hungary's regional inclusion in the pan-European market, albeit focusing on the impact of international corporations rather than the regions themselves (Szakálné Kanó et al. 2019).

We acknowledge the complex tapestry of factors that mold regional development. However, our research narrows its lens to scrutinize the role of international border proximity and the availability of major port and railway infrastructure in modulating GDP per capita changes and growth rates across Hungary's NUTS-3 regions. Regional disparities result from a confluence of variables, from demographic compositions to the spectrum of economic activities present.

Although our analysis offers critical insights into how transport-centric factors correlate with economic development, it represents a singular facet in the multifaceted realm of Hungary's regional economic dynamics. Our methodological approach, fortified by data-driven decision making principles, seeks to unravel the contributions of these targeted factors to regional economic development, albeit without capturing every element influencing regional development comprehensively.

Despite the comprehensive body of literature delving into various aspects of economic competitiveness, international market entry, logistics infrastructure, and their interplay, specific questions warrant further investigation. While existing research has shed light on the impact of transportation networks, proximity to international borders, and the

role of logistics infrastructure, some nuances require deeper exploration. Furthermore, the complex relationships between competitiveness, economic growth, and the specific contexts of subnational regions like Hungarian counties, call for a more targeted inquiry. As a result, this paper aims to contribute to the existing knowledge by focusing on the intricate connections between major transportation routes, border proximity, and economic development within Hungarian counties. By addressing these gaps and employing a comprehensive analytical approach, this study seeks to provide a more nuanced understanding of the factors influencing subnational economic growth and to offer insights that can guide policy decisions and future research endeavors.

3. Methodology

We examined the statistical data of Hungary for the period from 2000 to 2020. The primary sources are presented in Table 1.

Table 1. Analyzed international, national, regional, and local documents.

Information Source	Information Type	Reference
World Bank Group	Data on the volume of the gross domestic product of Hungary for 2000–2021.	https://data.worldbank.org (GDP per Capita (current US$)—Hungary n.d.)
Hungarian Central Statistics Office	Data on the volumes of the gross regional product of individual counties of Hungary for 2000–2021	https://www.ksh.hu (Gross Domestic Product (GDP) n.d.)
Flanders Investment and Trade	Hungarian logistics infrastructure data	https://www.flandersinvestmentandtrade.com (Logistics Sector in Hungary n.d.)

Our study is dedicated to specific Hungarian counties that markedly differ in their levels of economic development. Figure 1 presents a map of Hungary where the color illustrates the disparity in GDP levels across the counties as of 2020.

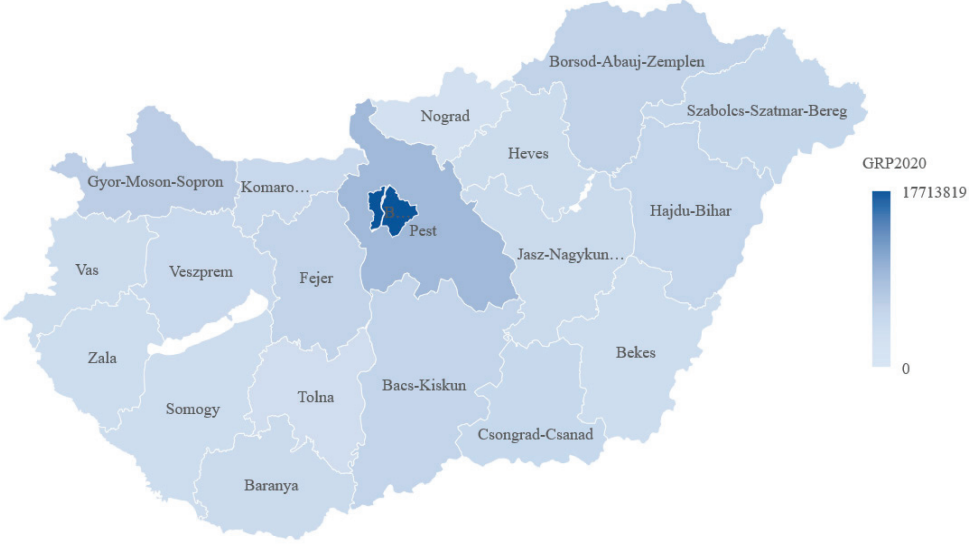

Figure 1. Differences in the GDP level of the Hungarian counties (2020) (forints).

Hungary's economy exhibits an extremely high concentration of economic activity within the capital area. Such a situation is common among many small countries and can significantly distort the influence of other factors. In this paper, we explore two key economic indicators, Gross Domestic Product (GDP) and GDP per capita, as central components of our analysis. The dataset employed in this study encompasses annual GDP values for a selection of counties spanning the years from 2000 to 2020, with each county's GDP measured in millions of forints. GDP represents the total economic output of a region and serves as a fundamental measure of economic activity. In addition to GDP, we also utilize GDP per capita, which is obtained by dividing the GDP by the population of each county. GDP per capita, in contrast to GDP, provides a more nuanced perspective by reflecting the economic output on a per-person basis, allowing for a better understanding of the standard of living and economic well-being within a region. These two indicators offer a comprehensive view of the economic dynamics within the counties under study and form the basis for our subsequent analysis. To quantify each county's economic performance, the GDP per capita growth rate from 2000 to 2020 was computed. The growth rate, denoted as GR_{i,Y_t}, was calculated using the following formula:

$$GR_{i,Y_t} = \frac{C_i - C_i(Y_{t-1})}{C_i(Y_{t-1})} \times 100$$

To assess the economic changes experienced by each county, the change in GDP per capita between 2000 and 2020 was determined. The GDP per capita change, denoted as ΔGDP_i, was computed using the following formula:

$$\Delta GDP_i = GDP_{2020,i} - GDP_{2000,i}$$

The average GDP per capita change (ΔGDP_{Avg}) across all counties and the average growth rate (GR_{Avg}) were calculated to provide a reference point for comparison. The formulas for these averages are as follows:

$$\Delta GDP_{Avg} = \frac{1}{N}\sum_{i=1}^{N}\Delta GDP_i$$

$$GR_{Avg} = \frac{GDP_{Avg,\,2020} - GDP_{Avg,2000}}{GDP_{Avg,2000}}$$

A matrix plot was generated to visually represent the relationships between growth rates and GDP per capita changes for each county. The x-axis of the matrix plot represents the growth rate, while the y-axis represents the GDP per capita change. Additionally, the average GDP per capita change and average growth rate are indicated as dashed lines on the matrix plot. An empty matrix that we use to visualize the results of calculations is shown in Figure 2.

According to our hypotheses, we assume that counties without a border, railroad, or port infrastructure will demonstrate the least GDP per capita change and the slowest economic growth. Furthermore, as we assume that both geographical position and railway or water routes have a positive influence, we expect the counties with at least two of these factors, and especially combining all three of them, to demonstrate the best results.

We expect counties like Veszprem, Vas, Heves, and Jasz-Nagykun-Szolnok to appear in zone A of the proposed matrix. Komarom-Esztergom, Gyor-Moson-Sopron, Somogy, Hajdu-Bihar, Szabolcs-Szatmar-Bereg, Bacs-Kiskun, and Csongrad-Csanad, are expected to be in zone D.

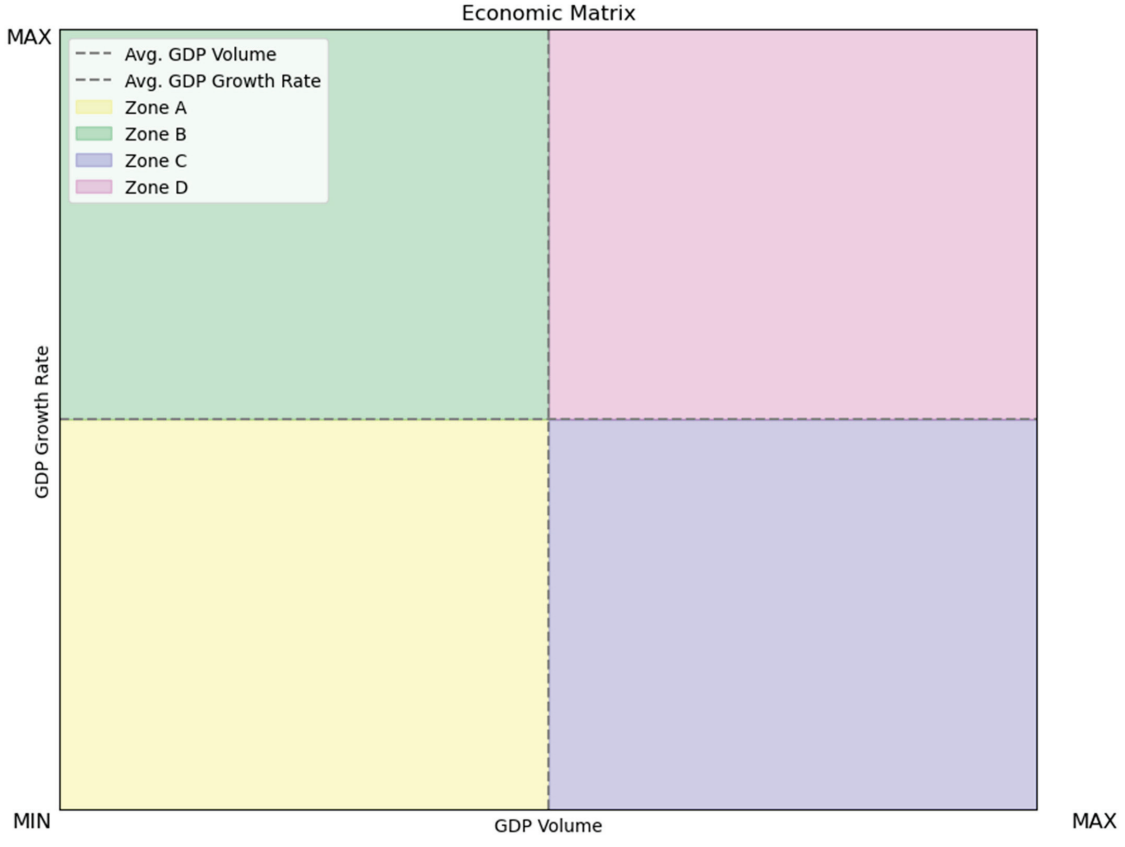

Figure 2. Empty matrix for representing results.

As the GDP per capita level varies throughout the country, the absolute change will depend on the previous year's parameters. We suppose that the growth rate is a more critical parameter as it shows future development possibilities. We assume that during the growth periods, counties with better connections to the world market will demonstrate higher growth rates. To measure it, we calculate the growth rate for each county and compare it with the total growth rate of Hungary. We assume that with 20 years of data, we should find some patterns and see that counties with better objective obstacles more frequently have a higher growth rate than the whole country. To do this, we perform several steps:

1. Calculate the average GDP per capita for all counties for each year;
2. Calculate the growth rate for each county for every year, comparing GDP per capita at the current year with the previous;
3. Calculate the average growth rate for every year, comparing the average GDP per capita at the current year with the previous;
4. Compare the growth rate of each county with the average growth rate in the same years;
5. Calculate the number of years when the county's growth rate was higher than the average growth rate in the same year;
6. Rank the counties according to the calculations.

Formally,

1. Calculate the average GDP ($AvgGDP_{Y_t}$) for year Y_t as:

$$AvgGDP_{Y_t} = \frac{1}{N}\sum_1^N C_i$$

where:
N is the total number of counties;
C_i is the GDP per capita of the county I;
Y_t is the year t, where t ranges from 2000 to 2020.

2. Calculate the growth rate (GR_{i,Y_t}) of county i for year Y_t as:

$$GR_{i,Y_t} = \frac{C_i - C_i(Y_{t-1})}{C_i(Y_{t-1})} \times 100$$

3. Calculate the total growth rate ($TotalGR_{Y_t}$) for year Y_t as:

$$TotalGR_{Y_t} = \frac{\sum_1^N (C_i - C_i(Y_{t-1}))}{\sum_1^N C_i(Y_{t-1})} \times 100$$

4. Compare the growth rate of county i with the total growth rate for year Y_t:

$$\begin{aligned} \mathrm{GR}_{i,Y_t} > \mathrm{TotalGR}_{Y_t} &: 1 \\ \mathrm{GR}_{i,Y_t} \leq \mathrm{TotalGR}_{Y_t} &: 0 \end{aligned}$$

5. Calculate the number of years ($HigherYears_i$) when the growth rate of county i was higher than the total growth rate:

$$HigherYears_i = \sum_{t=2001}^{2020} Comparison_{i,Y_t}$$

6. Rank the counties based on $HigherYears_i$, where a higher value indicates a higher rank.

We perform all the calculations using Python code.

4. Results

4.1. Characteristics of Regional Differences in the Economic Development of Hungary

Like most small European countries, Hungary exhibits a substantial concentration of economic activity in its capital region. As of the end of 2020, Hungary's GDP stood at HUF 47.9 billion, with 48% of this total, or 22.4 billion forints, stemming from the capital, Budapest, and the surrounding metropolitan area of Pest. This concentration primarily arises from the presence of head offices of Hungarian companies within the metropolitan area. The distribution of the remaining GDP significantly depends on the economic potential of non-capital counties, underscoring the importance of assessing regional economic development. To assess the impact of factors like proximity to international borders and the presence of railway and water routes on the levels and rates of economic development in Hungarian counties more accurately, we excluded the capital, Budapest, and its metropolitan area, Pest, from our calculations. Table 2 provides an overview of the analyzed regions and their assigned codes for subsequent processing. In the provided codes, "B" signifies that the region borders a neighboring country. "R" indicates the presence of significant railway connections within the region, while "P" denotes the existence of major freight river ports.

Table 2. Analyzed counties and their labels.

County	Border Region	Railroad	River Ports	Label
Fejer	False	True	False	Fej_R
Komarom-Esztergom	True	True	True	Kom_BRP
Veszprem	False	False	False	Ves
Gyor-Moson-Sopron	True	True	True	Gyo_BRP
Vas	False	False	False	Vas
Zala	True	False	False	Zal_B
Baranya	True	False	False	Bar_B
Somogy	True	True	False	Som_BR
Tolna	False	False	True	Tol_P
Borsod-Abauj-Zemplen	True	True	False	Bor_R
Heves	False	False	False	Hev
Nograd	True	False	False	Nog_B
Hajdu-Bihar	True	True	False	Haj_BR
Jasz-Nagykun-Szolnok	False	False	False	Jas
Szabolcs-Szatmar-Bereg	True	True	False	Sza_BR
Bacs-Kiskun	True	False	True	Bac_BP
Bekes	True	False	False	Bek_B
Csongrad-Csanad	True	False	True	Cso_BP

We can see from the table that some counties have multiple attributes (e.g., Komarom-Esztergom or Gyor-Moson-Sopron with all three labels), and others have none (e.g., Vas with no labels). The following subsection will illustrate the relationship between geographical characteristics, such as proximity to international borders or major railroads or ports, and critical economic development indicators.

In our study, we have explored economic indicators for individual counties in Hungary in recent years, with a specific focus on GDP per capita. Unlike the traditional GDP, GDP per capita provides a per-person measure of economic well-being and offers a more accurate reflection of the average economic conditions in a region. By utilizing GDP per capita, we gain a more nuanced understanding of regional economic disparities, which can be invaluable for policy analysis and development strategies.

Figure 3 shows the economic performance of Hungarian counties between 2000 and 2020. Throughout all the years presented, the top ranked counties in terms of economic development have been border regions focused on trade with Hungary's key partners—Austria, Germany, Romania, and Slovakia. The leading county among non-capital counties is Gyor-Moson-Sopron, located on the western border of Hungary. In 2020, the GDP of this county was HUF 2.64 billion, which was 10.55% of all non-capital counties in Hungary. This county is consistently one of the economic leaders among the non-capital counties of Hungary. The average share of this county from 2000 to 2020 was 10,39%, with the minimum indicator of 9.11% in 2005, and the maximum of 11.57% in 2016. If we use GDP per capita as an indicator, we see the same picture. In 2022, the GDP per capita in Gyor-Moson-Sopron was HUF 5617 thousand, the best result for all non-capital counties in Hungary. The average share of this county form 2000 to 2020 was 8,87%, with the minimum indicator of 8.25% in 2005, and the maximum of 9.64% in 2016.

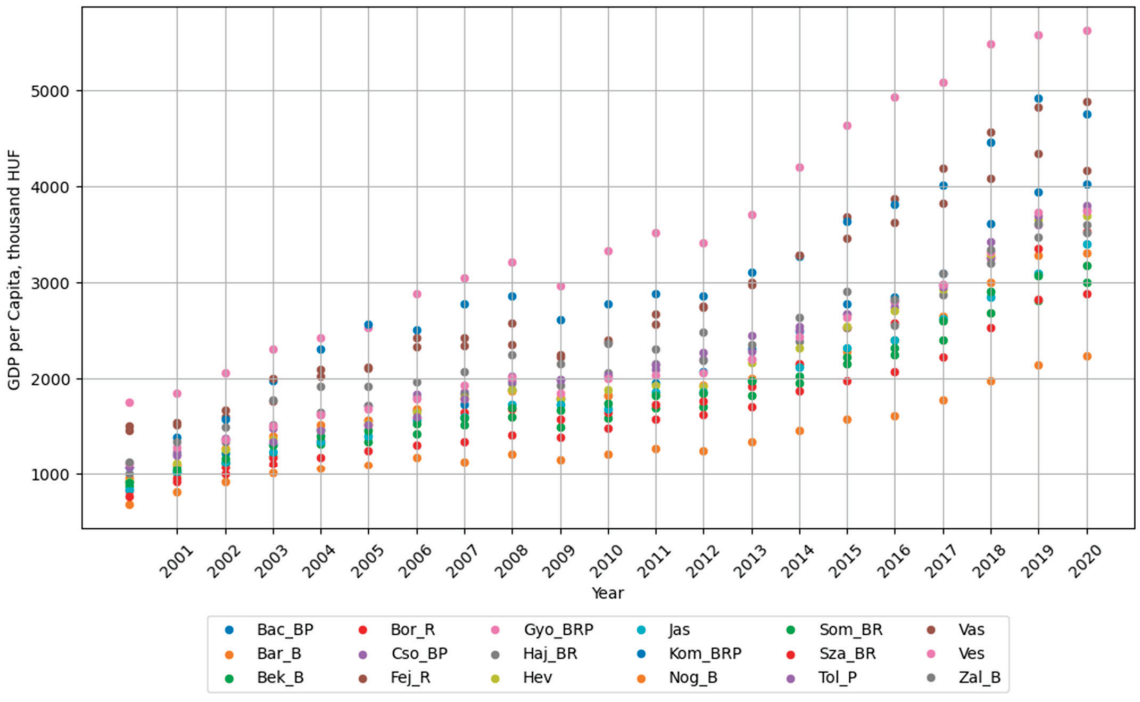

Figure 3. Economic Performance of Hungarian Counties (2000–2020). Source: Compiled by the authors based on data from the Hungarian Central Statistical Office.

In second place according to the GDP indicator for non-capital counties is Borsod-Abauj-Zemplen, located in the northwest of the country. Its share in GDP in 2020 was 4.59%. This is the average for the period 2001–2020. The share of the GDP of Borsod-Abauj-Zemplen in the Hungarian economy ranged from 4.12% in 2010 to 4.94% in 2017. Thus, the top rankings belong to two border counties oriented towards Hungary's western and northeastern foreign trade partners. However, if we use GDP per capita as an indicator, the rank of Borsod-Abauj-Zemplen is much lower. In 2022, the GDP per capita in Borsod-Abauj-Zemplen was HUF 3534 thousand, only 11th place among all non-capital regions in Hungary. We combined the average indicators of GDP and GDP per capita in 2000–2020 in Table 3.

As mentioned earlier, in our further study we will use GDP per capita as our main indicator. The level of GDP per capita in neighboring counties can differ significantly. So, for example, Vas and Veszprem counties, which neighbor Gyor-Moson-Sopron county, had the average share of all non-capital counties in Hungary in 2000–2020 equal to 6.20% and 5.58%, respectively. At the same time, Vas county, like Gyor-Moson-Sopron county, is a border region and, in terms of its geographical location, is as close as possible to Hungary's critical foreign trade partners. The neighbor county of Borsod-Abauj-Zemplen, the county of Nograd, lags behind it more noticeably. Nograd county's average share of all non-capital counties in Hungary in 2000–2020 was only 3.33%. This figure is the lowest in Hungary. We can see in Table 2 that for GDP as an indicator the differences between the counties are even larger.

Why do neighboring border counties in Hungary differ so much regarding GDP? In the case of Nograd County, its low performance can be explained by the land area of the county, which is several times smaller than the land area of Borsod-Abauj-Zemplen County. However, the counties of Vas and Veszprem are not inferior in size to those of Gyor-Moson-Sopron but are significantly behind in terms of economic indicators.

Table 3. The average indicators of GDP and GDP per capita in 2000–2020, Hungarian non-capital counties.

County	Average GDP, Millions HUF	Share	Average GDP per Capita, Thousands HUF	Share
Gyo_BRP	1,606,457	10.39%	5617	8.37%
Fej_R	1,211,227	7.84%	4885	7.28%
Kom_BRP	905,693	5.86%	4750	7.08%
Vas	709,333	4.59%	4161	6.20%
Bac_BP	1,129,583	7.31%	4019	5.99%
Cso_BP	911,593	5.90%	3805	5.67%
Tol_P	503,800	3.26%	3752	5.59%
Ves	775,825	5.02%	3740	5.58%
Hev	640,197	4.14%	3690	5.50%
Haj_BR	1,159,666	7.50%	3605	5.37%
Bor_R	1,324,959	8.57%	3534	5.27%
Zal_B	665,379	4.30%	3519	5.25%
Jas	733,397	4.74%	3404	5.07%
Bar_B	754,868	4.88%	3307	4.93%
Som_BR	595,362	3.85%	3178	4.74%
Bek_B	633,023	4.10%	2995	4.46%
Sza_BR	927,052	6.00%	2885	4.30%
Nog_B	270,438	1.75%	2237	3.33%

4.2. Calculating the Influence of Factors

We start by calculating the GDP per capita change over the past two decades. We calculate the average GDP per capita change for 18 Hungarian counties, excluding the capital region. In Figure 4, the average GDP per capita change is represented by a blue line, while the change for every county is represented by a colored dot.

As the Hungarian economy has been growing over the last two decades, we can see that the average GDP was positive each year, except for 2009. We can see on the graph that some counties are much more frequently above or under the average line. This indicates that the GDP change in these counties is either higher or lower than the average. We rank all the counties in the following table due to the number of higher years.

According to our previous labeling, we have three groups of counties. We will label them according to the Hypotheses' numbers. The first group, H1, comprises ten counties with a railroad or a port. The second group, H2, consists of 12 counties, which are border regions. The third group, H3, consists of four counties that do not have any of these factors. We can see from Table 4 that counties with multiple attributes rank higher. For example, Komarom-Esztergom and Gyor-Moson-Sopron, with all three labels, are among the highest ranked according to this parameter. On the other hand, the counties without proximity to international borders or the presence of major railroads or ports rank much lower. Also, we can conclude that only five counties experienced higher than average GDP per capita change in more than half of the years we had data for. And none of them is from the H3 group.

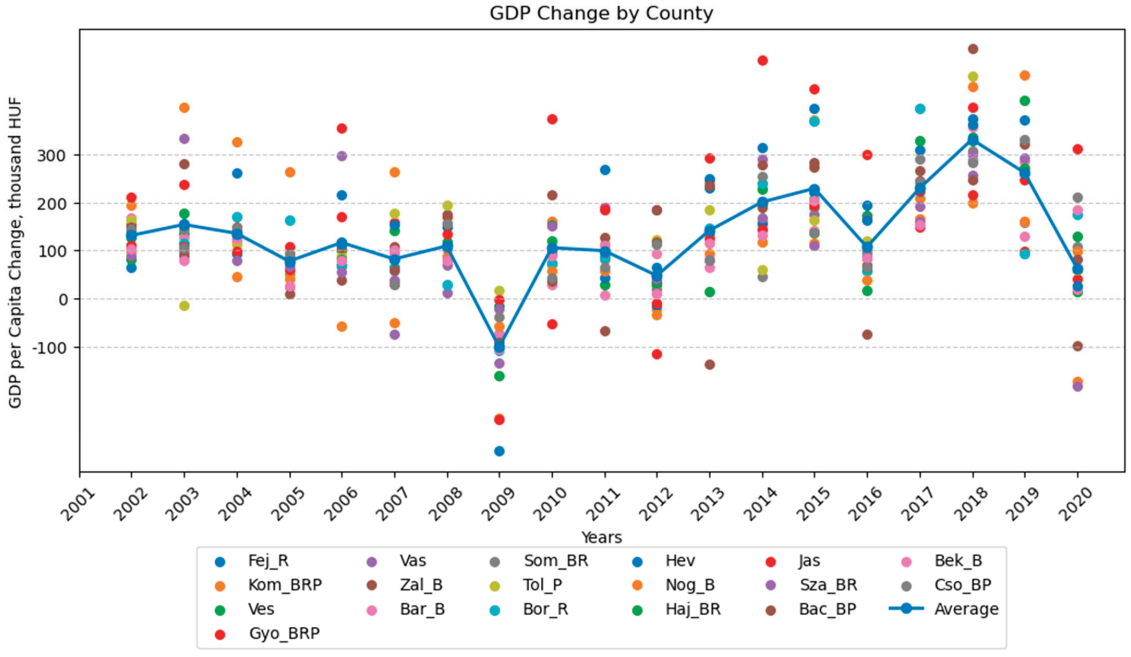

Figure 4. County-wise GDP change, 2001–2020.

Table 4. Ranking of Hungarian Counties by GDP Change Performance (2001–2020).

Rank	County	Label	Number of Higher Years
1	Fejer	Fej_R	16
2	Bacs-Kiskun	Bac_BP	13
3	Gyor-Moson-Sopron	Gyo_BRP	13
4	Komarom-Esztergom	Kom_BRP	12
5	Zala	Zal_B	12
6	Tolna	Tol_P	10
7	Csongrad-Csanad	Cso_BP	10
8	Vas	Vas	10
9	Baranya	Bar_B	8
10	Heves	Hev	8
11	Hajdu-Bihar	Haj_BR	8
12	Veszprem	Ves	7
13	Borsod-Abauj-Zemplen	Bor_R	7
14	Jasz-Nagykun-Szolnok	Jas	5
15	Somogy	Som_BR	3
16	Bekes	Bek_B	3
17	Nograd	Nog_B	2
18	Szabolcs-Szatmar-Bereg	Sza_BR	2

So, after this stage of calculations, we can confirm Hypothesis 3, as all four counties in the H3 group have a lower ranking in the table. We can also take the results of the H1 group

as a light confirmation because six of the 10 counties are among the highest ranked in the table. As for H2, the results are divided 50/50, so we cannot see any proof or refutation of these hypotheses. However, it is important to note that the GDP per capita change is measured in absolute numbers. So, the counties with higher GDP per capita in previous years will have better results in a growing economy. In such cases, whether their high ranking is solely attributable to the analyzed factors is uncertain, as it could also result from previous advantages. To deal with this problem, we decided to calculate the growth rate of all counties. We suppose that the counties that are closer to borders, and/or have ports and railroads, will demonstrate higher growth rates, as this is crucial in Hungary, a highly open economy oriented mainly toward the world market instead of the inner one. We programmed all the calculations in Python. The results are presented in Figure 5.

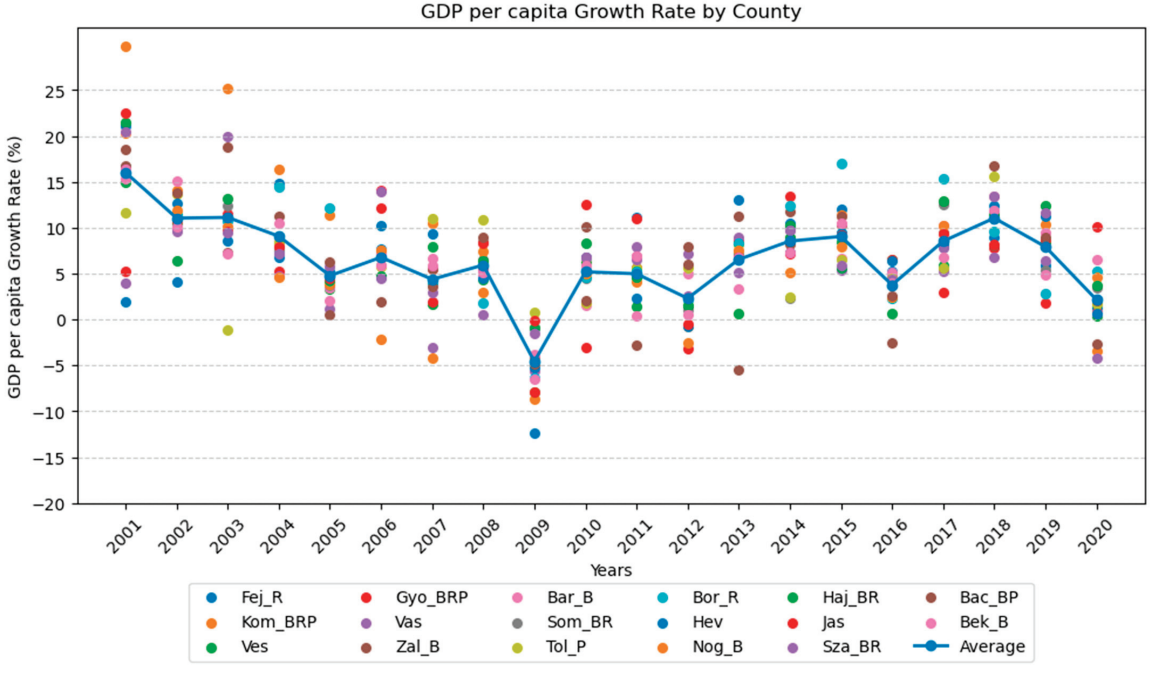

Figure 5. County-wise GDP per capita growth rate (2001–2020). Source: Compiled by the authors in Python based on data from the Hungarian Central Statistical Office.

This graph illustrates various counties' annual GDP per capita growth rates over a two-decade period, from 2001 to 2020. Each data point represents the percentage growth rate in GDP per capita for a specific county in Hungary. The counties are plotted as scattered dots, with each county represented by a different color. The line graph depicts the average GDP per capita growth rate across all counties yearly, providing insights into regional economic trends and disparities. The graph highlights the dynamic nature of economic growth, enabling viewers to compare individual county performance with the overall average throughout the years. Table 5 shows the ranking of Hungarian counties by GDP per capita growth rate performance.

Table 5. Ranking of Hungarian counties by GDP per capita growth rate performance (2001–2020).

Rank	County	Label	Number of Higher Years
1	Bacs-Kiskun	Bac_BP	11
2	Zala	Zal_B	11
3	Fejer	Fej_R	10
4	Tolna	Tol_P	10
5	Szabolcs-Szatmar-Bereg	Sza_BR	10
6	Heves	Hev	10
7	Komarom-Esztergom	Kom_BRP	10
8	Csongrad-Csanad	Cso_BP	10
9	Gyor-Moson-Sopron	Gyo_BRP	10
10	Somogy	Som_BR	9
11	Baranya	Bar_B	9
12	Nograd	Nog_B	9
13	Hajdu-Bihar	Haj_BR	9
14	Borsod-Abauj-Zemplen	Bor_R	9
15	Bekes	Bek_B	9
16	Jasz-Nagykun-Szolnok	Jas	9
17	Vas	Vas	8
18	Veszprem	Ves	7

We can see from the table that the differences between the top and bottom ranked counties are not as significant as in Table 4. Occasionally, all counties demonstrate a growth rate higher than the average. Still, we can assume that the number of these years tells us about some advantages of development opportunities.

Let us check our hypotheses once again. We can see from Table 5 that our Hypothesis 3 is the truest. All four counties without a border, port, or major railroad are in the bottom half of the table. Moreover, three of them are in the last positions. This means that most of the time, even in the growing economy, they grow with less speed. Combining this with the results from Table 4, we see that these counties lag behind the leading counties year by year, leading to increased economic differences within the country.

We can also take the results as a partial confirmation of Hypotheses 1 and 2, as the lowest result for a county with a port or railroad is nine advantaged years of 20. We can also conclude that the counties combining all three factors have the best opportunities for economic development. To finalize our calculations and visualize all the results, we prepared a Python code for the combined calculation of growth rate and GDP per capita change. We printed a matrix demonstrating the top and bottom ranked of the non-capital Hungarian counties (Figure 6).

According to the matrix, the 18 counties are divided into four zones. There are six counties in zone A, which means that these counties demonstrate both a growth rate and GDP per capita change worse than the average. Among these counties, there are Veszprem, Zala, Baranya, Somogy, Bekes, and Nograd. There are four counties in zone B, which means that they have higher than average volumes of GDP per capita change but lower than average growth rates. Among these counties, we can see Gyor-Moson-Sopron, Fejer, Vas, and Tolna. Three counties with higher growth rates and lower GDP per capita change are presented in zone C. Those are Hajdu-Bihar, Jasz-Nagykun-Szolnok, and Szabolcs-Szatmar-Bereg. Finally, five counties in zone D are among the top ranked, both by growth rate and GDP per capita change. These counties are Komarom-Esztergom, Bacs-Kiskun, Csongrad-Csanad, Heves, and Borsod-Abauj-Zemplen.

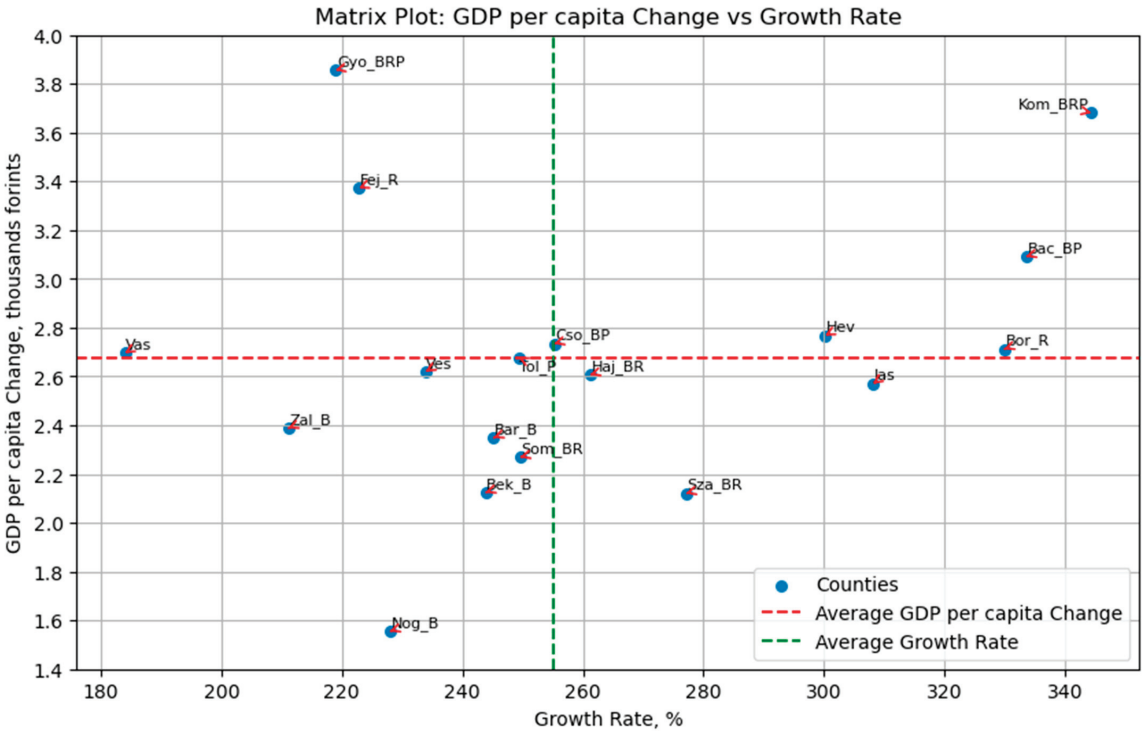

Figure 6. GDP per capita change and growth rate matrix for non-capital Hungarian counties (2000–2020).

We use the matrix to check our hypotheses once again. Hypotheses 1 is not proved, as we can see border counties in all four zones of the matrix. Zala and Nograd, despite their positions close to borders, demonstrate worse results both in growth rate and GPD per capita change. On the other hand, two leading counties are also close to borders—Borsod-Abauj-Zemplen in the northeast and Komarom-Esztergom in the northwest. We can draw the conclusion that closeness to a border can be a solo factor influencing the county's economic development.

There are ten counties which have major ports and/or railroads. Only one of these counties is located in zone A. In zone D four of the five counties are from the H2 group. We can see in the matrix that the absolute majority of H2 counties outperform the average indicators. So, we can assume the Hypothesis 2 is proved. We can also draw an additional conclusion that combining closeness to borders, ports, and railroad infrastructure, as can be seen in Gyor-Moson-Sopron or Komarom-Esztergom, allows a county to achieve the best results.

As for Hypothesis 3, we can draw a conclusion that the absence of a major port and railroad infrastructure, as well as an inner geographical position, is not really crucial in the case of such a small country like Hungary. Although three of the four H3 counties have lower than average results for growth rate and GDP per capita change indicators, one of them, Heves, is present in zone D of the matrix. The growth potential can be based on other factors not explored in our research. Yet, we can say that the absence of all three factors makes rapid economic development more difficult. To check our conclusions, we prepared a Python code for the same calculation for the GDP indicator. The matrix is shown in Figure 7.

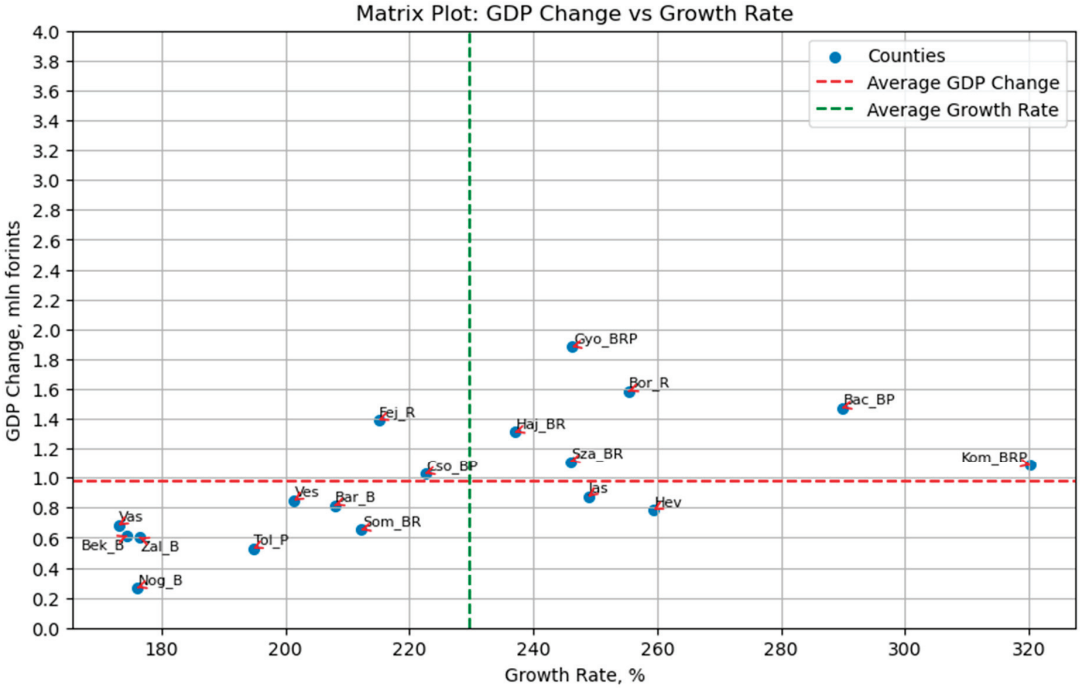

Figure 7. GDP change and growth rate matrix for non-capital Hungarian counties (2000–2020). Source: Compiled by the authors in Python based on data from the Hungarian Central Statistical Office.

The lag of the regions of group H3 when calculated by GDP is much more noticeable, as is the ranking of the counties in which all three factors are represented. We can see that eight of all non-capital counties have lower than average GDP change and lower than average growth rates. These low ranked counties, year by year, have weakened economic positions compared with the rest of the country. We can see that seven of these counties have only one or zero of the factors we evaluate. On the other hand, six counties have higher than average GDP change and higher than average growth rates. And five of these counties have at least two of the evaluated factors. Moreover, both counties with all three factors are ranked top: Komarom-Esztergom has the highest growth rate, and Gyor-Moson-Sopron has the highest GDP change.

Using GDP as an indicator makes our previous conclusions more obvious. We can draw a conclusion that the presence of at least two of the evaluated factors significantly influences the county's development potential. As a result, we see that the differences in the economic potential of individual counties are only increasing each year. Using GDP per capita as a key indicator slightly reduces the level of difference, but does not reverse the overall trend. However, the value of proximity to borders turns out to be less than expected, and the availability of a developed transport infrastructure suitable for large volumes of cargo transportation is of paramount importance.

5. Discussion

In our comprehensive analysis of Hungary's regional economic disparities spanning two decades, from 2001 to 2020, we focused on proximity to international borders and the presence of major railroads and ports as critical determinants of economic trajectories.

We shed light on the significant influence of geographical factors on economic growth at the county level. Specifically, our study focused on proximity to international borders

and the presence of major railroads and ports as critical determinants of economic trajectories. The factors that we chose for our analyses are parts of major research objects, which are among the topics of interest for many researchers. Gallup et al. delve into the relationship between geographical factors and economic development and provide insights into how spatial characteristics influence industrial performance and economic activity (Gallup et al. 1999). Nordhaus discusses the often overlooked role of geographic factors in macroeconomics and growth economics. It highlights aspects like climate, proximity to water, and soil quality as influential factors in economic development (Nordhaus 2006). The methodology presented in our article for analyzing the influence of individual factors on absolute and relative changes in key economic indicators can also be applied to analyzing the above-mentioned geographical factors.

Our investigation into the economic dynamics of Hungary offers insights that can be of interest to researchers across European countries. Rasvanis and Tselios, for instance, delve into the intersection of geography and institutional factors impacting entrepreneurial activities, shedding light on how these elements affect business prospects and economic growth in Greece (Rasvanis and Tselios 2023). Basboga's exploration of border openness and cross-border cooperation's impact on regional growth in European regions underscores the role of cross-border activities in fostering economic development (Basboga 2020). Neuberger et al. have scrutinized the relationship between regional innovativeness and location factors, including proximity to borders (Neuberger et al. 2021). While our study confirms the importance of border proximity, it also emphasizes that it cannot be the sole determinant.

Similarly, Ferrari et al.'s focus on port activities in European regions highlights the pivotal role of ports in local development (Ferrari et al. 2012). Additionally, Bottasso et al.'s analysis of port activities on local development across European countries suggests that ports have non-negligible effects on local GDP (Bottasso et al. 2014). Our research reaffirms the positive impact of port infrastructure on local economic development. We find that these geographical advantages significantly influence economic growth, with counties lacking these advantages consistently experiencing slower economic expansion, thus exacerbating regional disparities. Our findings align with those of scholars like Lugovoy et al. (2007) and Chen and Hall (2011), who have observed similar trends in various regions.

Future research should aim to delve deeper into the intricate interactions between geographical factors and other socioeconomic variables to enhance our understanding of this multifaceted topic. Moreover, investigating policy interventions and institutional development, as suggested by Rodrik et al. (2004), can play a vital role in mitigating regional economic disparities, not only in Hungary but also in regions confronting similar challenges.

6. Conclusions

In our detailed examination of economic performance across Hungarian counties over the past two decades, we focused on three critical factors: proximity to international borders, significant ports, and major railway junctions. Utilizing GDP per capita as our principal indicator, we discerned a complex narrative of regional disparities and growth opportunities within Hungary. Our study reaffirms the complexity of these three factors in influencing economic growth. Counties without the advantage of border proximity, significant ports, or major railway junctions, such as Jasz-Nagykun-Szolnok, Vas, and Veszprem, consistently exhibit slower economic growth. This reaffirms that the absence of these specific advantages poses substantial challenges in fostering economic development, causing these regions to fall below national average development indicator levels frequently. To enhance our analysis and present our findings more effectively, we employed Python coding to create a matrix, categorizing counties based on their economic performance. This methodological approach allowed for an in-depth validation of our hypotheses and a nuanced understanding of the multifaceted economic landscape in Hungary.

Our findings also provide a nuanced view of the effects of border proximity on economic performance. While Hypothesis 1, focusing on border proximity, is not universally confirmed—with border counties present in all four matrix zones—it is clear that this factor alone does not guarantee superior economic outcomes. Notably, while Zala and Nograd are close to borders, they underperform in both growth rate and GDP per capita change. However, border proximity does contribute significantly to the success of top ranked counties like Borsod-Abauj-Zemplen and Komarom-Esztergom, suggesting that while border closeness is not a standalone factor, it can contribute positively in certain contexts.

Regarding the presence of significant ports and railway junctions, our analysis confirms Hypothesis 2. The majority of counties benefiting from these infrastructures outperform average economic indicators. Specifically, four out of five counties with the highest performance in both growth rate and GDP per capita change possess these logistical advantages. Our data suggests that these factors, especially when combined with border proximity, as seen in counties like Gyor-Moson-Sopron and Komarom-Esztergom, create the most conducive conditions for economic prosperity. For Hypothesis 3, our results indicate that while the absence of significant ports and railway infrastructure, coupled with an inland position, generally correlates with lower economic performance, it is not definitively detrimental in Hungary's context. An example is Heves county, which exhibits high performance despite lacking these three factors. This suggests that other unexplored factors may also significantly influence economic growth.

In conclusion, our research highlights the intricate interplay between border proximity, ports, and railway junctions in regional economic performance in Hungary. While the absence of these factors can impede growth, their presence—especially in combination—offers substantial economic opportunities. Understanding these regional disparities is vital for stakeholders and policymakers committed to fostering balanced growth and national prosperity. It is also clear that further research might uncover additional factors that contribute to the economic vitality of Hungary's counties, providing a more comprehensive picture of development drivers.

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Article

Revitalizing from Ashes: Economic Development and Business Resilience in the City of Vukovar

Jakša Puljiz, Marina Funduk and Ivana Biondić *

Institute for Development and International Relations, 10000 Zagreb, Croatia; jpuljiz@irmo.hr (J.P.); marina@irmo.hr (M.F.)
* Correspondence: ibiondic@irmo.hr

Abstract: The paper examines a paradigmatic example of post-conflict economic development of Vukovar, Croatia. It represents a pertinent case study for localities encountering analogous challenges, most notably urban areas in Ukraine in the near future. The war that broke out in 1991 brought significant human casualties, population displacement, and extensive destruction of residential, social, and economic infrastructure. The completion of the peaceful reintegration of Vukovar into Croatia's legal system in 1998 marked the beginning of the socio-economic revitalization process. The research scrutinizes the primary impediments and prospects for Vukovar's economic growth, probing why substantial investments in reconstructing housing, transport, communal infrastructure, and fiscal incentives for businesses have not paralleled its economic performance. It concentrates on the local business climate and influential factors as potential explanations for this discrepancy. The topic was designed as a case study and was covered by document analysis, survey method, and semi-structured interviews. Utilizing a mixed-methods approach, the study collates perspectives from entrepreneurs and business support institutions. The results confirmed that reconstruction of housing and social infrastructure is necessary, but more conditions are needed for successful post-conflict economic development, and that the business climate in lagging local units highly depends on state- and locally designed business-support measures.

Keywords: local economic development; post-conflict reconstruction; regional development; City of Vukovar; entrepreneurs

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1. Introduction

Cities such as Vukovar are poignant symbols of resilience and the arduous path toward recovery in the aftermath of conflict. The City of Vukovar has undergone two simultaneous transitions in the post-1990 period. One refers to the typical transition of the political and economic systems for the ex-communist countries in Central and Eastern Europe. The other refers to post-conflict recovery after a war broke out in 1991 that destroyed the city's social and economic fabric. Such a "double transition" experience makes it an interesting case for Ukrainian cities seeking sustainable growth and prosperity once the war destructions are over. The case of Vukovar shows that return to prosperity can be challenging, depicting it as an ongoing process that continues to evolve even after three decades. From being praised as one of the most developed cities before 1991, Vukovar is today categorized as one of Croatia's less developed local units. Albeit slow, the city's progress is evident, as the study results will show. However, given the substantial amount of funding invested into post-conflict reconstruction, our research question arises: What factors impeded the City of Vukovar from achieving a more successful return to prosperity, and what were the primary constraints contributing to this outcome?

To answer this question, the paper examines the state of the economy in Vukovar and the factors influencing its post-conflict development. The study relies heavily on the position of entrepreneurs as key actors and pivotal contributors to local growth and

development (Lichtenstein and Lyons 2001; Audretsch and Keilbach 2005; Fritsch and Mueller 2008).

Consequently, our paper's main aim is to investigate the attitudes and opinions of entrepreneurs and entrepreneurial support institutions about the entrepreneurial environment and critical obstacles to more dynamic growth. It mainly considers the views of small and medium-sized entrepreneurs as the primary beneficiaries of various support measures. The study also questions the role of local authorities in promoting entrepreneurship in Vukovar. Previous analyses have affirmed that local authorities represent essential stakeholders in establishing a favorable business climate and supporting entrepreneurs (for example, Olsson et al. 2015; Olsson et al. 2020; Thekiso 2016). With that in mind, two hypotheses were identified and tested in this study:

Hypothesis 1 (H1). *Reconstruction of housing and social infrastructure is necessary, but more conditions are needed for successful post-conflict economic development.*

Hypothesis 2 (H2). *The business climate in lagging local units highly depends on state- and locally designed business-support measures.*

The structure of the paper unfolds as follows. It commences with a literature review and a short exploration of Croatia's main strategic acts and documents pertinent to developing the City of Vukovar. Following this, the methodology is presented, providing an account of the research methods employed. The paper's focal point lies in presenting the results derived from the online survey and semi-structured interviews, with the conclusive section dedicated to a thorough discussion of the analysis findings and the presentation of the key insights gleaned from the study.

2. Literature Review

2.1. Economic Transition and Regional Development in South-East Europe

To understand the current economic development of Vukovar, it is necessary to take a more comprehensive look at the transition process that ex-communist countries have undergone since 1990. The transition from a socialist system to capitalism in Eastern Europe was a complex and multifaceted process, characterized by a substantial initial decline in output, followed by deindustrialization and a rapid expansion of the service sector (Williamson 1993; Fisher and Sahay 2000; Lynn 2001). After several years, economic recovery ensued, buoyed by favorable geographic positioning, the availability of educated human resources, and substantial inflows of foreign direct investment (FDI). Hanzl-Weiss and Jovanović (2022) estimate that between 1993 and 2020, the average annual FDI inflow in Central, East, and South-East Europe constituted 4.4 percent of GDP, facilitating convergence with the EU average in terms of GDP per capita.

Despite sharing numerous commonalities, significant differences soon became evident among the former communist countries in Europe. Generally, countries in South-East Europe (SEE), including Croatia, lagged behind those in Central and Eastern Europe (CEE) in terms of the speed of economic recovery, structural change, and sectoral specialization during the first transition decade (Petrakos et al. 2002). The collapse of the socialist industrial base was more pronounced in SEE, mainly due to the dissolution of Yugoslavia and ensuing conflicts that impacted the entire region (Bartlett 2014). Moreover, SEE's privatization process was slower than that of CEE countries and the Baltic states. Persistent issues with corruption and weak institutions in SEE remained significant hurdles despite partial improvements attributable to the European integration process (Jurlin and Čučković 2010).

A salient aspect of the transition process was the exacerbation of regional disparities during the first transition decade (Petrakos and Totev 2008; Resmini 2002). Empirical studies indicate that post-1990 economic growth was spatially selective, favoring metropolitan and western regions, thereby intensifying pre-existing disparities (Fazekas 1996; Nemes-Nagy 2000; Bachtler et al. 2001; Romisch 2003; Petrakos et al. 2005). Regions heavily industrialized

during socialist times experienced the most severe declines, mainly due to the inability to restructure unproductive state-owned enterprises effectively in the early transition years (Bachtler et al. 2001; Ivanička and Ivanička 2007). Crisis management efforts related to the industrial restructuring of regions overly reliant on traditional industries were less successful than in more prosperous regions (Szalavetz 2003). This problem was closely linked to the significant social costs during rapid industry failures.

Croatia's political and economic transition occurred under turbulent circumstances following the dissolution of Yugoslavia and was compounded by the war environment that persisted until 1995 (Stojčić 2012). The disruption of transport links and loss of the Yugoslav market led to Croatia experiencing one of the most severe GDP declines among SEE countries in the early transition years (Vidovic and Gligorov 2006). By 1994, macroeconomic conditions had improved, primarily due to a successful anti-inflationary program and exchange rate stabilization, creating a more conducive environment for necessary economic reforms. However, the outcomes of these reforms, particularly in terms of the effects of the privatization process, were disappointing (Rohatinski and Vojnić 1996; Franičević 1999; Bendeković 2000). The decline in competitiveness of traditional industries in Croatia was prolonged, while the emergence of new industries was inadequate (Stojčić and Aralica 2018). The slow and inefficient industrial transformation was linked to deficiencies in the evolution of national industrial policy, which lacked elements of modern vertical industrial policy (Bartlett 2014). Post-conflict reconstruction posed an additional developmental and policy challenge, necessitating significant financial and other resources, particularly in the first decade after independence. Official estimates in 1998 prices put the total direct material and non-material war damages for Croatia at USD 37 billion, equivalent to 142 percent of Croatia's 1998 GDP. Indirect damages, such as production losses due to destroyed factories and facilities, were not accounted for, suggesting that total damages were substantially higher than estimated (State Commission 1999).

Croatia's regional development landscape is marked by the advantageous position of the City of Zagreb metropolitan region and some coastal counties where tourism is a critical economic activity. Conversely, lagging counties, predominantly in the Eastern region of Slavonia and Baranja, are characterized by a significant agricultural output share, a weak export base, lower education levels, and sustained outmigration (Đokić et al. 2016; Bačić and Aralica 2017). Regional competitiveness indicators for 2007 and 2010 identified this region as the least competitive, requiring concentrated long-term efforts to catch up with the rest of the country (Čučković et al. 2013). It is crucial to notice that this region was heavily impacted by the consequences of the Homeland War (1991–1995), with the City of Vukovar experiencing particularly severe destruction.

Even though more than thirty years have passed since the dissolution of Yugoslavia, specific studies on post-conflict economic recovery are rare. Bateman (2000) emphasizes the slow development of policies intended to promote small and medium enterprises in all ex-Yugoslav republics during the 1990s. He notes that "one-size-fits-all" neo-liberal policy interventions introduced in other post-communist economies were transferred to South-East Europe, slowing down the development of SMEs and the post-conflict recovery process. In their study of the role of the SME sector in the post-conflict economic recovery of Croatian counties, Maleković et al. (1998) advocate that support for small enterprises must be tied more closely to other development, reconstruction, and rehabilitation programs underway. They also see SMEs as an engine for local economic development and a tool to boost post-conflict and post-communist transition in lagging regions. Bartlett et al. (1996) point to the problem of the industrial base's collapse and the displaced's unwillingness to return as important obstacles for regions most affected by the conflict.

2.2. Pre- and Post-1991 Development Context of the City of Vukovar

The City of Vukovar, located in the easternmost part of Croatia along the Danube River, was classified as a middle-sized urban area in 1991, with a population of 46,735. It was known for its heavy industrialization, hosting Borovo, the largest shoe-making

company in Yugoslavia, and its rich cultural heritage, including a baroque-style city center (Karač 2004). The 1991 conflict brought immense human losses and physical devastation to Vukovar and its surrounding areas. The Vukovar-Srijem County, with Vukovar as its capital, accounted for 17.8 percent of total war damages, significantly exceeding its population share of 4.8 percent in 1991. Vukovar experienced material damage per capita, eleven times higher than the national average. The city's transport, utility, and energy infrastructure suffered extensive damage. Additionally, significant damage was inflicted on economic facilities in Vukovar, with Borovo and Vupik enduring the highest direct damages among all Croatian companies (Institute for Development and International Relations 2018).

From 1991 until the conclusion of the peaceful reintegration process in 1998, facilitated by the UN mandate (UNTAES mission), Vukovar remained outside of the control of the Croatian government. The 1998 reintegration marked the commencement of the reconstruction phase, with the city formally reintegrating into the Croatian legal system. Despite successful efforts in housing reconstruction and substantial investments in transport, utility, and energy infrastructure, the return of the displaced population saw only partial success. The return rate stood at 57.1 percent, falling below the county average of 71.1 percent (Živić 2012). Census data disclosed a notable decline in the population, reaching 30,126 in 2001 and continuing to decrease over the subsequent two decades, settling at 22,255 in 2021. This figure represents less than 50 percent of its pre-conflict size, underscoring the enduring demographic impact of the conflict.

In response, the central government designed a range of instruments to stimulate economic development, many of which remain in force. However, economic redevelopment proved to be an exceptionally challenging task. Economic growth was hampered by various challenges faced by local companies, such as market loss, outdated technology, employee excess, reduced property value, lack of credit support from commercial banks, unresolved ownership issues, slow privatization, delayed reconstruction of supporting infrastructure (especially in transport), a slow demining process, and the loss of a highly educated population (Faculty of Economics University of Split 2008). One of the most visible changes in Vukovar and other heavily industrialized Croatian cities is the employment structure, now dominated by small and medium enterprises (SMEs). The transformation is exemplified by Borovo, which, before 1991, employed around 23,000 employees, with approximately 16,000 in Vukovar and nearby municipalities. In contrast, in 2022, the same company employed only about 600 employees, according to data from the Financial Agency.

2.3. Policy Instruments Related to Economic Redevelopment of Vukovar

In 1996, the Croatian parliament passed two laws to foster post-conflict reconstruction, economic development, and return of the displaced people: the Act on Areas of Special State Concern (LASSC) and the Act on Reconstruction (LAR). LASSC contained many measures to encourage the return of local units' population, economic development, and fiscal capacity, which were therefore granted the status of Areas of Special State Concern. Most important were various tax concessions for businesses (profit tax and health and insurance contributions) and physical persons (income tax) (OG 44/199 (The Official Gazette 1996a)). LAR provided various measures for reconstructing and constructing damaged housing units (OG 24/1996 (The Official Gazette 1996b)). Both laws applied to Vukovar. In order to additionally stimulate and speed up post-conflict recovery in Vukovar, the Croatian Parliament passed the 2001 Act on Reconstruction and Development of the City of Vukovar, initially in 2001 (OG 44/01 (The Official Gazette 2001a)). Based on this Act, a new institution has been founded—Fund for Reconstruction and Development of the City of Vukovar (FRDV)—to provide additional funding for public and private development projects contributing to the city's economic and demographic revitalization. The fund's operations were based on the multiannual work program specifying the main obstacles for the city and the Fund's priorities. Investment areas covered by the Fund were initially quite diverse and included housing, communal infrastructure, transport, social infrastructure, cultural heritage, economic development, demining, human resources, spatial planning,

and cadastre. Several incentive measures were stipulated in other legal acts and programs, such as soft loans for entrepreneurs provided by the Croatian Bank for Development and Reconstruction (HBOR) or loan guarantees provided by the Croatian Agency for SMEs (HAMAG-BICRO).

According to the analysis of state measures for incentivizing the development of Vukovar prepared in 2008, between 1998 and 2007, over EUR 200 million were invested in the reconstruction of the housing stock (Faculty of Economics University of Split 2008). By 2014, the reconstruction of the housing stock had been nearly completed, covering over 95 percent of destroyed and damaged housing units (Fund for Reconstruction and Development of the City of Vukovar 2014). Along with the housing stock reconstruction, the central state invested heavily in the reconstruction of the physical infrastructure. Data from FRDV show that between 2009 and 2013, the value of realized investments into physical infrastructure was approximately EUR 23 million yearly. This was approximately four times the total value of the city budget at that time, indicating a very strong level of state support. Investments were mainly realized in social infrastructure (schools, museums, etc.) and local communal infrastructure (utilities, local roads, etc.), accounting for over 90 percent of total investments.

On the other hand, support for business development was relatively marginal, amounting to EUR 1.4 million annually (Fund for Reconstruction and Development of the City of Vukovar 2014). Equally important, the level of individual grant support for entrepreneurs was relatively modest, ranging between ten and twenty thousand euros. Support was mainly intended for the purchase of capital equipment and improvements of business facilities. A more recent report covering the period 2015–2022 shows that annual grant support for entrepreneurship has been reduced to EUR 480 thousand (Fund for Reconstruction and Development of the City of Vukovar 2022). On the other hand, the Fund's total budget has increased, meaning that the share of the Fund's support for entrepreneurship in its total activities has gradually declined.

Another wave of support that followed Croatia's accession to the EU was related to EU funding. For the period 2016–2023, Vukovar was entitled to EUR 20 million worth of investment in the program called the Intervention Plan. The plan was prepared under the guidance of the Ministry of Regional Development and EU funds and backed by the EU Cohesion policy funds. It envisaged support for implementing larger infrastructure projects, whose value was mainly over EUR 2 million and mainly in education, sport, and recreation (The City of Vukovar 2017). For the period 2021–2027, the city and five neighboring municipalities have prepared an Urban Development Strategy (The City of Vukovar 2023). The document provides a strategic framework for various investments, mainly into social infrastructure and transport, and opens the possibility of accessing EUR 18 million from the EU European Regional Development Fund to realize projects until 2030. This first strategic document directly promoted inter-municipal cooperation in strategic planning and project preparation.

To additionally support local entrepreneurs, from 2015 onwards, the city has prepared its yearly program for the development of entrepreneurship. The program usually encompasses a relatively high number of measures designed to support the various needs of entrepreneurs, from opening the business to increasing employment, purchasing equipment, developing skills, etc. Compared to the support provided by FRDV, this program has a smaller total budget and a smaller individual grant size, ranging mainly between three and six thousand euros (Institute for Development and International Relations 2019).

It is important to note that state support for Vukovar has been quite early based on the strategic documents referring to city development. From its establishment, FRDV based its activity on multiannual planning documents called Plan and Program for Reconstruction and Development of Vukovar. These documents were adopted for 2004–2008, 2009–2013, and 2014–2020. On the other hand, the City of Vukovar adopted its first development strategy only in 2010, while more effort in strategic planning by city authorities was realized after Croatia acceded to the EU. In entrepreneurship, the most important is the Economic

Development Strategy for the City of Vukovar 2021–2031 2022, which was adopted in 2021. The Strategy identified four strategic goals: (1) increasing the number of employees of entrepreneurs based in the City of Vukovar to 7.000; (2) increasing the average salary in entrepreneurship to 100 percent of the national average; (3) increasing the export value of micro, small and medium-sized enterprises by at least 150 percent compared to 2020; and (4) tripling of the annual value of entrepreneurs' investments in fixed assets compared to 2020 (Economic Development Strategy for the City of Vukovar 2021–2031 2022). However, unlike the Intervention plan and Urban development strategy, this document needs backing in specific and additional financial sources for the city. However, it relies on already secured financial means from national and local sources.

Table 1 summarizes the most important milestones in the case of support measures for the City of Vukovar.

Table 1. Key milestones in design of support measures for the City of Vukovar.

Year	Main Acts and Strategic Documents	Coordinating Body	Main Support Measures
1996	Act on Reconstruction (OG 24/1996)—The Official Gazette (1996b)	Central state body in charge of reconstruction process	Housing reconstruction
1996	Act on Areas of Special State Concern (OG 44/1996)—The Official Gazette (1996a)	Central state body in charge of regional development	Other types of housing care for displaced population Tax reliefs for businesses Tax allowances for individuals
2001	Act on Reconstruction and Development of the City of Vukovar (OG 148/13)—The Official Gazette (2001b)	Central state body in charge of regional development/Fund for Reconstruction and Development of the City of Vukovar	Tax reliefs for businesses Tax allowances for individuals
2002	Plan and program for reconstruction and development of Vukovar (Fund for Reconstruction and Development of the City of Vukovar 2002)	Central state body in charge of regional development/Fund for Reconstruction and Development of the City of Vukovar	Investments into social and communal infrastructure (from large to small) Small grants for business development
2017	Intervention plan of the City of Vukovar (2016–2023) (The City of Vukovar 2017)	Ministry of Regional Development and EU funds/City of Vukovar	Large investments into educational, sport, and communal infrastructure. Grants for business development
2015	City's program for support of entrepreneurship (on yearly basis)	City of Vukovar	Small grants for entrepreneurs
2023	Urban development strategy 2021-2027 (The City of Vukovar 2023)	Ministry of Regional Development and EU funds/City of Vukovar	Large investments into cultural heritage, urban mobility, city transport, sport and social infrastructure

Source: Authors' elaboration.

3. Methodology

The research topic was designed as a case study, aligning with Yin's (2014) methodology. The primary methods for gathering and processing information included document analysis, survey, and semi-structured interviews.

Data on the City of Vukovar was collected after examining the relevant academic and policy literature. Secondary data was mainly collected from the Croatian Bureau of Statistics, the Ministry of Regional Development and EU funds, and the Financial Agency (which collects yearly financial reports on Croatia's business entities). Then, to gain further insights into the state of entrepreneurship in the city, the opinions and attitudes of entrepreneurs were examined through an online survey. A structured questionnaire was

prepared containing questions regarding the business climate in Vukovar, the collaboration between entrepreneurs and the local government, key issues, and essential economic needs. One hundred two entrepreneurs completed the survey and responded to the questionnaire. Informed consent was obtained from all participants, and their identities remained anonymous throughout the study.

A mixed-methods approach was used to analyze the data from the survey. Several considerations guided the decision to use a mixed-methods approach and integrate quantitative and qualitative data. The survey responses of entrepreneurs supplemented quantitative data from the business registers and the Croatian Bureau of Statistics, while semi-structured interviews with entrepreneurs and other local stakeholders provided qualitative data. The use of multiple methods allowed for validation through data triangulation. Findings from one method could be cross-verified or complemented by findings from another, enhancing the robustness of the study's outcomes. Quantitative data added a layer of precision to the research, enhancing the ability to draw meaningful insights and contribute to a more thorough comprehension of the subject matter. In contrast, qualitative data were vital for confirming and explaining these patterns by examining individual responses and narratives. Moreover, qualitative data, particularly from open-ended questionnaire responses, provided an additional contextual layer to interpreting quantitative results.

Individual interviews were conducted through in-depth discussions with twenty entrepreneurs operating in Vukovar in November 2021. Interviewees were selected based on the criteria that their headquarters is registered in the City of Vukovar, that they have operated longer than five years, and that they are sectorally balanced (most were from manufacturing, followed by various service sectors). The interviews were mainly achieved through face-to-face meetings, while two were conducted via phone conversations due to the inability of selected entrepreneurs to attend in person. Entrepreneurs had the opportunity to provide comments and opinions through a structured conversation based on prepared and pre-distributed questions, and a high-quality discussion unfolded beyond the formal scope of the questions. Interviews were also conducted with representatives of entrepreneurial associations: the Croatian Chamber of Economy—Vukovar Branch and the Croatian Chamber of Crafts—Craftsmen Association of the City of Vukovar. Four extra interviews were conducted with representatives of the Vukovar Development Agency—VURA, the Fund for the Reconstruction and Development of the City of Vukovar, the University of Applied Sciences "Lavoslav Ružička" in Vukovar (Polytechnic Vukovar), and the Branch Office of the Croatian Employment Service in Vukovar throughout December 2021 and January 2022. All respondents from business support institutions and education had a long work history and extensive knowledge of the city. In total, 26 interviews were conducted with stakeholders involved in the local labor market.

4. Results

4.1. State of Local Socio-Economic Development

As previously explained, the conflict significantly impacted the local economy in Vukovar. Since the end of reintegration in 1998, economic activities have also started to recover. However, reaching the pre-conflict level in some aspects, such as employment level, turned out to be non-achievable, directly related to the unsuccessful return process of the displaced population and substantial outmigration in the post-conflict period.

Figure 1 illustrates the evolution of the employed population relative to the total population in Croatia and Vukovar from 1988 to 2021. By the year 2021, the employment-to-population 20–59 years ratio in Croatia had not only recuperated but exceeded its pre-conflict levels. In contrast, the City of Vukovar exhibited a markedly different trend, with its ratio only slightly surpassing pre-conflict figures. Examination of the absolute employment figures underscores the extent of the devastation the workplaces experienced. In Vukovar, the employee count plummeted from over 30,000 in 1988 to less than 10,000 in 2015, representing approximately a two-thirds decline. Since 2016, employment figures have steadily increased to around 12,600 in 2021 but are still significantly lower than in 1988.

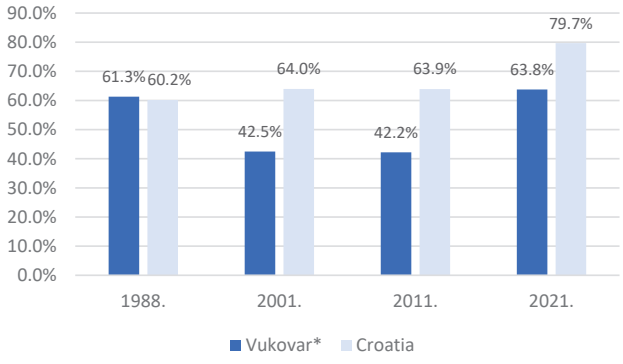

Figure 1. Ratio of employed people relative to population 20–59 years. Source: Authors' calculation based on data from Croatian Bureau for Statistics (Croatian Bureau of Statistics Database n.d.). For 1988, only employment data were collected, while data on population 20–59 were based on population census figures from 1991. * Estimates for Vukovar are made based on the territorial borders of the city from 1988 in order to ensure sound comparison between 1988 and other years.

The employment record demonstrates that post-conflict economic recovery in the case of Vukovar is a highly challenging process and that the enormous investments into reconstruction have not led to desired economic outcomes, at least in terms of employment.

One of the explanations for the unsatisfactory employment level, even twenty years since the beginning of the reconstruction process, is a lack of investors, especially foreign ones. Derado et al. (2011) confirm a positive relationship between the economic performance of Croatia's regions and the amount of inward foreign direct investments (FDI). However, while some other localities in Croatia have benefited enormously from the foreign direct investments, Vukovar and its county were relatively unsuccessful in the period 2002–2011 (Kersan-Škabić and Tijanić 2014). Data acquired from the Financial Agency on entrepreneurs employing more than 20 workers for 2022 corroborate previous findings, as they show that out of forty-three companies, only three were foreign-owned, confirming the small role of FDI for the city's economy, despite the incentives and favorable geographical position along the Danube and between Croatian capital of Zagreb and Serbian capital of Belgrade (Financial Agency Database 2023). This indicates that Vukovar exhibits persistent issues with attracting foreign investors despite numerous incentives provided.

The performance of the business sector has varied over time. Results from Table 1 demonstrate that business entities have been relatively successful in the first period until the economic crisis in 2008 broke out. Entrepreneurs have significantly increased their revenues, gross investments, and number of employees, achieving above-average results compared to the national level. However, they could not achieve above-average wage growth, an essential aspect for overall development, given that the average wage is continuously below average. According to data for 2020, the average wage in the business sector was still around 20 percent less than the national average. The 2008–2015 period was challenging due to the prolonged economic crisis that hit Croatia. In such circumstances, business entities from Vukovar recorded a substantial decline in investments and employment, indicating a lack of resilience to deal with the economic crisis. Strong revenue growth has been related to exceptional positive dynamics of one trading company operating within the energy sector. However, its influence on local employment remains relatively minor. The post-crisis period from 2015 onwards brought the city back to above-average dynamics for all considered indicators. Particularly important, wages have recorded the most robust growth so far, reducing the wage level gap compared to the national average.

Improved business performance in the post-2015 period is correlated with the improved perspective of living in Vukovar. As Figure 2 shows, Vukovar experienced a negative migration trend for most of the post-conflict period, with people migrating to

other Croatian counties and abroad. However, the situation changed over time, especially since 2017, closely resonating with business dynamics, albeit with a time lag, as can be noticed when comparing Table 2 and Figure 2. After the period of extensive negative net migration, the migration balance abroad was practically neutral in 2022.

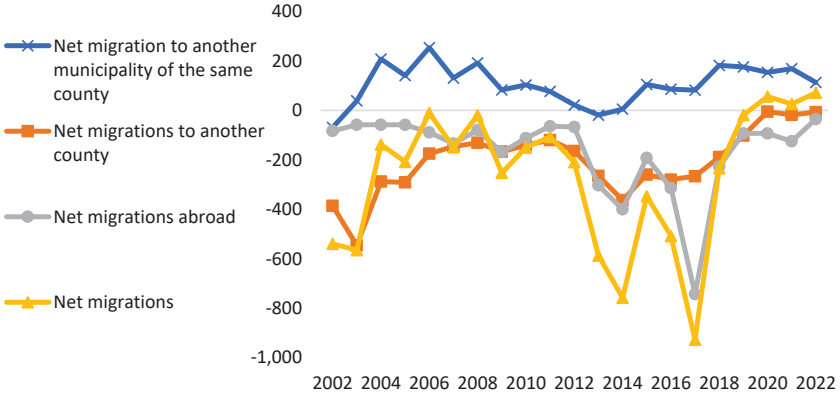

Figure 2. Internal and external migration balance for the City of Vukovar, 2001–2022. Source: Authors' calculation based on data from Croatian Bureau for Statistics (Croatian Bureau of Statistics Database n.d.).

Table 2. Performance indicators of business entities from the City of Vukovar, 2003–2020.

Indicator	Dynamics (Absolute Values)			Dynamics in Comparison to National Average (Croatia = 100)		
	2003–2008	**2008–2015**	**2015–2020**	**2003–2008**	**2008–2015**	**2015–2020**
Number of enterprises	45.9%	35.5%	40.9%	118.8	106.2	108.0
Number of employees	35.7%	−31.7%	36.8%	120.4	72.9	121.1
Revenues	100.8%	131.9%	113.8%	138.3	237.7	183.8
Average wage	13.1%	22.7%	29.1%	92.6	103.3	108.5
Gross investments into long-term assets	242.1%	−77.9%	0.6%	222.8	43.4	151.4

Source: Authors' calculation based on data from Financial Agency.

Besides continuous improvement in terms of the quality of social infrastructure, enhanced availability of better-paid jobs is another potential explanation for such migration dynamics. The relationship between incomes and migration is thus further explored by comparing dynamics in net personal incomes per capita (relative to the national average) and net migrations (absolute values). In this case, personal incomes include workplaces in the business and non-business sectors. Results from Figure 3 show that there is indeed a familiar pattern, albeit with a time lag in case of migrations. For example, the relative fall in personal incomes in 2010–2012 accompanied the fall in migration in 2011–2014. Similar lagged reactions in migration data are observable between 2016 and 2019 when relative growth in personal incomes took place. However, the positive reactions on the migration side were evident from 2017 onwards.

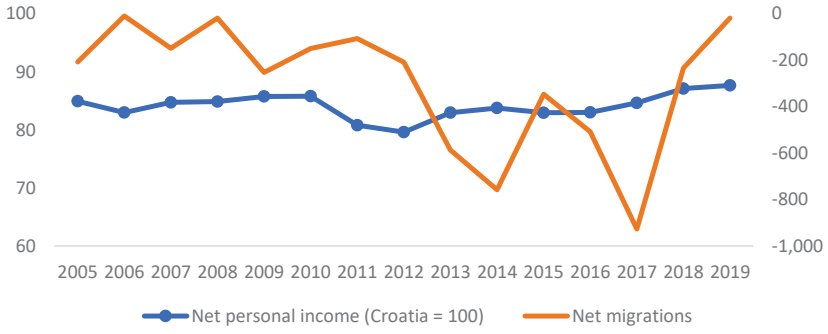

Figure 3. Net migrations and personal incomes for the City of Vukovar, 2005–2018. Source: Authors' calculation based on data from Ministry of Regional Development and EU funds (personal incomes) and Croatian Bureau of Statistics (migrations) (Croatian Bureau of Statistics Database n.d.).

Except for secondary data analysis, surveys and interviews with relevant stakeholders were conducted to complement initial findings further and deepen the comprehension of the business environment in Vukovar.

4.2. Survey Findings

The analysis of responses from entrepreneurs from the online survey provides further insights into their perspectives on the entrepreneurial environment in Vukovar and key obstacles to growth. The online survey, whose questions can be found as Appendix A, was sent to 593 entrepreneurs from the City of Vukovar, with a response rate of 17.2% (102 filled out the forms received). Overall, the prevailing sentiment among entrepreneurs on the business environment is moderately positive, with an overall score of 3.22 out of 5 (where one marks a lousy business environment and five marks an excellent business environment).

Several vital challenges faced by entrepreneurs were identified from the survey. The shortage of a qualified workforce is a pervasive issue, limiting the potential for further development and expansion. Coupled with this is the challenge of low local purchasing power, intricately linked to demand dynamics and constraining the regional entrepreneurial ecosystem. High operating costs, incredibly impactful for lower-value-added production reliant on utility prices, compound the challenges businesses face in Vukovar. The results can be seen in Figure 4.

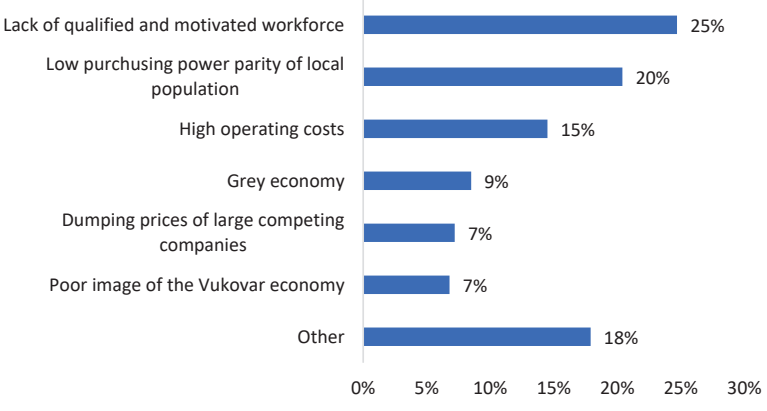

Figure 4. Most important challenges faced by entrepreneurs in business (% of total votes). Source: Authors' calculation based on data from the survey (N = 102).

The fall of the importance of the manufacturing industry, but also the lack of belief in its future, is acknowledged when looking at the entrepreneurs' view on the most promising sectors (Figure 5). IT, tourism, food, and agriculture sectors were recognized as leading sectors for future growth. The IT sector, in particular, stands out as a beacon for potential economic development, buoyed by favorable conditions like a 50 percent refund of payroll taxes. However, it is acknowledged that to realize this potential fully, there is a need for a qualified and available workforce, high-quality broadband internet coverage, and targeted campaigns to position Vukovar as an attractive destination for IT businesses. Tourism is identified as another sector with high growth potential, calling for a shift from current "daily tourism" to a more extended stay model. Entrepreneurs see an opportunity for expansion by enhancing offerings in hospitality and gastronomy, branding the destination, and organizing seasonal programs and events. The agricultural-food sector also emerges as a sector with high expectations for future growth, underlining the diverse opportunities present in Vukovar.

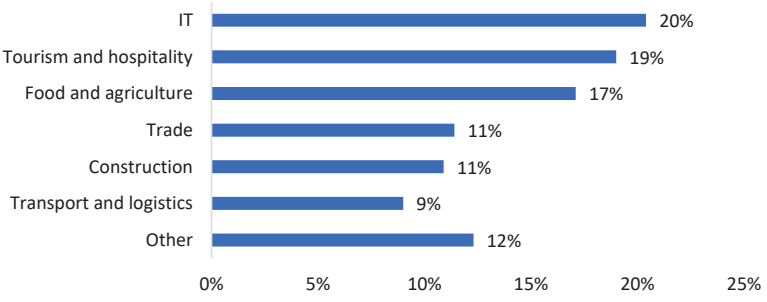

Figure 5. Sectors—carriers of the economic development of Vukovar in the next decade (% of total votes). Source: Authors' calculation based on data from the survey (N = 102).

The survey also explores the most crucial local factors for enhancing entrepreneurship in Vukovar, as shown in Figure 6. Fiscal incentives outlined in the Act on the Reconstruction and Development of the City of Vukovar take precedence, indicating the significance of these policy instruments for local entrepreneurs. The quality of city support programs and those from the Fund for the Reconstruction and Development of the City of Vukovar are also highlighted, as well as the possibilities for using EU funds. On the other hand, the quality of the local utility and educational infrastructure, as well as the proactive attitude of local government, were given much lower scores, suggesting that direct fiscal incentives are still perceived as the best stimulus for entrepreneurs. Such a view of the entrepreneurs confirms their strong attachment to the subsidies, which is hardly surprising given that some have been present for over two decades.

The overall rating for the cooperation between the City of Vukovar and entrepreneurs is relatively high (average grade 3.7). While many interviewees express high satisfaction levels, improvement is needed, particularly in communication and networking support. Entrepreneurs also point to the need for coherence and complementarity between public calls for entrepreneurs prepared by the FRDV and those prepared by the City of Vukovar. This made it challenging for entrepreneurs to determine precisely what to apply for and which parts of their activities would be eligible.

The survey also revealed that despite the prolonged presence of the local entrepreneurship program as well as a range of other activities by the city and local entrepreneurship agency, almost half of the respondents rarely or never cooperate with the city, underscoring the need for enhanced communication and visibility of the city's activities. Those who were participating in the annual public call for entrepreneurship development (published for 2021) were, on average, moderately satisfied with its main features and level of administrative complexity (the average grade for the program's main features varies between 3.18

and 3.38), meaning that the program itself can be further improved to better suit the needs of participants.

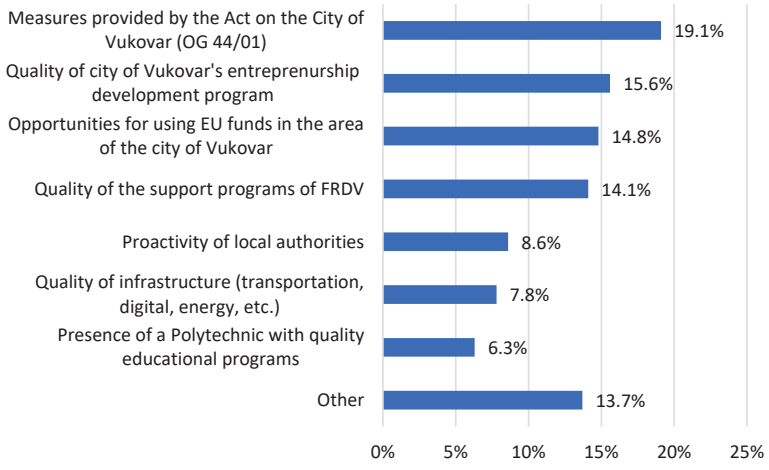

Figure 6. Most important local factors for further development of entrepreneurship in Vukovar (% of total votes). Source: Authors' calculation based on data from the survey (N = 102).

4.3. Interview Findings

Semi-structured interviews with key stakeholders, including entrepreneurs and entrepreneurial organizations, were organized once the survey had been carried out. The question guidelines can be found in Appendix B.

The findings regarding the business environment and conditions in Vukovar generally align with the results obtained from the online survey. Most interviewees expressed satisfaction with profit tax exemptions, concessions for health and pension contributions, and measures from the programs provided by FRDV and the City of Vukovar. A smaller part of them perceived the business environment as challenging, citing meager wages and continuous emigration as signs of weaknesses. Also, several interviewees emphasized the burden of the post-war city with a need for a positive city image outside of the war-related topics. Lack of greenfield investments is widely recognized as an essential issue. Several interviewees connect this problem, among others, with the need for more information about the tax and other benefits for potential investors in Vukovar (those coming from other regions or from abroad). Another frequently mentioned issue was the need for more networking among local entrepreneurs. There are no regular business events that would help share experiences and matchmaking, which could be valuable, especially for young entrepreneurs. Also, the city does not host any significant business events that would be of national or international significance and could be used for the city's promotion as a good site for business. Such commentaries confirm that more indirect and non-financial support activities are also an important aspect of promoting the local business climate and that local government should pay more attention to it.

Concerning pressing obstacles for business, respondents highlighted issues like a lack of business premises and storage spaces in the city, a chronic shortage of qualified and adequate workforce, low purchasing power, and a relatively narrow local market. Many find the problem of the quality and coverage of educational programs offered in the city, emphasizing the need for IT-related education and the low quality of education in general. They see the presence of Polytechnic Vukovar as the only higher educational institution with local presence as an essential factor for the city's development. However, they do not find sufficient benefits for their businesses given the content of the educational programs provided by the Polytechnic.

The Croatian Employment Service representative noted that many unemployed individuals need more interest in finding a job and decline available opportunities, partially related to the lack of entrepreneurial spirit. Quality of infrastructure, including internet connection and transport infrastructure, received positive ratings overall. However, concerns were raised about transportation links with neighboring rural areas, with bus lines needing to meet those areas' needs adequately. This creates a problem for daily migrants from rural areas, especially women, who often use public transportation to reach the city.

Cooperation with local administration yielded mixed comments, with some expressing contentment. In contrast, others emphasized dissatisfaction, expecting more support from the city and better communication of the city with the business community. However, existing incentive measures were consistently highlighted as valuable instruments driving entrepreneurship in Vukovar. Several participants expressed that local administration should be more active in targeting and attracting potential investors, given the benefits they can enjoy in Vukovar.

The perspective on entrepreneurship in Vukovar and its development leaned predominantly positive, with many entrepreneurs identifying EU funds as crucial support sources for the upcoming period. However, most entrepreneurs emphasized that plans for further growth and expansion were contingent on skilled staff availability and suitable business premises.

5. Discussion

Research findings offer an insight into the post-conflict entrepreneurial landscape for a small urban area represented by the City of Vukovar. After its reintegration into Croatia's legal system, the city has experienced enormous public investments in its reconstruction. These investments mainly focused on rebuilding housing stock, transport, and social and communal infrastructure. However, it became evident that these investments did not yield the expected economic outcomes even twenty-five years after the reconstruction started. From one of the most developed cities before 1991, Vukovar is among the less developed Croatian cities today. The new economic structure built after 1998 could not provide sufficient well-paid jobs. Consequently, new waves of emigration took place, the strength of which largely depended on the national economic cycle.

Policy instruments to spur entrepreneurship were manifold and included nationally and locally designed ones. The approach gradually evolved from the initial emphasis on tax concessions to become more program-based, providing grants for investments and other needs of the entrepreneurs (Fund for Reconstruction and Development of the City of Vukovar in 2004 and the City of Vukovar only in 2015). Today, it involves a multiplicity of different support measures (mainly provided by the city's program for entrepreneurship) covering various needs of entrepreneurs. While the increasing availability of various support measures is a positive indicator of an improved business climate, questions arise regarding the effectiveness of the incentive programs in achieving long-term sustainability, fostering innovation, and addressing the specific needs of different sectors. Most of the grants awarded to entrepreneurs by the FRDV and the City of Vukovar were relatively small and tailored mainly to the needs of start-ups and micro enterprises (Institute for Development and International Relations 2019). Such a fragmented approach to grant incentives seems inefficient in stimulating larger capital investments with a more significant impact on the local economy. Data on foreign investments confirm that attracting investors from abroad has not been successful, putting additional doubts on the effectiveness of incentives in attracting investors.

Survey shows stakeholders see more perspective for future development in less-capital-intensive sectors such as IT. However, this contradicts the availability of educational programs at the local level and the developments in other nearby cities. The only higher education institution in the city does not provide such education (University of Applied Sciences "Lavoslav Ružička" in Vukovar), so the closest higher education related to Information and communications technology (ICT) is in the nearby regional and university center,

the City of Osijek. Osijek has been a well-established regional ICT center for extended periods, intensively working on creating its own ICT entrepreneurial ecosystem (Mesarić et al. 2014). In such circumstances, relying on the ICT sector as a driving force seems to lack foundations.

While the efforts of the city administration are generally well-received among entrepreneurs, there is plenty of room for improvement. Enhanced coordination and clear communication channels between entrepreneurs and local authorities could foster a more dynamic and responsive entrepreneurial ecosystem. It is also evident that the city's benefits for potential investors need to be better promoted. Neither general nor targeted campaigns towards potential investors have been undertaken so far, consequently reducing the true potential of fiscal and other benefits in attracting investments. This is surprising given the vast amount of evidence that investment promotion measures can bring tangible benefits (Charlton and Davis 2007; Drahokoupil 2008; Pasquinelli and Vuignier 2020) and the important role of the subnational level in investment promotion (OECD 2018). Another important issue is the need for adequate business premises, which can deter the growth of local entrepreneurs and slow the arrival of new investors. This issue is closely linked with land management and the city's spatial planning practice, which seems to represent a policy challenge for the local administration.

Responding to our research Hypothesis 1 (H1), reconstruction of housing and social infrastructure are necessary but insufficient conditions for successful post-conflict economic development; our case study reveals that despite a very successful reconstruction effort and initial partial return of displaced population, Vukovar very quickly started to face substantial outmigration and loss of population. This indicates that the economic dynamism achieved in the first phase of economic redevelopment (until 2008) was too weak to secure favorable conditions. The reasons for such an outcome should be sought, among others, in the influence of policy instruments since they were the main impetus in rebuilding the local economic fabric. Emphasis on tax and other concessions was obviously not attractive enough to stimulate investors to open more and better-paid workplaces. Program-based grant support for entrepreneurship came later and was mainly focused on smaller grants, thus reducing its potential to attract more significant investments. The survey also affirms that intensive support from national and local levels did not solve some pressing issues, such as lack of qualified workforce or lack of business premises. This raises additional questions about the appropriate design of support instruments.

As a result, the city today is still lagging behind most of its peers in Croatia, as seen by recent results on the development ranking of local self-government units. According to results published in January 2024 published by the Ministry of Regional Development and EU funds, Vukovar was ranked 260th place among 556 local units in Croatia, distinctively lower than most of the local units of similar population size and far from its pre-conflict status and far away from its pre-1991 status as one of the most developed cities in Croatia (Ministry of Regional Development and EU Funds 2024). As such, the results support Hypothesis 1 (H1) of our research.

Research findings also support Hypothesis 2 (H2), which asserts that business climate in lagging local units highly depends on the combination of state and locally designed business-support measures. Survey and interview results confirmed that entrepreneurs find support measures essential for their business despite most measures having a limited financial impact. Given the constrained fiscal capacity of local authorities in the post-conflict period, it is clear that central state measures are of pivotal importance, particularly in the beginning, until the city becomes more fiscally capacitated. While recognizing the importance of direct fiscal support, entrepreneurs expressed the necessity for more support in networking and the general promotion of entrepreneurship through various events and other activities. Such soft activities could help improve the city's general image, which is still best known for its destructions during the war. The limited emphasis on robust networking platforms poses challenges for local entrepreneurs, hindering knowledge sharing and collaboration. To fortify Vukovar's entrepreneurial ecosystem, urgent attention

is needed to formulate and implement measures enhancing networking opportunities, improving communication channels, and promoting cross-sectoral exchange, fostering a more dynamic and interconnected business environment that attracts external interest and investments for sustained economic growth. The recommendations by entrepreneurs and other stakeholders engaged in entrepreneurship should serve as a guiding tool for both local and national actors in formulating the next set of support measures. Central state support measures have remained relatively static, maintaining practically the same content since their introduction. On the other hand, the City of Vukovar, through its program, demonstrated a more innovative approach to designing measures but faced limitations in financial support, hindering its overall effectiveness.

6. Conclusions

Numerous local units in Croatia have passed through difficult transitions in the last three decades, combining the post-war reconstruction with the need to transform their local economic structure and improve their long-term resilience to contemporary economic and social challenges. The City of Vukovar is a distinguished example of such development, given the level of its pre-war status and the extensive war-related destructions it has encountered. Its prolonged transition is not only connected to the consequences of war but also to its heavy industrialization before the war, which is in line with the findings from earlier studies (Bachtler et al. 2001; Ivanička and Ivanička 2007; Bartlett et al. 1996). Along with creating necessary conditions for the return of the displaced populations in terms of housing and communal infrastructure, post-war economic recovery has to be addressed with equal policy importance from the very beginning, as has been suggested by Maleković et al. (1998). Vukovar's experience demonstrates that tax and other concessions are insufficient in creating a favorable local business climate and that more creative policy solutions are required.

Close cooperation between central and local levels is particularly important given the lack of necessary financial and human resources in war-affected areas. Croatian case of setting up a special centrally managed institution to spur Vukovar's socio-economic development turned out to be a step in the right direction. However, to ensure effective contribution from such institutional support, it is necessary to continuously adapt its instruments to the evolving needs of the local economy. In that sense and in line with conclusions by Kwon and Gonzalez-Gorman (2014), the study suggests the importance of continuously evaluating entrepreneurs' evolving needs and the adaptive refinement of program content to align with emerging requirements. This recommendation underscores the dynamic nature of the entrepreneurial landscape, emphasizing the necessity for ongoing support systems to evolve in tandem with the changing needs of businesses. By regularly assessing entrepreneurs' challenges and tailoring support programs accordingly, stakeholders can ensure the sustained relevance and effectiveness of initiatives that foster entrepreneurial growth in Vukovar. This proactive approach not only enhances the resilience of the local business ecosystem but also contributes to creating a supportive environment conducive to innovation and sustainable development.

As recent research by Rodzinka et al. (2023) shows, in the case of Polish subnational units, there is no single instrument that proved successful in spurring local economic development. Instead, different sets of instruments to support entrepreneurship should be chosen for different places depending on their structural characteristics.

While this research effectively provides valuable insights into entrepreneurs' perspectives on the entrepreneurial environment and identifies key obstacles to growth, it is crucial to acknowledge and address certain limitations inherent in the study. The study's scope is confined to Vukovar, a mid-size city in Croatia with a population of 23 thousand people as per the 2021 census. While the insights gained from this setting are valuable in their own right, caution must be exercised when extrapolating these findings to larger cities in different geographical contexts, such as Ukraine. Notably, Vukovar's size may need to adequately mirror the scale and complexity of more substantial Ukrainian cities, where

a city of comparable size might be considered small. Also, a more extensive and diverse pool of interviewees would additionally add to a better understanding of entrepreneurial challenges and opportunities.

Despite these limitations, this research gives ground for further exploration of the topic and highlights areas where research could provide additional depth and context. Future research could delve more deeply into exploring demographic challenges and the interplay between demographic factors and local economic development. Investigating more in-depth reasons for the working-age population to settle or leave the city can bring further insights that contribute to formulating sustainable strategies for fostering economic resilience and vitality in Vukovar. This demographic lens can shed light on the evolving composition of the local populace and its implications for entrepreneurship, employment, and community well-being.

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Institutional Review Board Statement: Ethical review and approval were waived for this study, since the research was not medical research on human subjects and did not include identifiablehuman material and data. It collected research participants' opinions and attitudes.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data are contained within the article.

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Appendix A. Questions from the Online Survey

1. Year of establishment of the company: _____
2. Please indicate the category to which your company belongs based on the number of employees.
   - Micro (<10 employees)
   - Small (<50 employees)
   - Medium (<250 employees)
   - Large (>250 employees)
3. How often do you collaborate with the City of Vukovar?
   - Annually
   - Every two to three years
   - Rarely (once every four years or less)
   - Never
4. How would you generally rate the quality of your collaboration with the City of Vukovar (1–5, where 1—Poor collaboration, 5—Excellent collaboration)
5. Please explain your previous answer. _____
6. How would you rate the business environment in the City of Vukovar (1–5, where 1—Poor business environment, 5—Excellent business environment)
7. Please select up to three sectors that you believe will be drivers of economic development in Vukovar in the next decade:
   - IT sector
   - Agricultural and food sector

- Transportation and logistics sector
- Pharmaceutical sector
- Metal processing sector
- Trade
- Tourism and hospitality
- Construction
- Other:

8. Please indicate up to three critical local factors for entrepreneurship development in the city:
   - Special incentive measures provided by the Act on the Renewal and Development of the City of Vukovar
   - Positive local entrepreneurial climate
   - Proactivity of local authorities
   - Quality infrastructure (transportation, digital, energy, etc.)
   - Quality city support programs for entrepreneurs
   - Quality support programs from the Fund for the Reconstruction and Development of the City of Vukovar for entrepreneurs
   - Significant opportunities for using EU funds in the area of the City of Vukovar
   - Presence of a Polytechnic with quality educational programs
   - Other:
9. Please indicate up to three significant challenges you face in your business that hinder further development:
   - Lack of qualified and motivated workforce
   - Poor performance of tax and other inspection services
   - Low purchasing power of the local population
   - Informal economy
   - High utility costs (e.g., electricity, gas, waste disposal)
   - Inability to collect receivables
   - Undercutting by large competing firms
   - Poor availability of rental space
   - Weak image of the Vukovar economy
   - Other:
10. How can the city further enhance the competitiveness of the local economy (rating 1–5, where 1—least important, 5—most necessary):
    - Construction and/or municipal development of business zones
    - Entrepreneurial incubators and shared workspace facilities
    - Upgrading municipal infrastructure for new investments (e.g., water supply and drainage)
    - Resolving property-legal issues in locations where there is interest in economic activity
    - Stronger promotion of IT education for young people
    - Connecting local entrepreneurs into economic-interest groups to strengthen market potential
    - Promoting the construction of a logistics distribution centre
    - Co-financing the introduction of business mentoring for micro and small businesses
    - Increasing the number of entrepreneurial events to strengthen networking among entrepreneurs and promote the city's economy
    - Co-financing business rentals in private ownership or reducing rental costs for entrepreneurs in city-owned spaces
    - Activating additional business spaces available for rent
    - Providing education related to the digital and green transition in the economy
    - More active efforts to attract new investors from outside the City of Vukovar
    - Installing optical cables throughout the city

- Improving transportation infrastructure
- Developing a sustainable waste management system
- Promoting the construction of renewable energy systems and the use of clean energy in the economy

11. Rating of parts of the call for proposals for the development of entrepreneurship in the City of Vukovar for the year 2021 (rating 1–5, where 1—completely inappropriate, 5—completely appropriate):
    - Application conditions
    - Volume of documentation to be submitted
    - Planned value of the call
    - Eligible activities
12. Please provide a final comment on the possibilities for additional stimulation of the economic development of the City of Vukovar by local authorities. _____

Appendix B. Interview Questions

Questions for Entrepreneur Interviews:

1. Briefly describe your company's business, including the category of entrepreneurs you fall into based on size and whether you are an exporter.
2. Can you assess the current business environment for your work? How satisfied are you with the business conditions in Vukovar?
3. What poses the most significant challenge to your business? Can you specify obstacles in your business related to the local level of government?
4. To what extent is transportation infrastructure critical for your business? How do you rate the quality of the transportation infrastructure in Vukovar?
5. To what extent is the quality of the internet important for your business? How do you rate the quality of your internet connectivity?
6. To what extent can you find a suitable workforce in the City of Vukovar? How satisfied are you with their education?
7. In which business segment could the local government help you the most or facilitate your operations?
8. How do you assess the collaboration with the local government? To what extent are you satisfied with the services of city utilities (water supply and sewage, cleanliness, etc.)? Where do you see room for improving the work of the local government?
9. Are you a beneficiary of incentive measures from the City of Vukovar for entrepreneurship? To what extent are you satisfied with these measures? Do you see the need for additional incentive measures by the city authorities, and if so, what measures would those be?
10. Are you a beneficiary of state incentive measures for entrepreneurship (e.g., corporate income tax exemptions)? To what extent are you satisfied with these incentive measures? Do you see the need for additional incentive measures at the state level, and if so, what would they be?
11. How do you assess the perspective of your business in Vukovar, and do you have plans for additional investments and job creation?

Questions for the Croatian Chamber of Economy—Vukovar Branch and the Croatian Chamber of Crafts

1. What are your experiences with business environment and business conditions in Vukovar—what do entrepreneurs mostly complain about and what do they praise?
2. Whish are the most significant obstacles in business, which are related to the local level of government?
3. What are main programmes you offer for local entrepreneurs?
4. How many entrepreneurs are interested in incentives, workshops and educational trainings?

5. What do entrepreneurs say about the quality of transport infrastructure and Internet connection in the area of the City of Vukovar?
6. What is the situation with the labour force in Vukovar?
7. Do you cooperate with the local authorities and in what extent?
8. What are perspectives of entrepreneurship?
9. Other—unstructured, depending on previous answers.

Questions for Fund for the Reconstruction and Development of the City of Vukovar Interview:

1. Can you assess the current business environment in the City of Vukovar?
2. Investments in public infrastructure are visible. In your opinion, why are there not more investments in the Vukovar economy?
3. Can you list the obstacles entrepreneurs complain about the most, especially those related to the local government? Have you had contact with potential foreign investors, and can you assess how they perceived Vukovar as an investment location?
4. How do you assess the state of infrastructure in the City of Vukovar? Is the condition of municipal and transportation infrastructure an advantage or a hindrance to the town of Vukovar?
5. Where do you see the most significant potential for the Vukovar economy? In which sectors?
6. How do you assess young entrepreneurs, or generally, the readiness of young people to engage in entrepreneurship?
7. How do you assess the quality of the local educational system (primary and secondary schools, Polytechnic) in meeting the economy's needs for the workforce?
8. How do you assess the existing incentive measures established by law for entrepreneurs in Vukovar?
9. What new incentive measures for the Vukovar economy would you introduce?
10. How do you assess the projects that entrepreneurs submit to the Fund's calls? To what extent are you satisfied with their quality, and are there qualitative changes over time?
11. How do you assess the cooperation with the local self-government in promoting entrepreneurs?
12. How do you assess the perspective of the economy of the City of Vukovar in the coming years?

Questions for Vukovar Development Agency Interview:

1. Can you describe how VURA promotes entrepreneurship development in the City of Vukovar?
2. How would you rate the quality of project ideas entrepreneurs prepare for public calls (city/national)?
3. What do the most common projects that entrepreneurs apply for public calls look like? Which sectors do they come from, and what are they seeking funding for?
4. How do you assess entrepreneurs' interest in the education that VURA provides?
5. How do you assess the willingness of entrepreneurs to associate and connect (e.g., through clusters, joint project initiatives, etc.)?
6. Can you assess the current business environment in the City of Vukovar? Why, in your opinion, are there fewer investments in the Vukovar economy?
7. Can you list the obstacles entrepreneurs complain about the most, especially those related to the local government?
8. Have you had contact with potential foreign investors, and can you assess how they perceived Vukovar as an investment location?
9. Where do you see the most significant potential for the Vukovar economy? In which sectors?
10. How do you assess young entrepreneurs, or generally, the readiness of young people to engage in entrepreneurship?

11. How do you assess the existing incentive measures for entrepreneurs in Vukovar? What new incentive measures for the Vukovar economy would you introduce (if necessary)?
12. How do you assess the perspective of the economy of the City of Vukovar in the coming years?

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Article

Which Economic Sectors Influence Average Household Income? A Spatial Econometric Study of Thailand's 76 Provinces

Viriya Taecharungroj

Business Administration Division, Mahidol University International College, Nakhon Pathom 73170, Thailand; viriya.tae@mahidol.edu

Abstract: This study investigates the impact of various economic sectors on household income in Thailand. It is conducted in light of the substantial "digital wallet" scheme initiated by the Thai government, with the goal of providing empirical evidence and suggesting alternative policies for regional development informed by sectoral and spatial insights. The research aims to deepen the understanding of how different economic sectors affect household income, filling a gap in the current understanding of the relationship between sectoral productivity and income. Utilising spatial lag models (SLM), the study analyses data spanning from 2005 to 2021, testing the effects of 19 economic sectors comprising the Gross Provincial Product (GPP) of Thailand's 76 provinces on the average household income. The findings indicate direct associations between agriculture, real estate, professional services, support services, and leisure sectors and household income, alongside pronounced spatial autoregression. This implies that income levels in one province can substantially influence those in neighbouring provinces. This research extends the understanding of economic influences at the regional level and highlights the importance of considering spatial factors in economic policymaking.

Keywords: spatial econometrics; spatial lag model; household income; gross provincial product; regional development; Thailand

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1. Introduction

An essential developmental goal for emerging economies like Thailand is the continuous enhancement of individual and household income, while addressing the pervasive issue of inequality. Achieving this goal is pivotal for the nation's transition to a high-income level. However, this objective is complex and far from straightforward, as developmental trajectories vary among countries and are not deterministic (Kutuk 2022). Therefore, Thailand needs a tailored approach, one that is contextually grounded, to effectively improve individual and household income.

Household income, as one of the crucial indicators of welfare, is shaped by various elements, ranging from demographic factors, employment, and education at the household level, and broader influences like economic shocks, government policies, population dynamics, and the evolution and development of various economic sectors (Aristei and Perugini 2015; Miles 1997; Kalogirou and Hatzichristos 2007; Dachin and Mosora 2012). Traditionally, the impact of sectoral shifts on income has been understood as a linear progression: starting from agriculture, moving to industrial, then to service sectors, and ultimately to knowledge-based industries (Li 2009; Tselios 2009). However, this linear perspective fails to fully capture the complex interactions among different sectors and their collective impact on household income. Therefore, the primary aim of this research is to provide a more comprehensive understanding of how various economic sectors influence household income.

This research is undertaken in the context of a significant economic stimulus initiative, the "digital wallet" scheme. The scheme, spearheaded by the current Thai government led

by the Pheu Thai Party formed in 2023, involves issuing a one-time electronic cash incentive of 10,000 Baht (approximately USD280) to eligible citizens. This proposed economic stimulus effort, set for 2024, is designed to rejuvenate the economy, with a particular focus on benefiting the retail, service, and tourism sectors. It is expected to impact 50 million individuals and support around 2.4 million small and medium-sized enterprises (SMEs) in 2024.[1] Experts predict it could enhance the Thai economy by 1.5 to 2 percentage points, potentially leading to a growth rate of around 5%, which is higher than previous forecasts.[2]

One key aspect of this one-time stimulus is the scope of eligible spending. The scheme allows recipients to purchase general products, food and beverages, and consumable goods within six months of receipt. However, electronic cash in the digital wallet cannot be used for services, online purchases, alcoholic beverages, tobacco, marijuana, kratom (plant leaves used for their stimulant and pain-relieving effects), vouchers, gold, diamonds, gemstones, debt payments, education, or utility fees.[3] While the focus on essential goods and food suggests that the funds will rapidly enter the economy within a short period, there is no empirical study or explanation of how this scheme could lead to long-term benefits.

The Pheu Thai Party also claims that the scheme aims to alleviate poverty, improve welfare, and boost income at the grassroots level.[4] A significant aspect of this scheme is that the electronic cash is to be spent within the district of the recipient's residence. This condition is intended to stimulate local economies and distribute income more evenly across the country by encouraging spending within local communities. However, it will likely be funded through government loans, amounting to around 500 billion Baht (approximately 3% of Thailand's GDP), which has raised questions about fiscal responsibility and potential constitutional and legal issues.[5,6] Eligibility for the scheme has been a point of debate. Initially proposed to be available to every Thai citizen over the age of 16, the plan was later revised to exclude wealthy individuals.[7]

Considering the magnitude of this scheme, a critical question arises: will it contribute meaningfully to the long-term welfare and income of the Thai population as intended? This question is especially pertinent given that the economic sectors directly benefiting from this scheme are narrow, focused primarily on retail, wholesale, and food services. An additional question is whether this scheme is an effective way to reduce income inequality across communities in Thailand. While the scheme aims to stimulate local economies and promote equitable income distribution, its focus on specific sectors may limit its reach and effectiveness in addressing broader income disparities. Understanding the effects of various sectors on people's income and their spatial dependencies is crucial for informing the government about potential policy improvements or necessary adjustments.

Therefore, this research is guided by two primary questions: RQ1, "what are the effects of changes in various economic sectors on average household income?" and RQ2, "what are the roles and characteristics of spatial dependencies on the effects of economic sectors and the dynamics of household income?"

To answer these questions, a spatial econometric model was employed to test the effects of 19 economic sectors comprising the Gross Provincial Product (GPP) of Thailand's 76 provinces on the average household income in these provinces. The study utilised biannual data from 2005–2021 from the National Statistical Office of Thailand. The results of the study reveal that the sectors of agriculture, real estate, professional services, support services, and leisure showed significant direct associations with household income. Furthermore, the study discovered pronounced spatial autoregression, indicating that the income levels in one province could significantly influence nearby provinces. This finding aligns with existing literature emphasising spatial correlation.

The next section of the paper reviews literature relevant to the drivers of household income, followed by sections on data and methods, findings, a discussion, and conclusions. The study aims to provide a comprehensive understanding of the relationship between economic sectors and household income in Thailand, offering insights that could inform future economic policies and strategies.

2. Literature Review

2.1. Factors Affecting Household Income

Household income is increasingly recognised as a crucial indicator of welfare, vital for understanding well-being and economic prosperity. It is typically measured as the aggregate disposable income of all members within a household, serving as a key metric for assessing inequality and poverty across different countries, a method extensively used in empirical literature (Gradin et al. 2008). Traditionally, theories explaining household income have been rooted in neoclassical growth principles, particularly focusing on regional economic convergence (Gebremariam et al. 2010). According to this school of thought, income disparities between regions are expected to diminish over time, with less affluent regions growing at a faster rate (Tselios 2009). However, this view is challenged by endogenous growth models, which argue that regional income disparities might actually widen due to factors such as economies of scale and the concentration of human capital (Yildirim et al. 2009).

The concept of "income mobility", which emphasises the analysis of longitudinal data, is critical in understanding how individual incomes evolve over time. This approach provides insights into both intragenerational and intergenerational shifts in income (Aristei and Perugini 2015; Ayala and Sastre 2008; Jäntti and Jenkins 2015). It reveals that changes in household income are more complex and less predictable than the neoclassical model suggests. Adding to the theoretical diversity, the "New Economic Geography" posits that a region's economic activity is influenced by its geographical location and its interactions with neighbouring regions (Yildirim et al. 2009). Thus, according to this theory, neither convergence nor divergence in income levels is predetermined (Yildirim et al. 2009). Empirical studies have shown that regional disparities within countries can sometimes be more significant than those observed between countries.

Considering these various theories and concepts that explain the dynamics of household income, this literature review seeks to explore the factors influencing household income in cities and provinces at both the household and macro levels.

2.1.1. Household Level Factors Affecting Household Income

Four key factors affect household income at the individual level. These factors are demographic aspects, education and human capital, employment status and job nature, and various other income dynamics. Each of these elements plays a crucial role in shaping the financial stability and growth potential of households.

Demographic factors, encompassing age, education, health, and household composition, are central to understanding household income dynamics. Changes in household composition, such as marriage, childbirth, or divorce, significantly influence income, impacting resource division and dependent numbers (Burgess and Propper 1998). Age and gender also play pivotal roles, with female-headed households and younger workers experiencing distinct income mobility patterns (Aristei and Perugini 2015; Engzell and Mood 2023). Additionally, variables such as household size and presence of elderly members influence income growth (Devicienti et al. 2014; Jin and Xie 2017).

Education and human capital investment also significantly influence household income mobility. The education level of household heads, particularly in terms of secondary and tertiary education, plays a critical role in determining income mobility due to better accumulation of human capital, adaptability, and enhanced income growth opportunities (Aristei and Perugini 2015; Engzell and Mood 2023; Jin and Xie 2017; Li 2009).

Employment status and job nature are crucial determinants of household income, with changes such as job loss or transitions between full-time and part-time work having a direct impact on income levels (Debels and Vandecasteele 2008; Jenkins 2000). The type of employment, be it temporary, permanent, or self-employment, significantly influences income mobility, with each employment status offering different levels of security and growth potential (Aristei and Perugini 2015). The occupational type, specifically in the context of urban-rural dynamics, plays a significant role in determining income levels.

Higher income is often associated with off-farm activities, indicating a shift from traditional agricultural sources to more diversified income streams (Benjamin et al. 2005; Su and Heshmati 2013). Additionally, the occupation of the household head, particularly in managerial or administrative roles or employment in government or public institutions, is associated with higher income levels (Jin and Xie 2017).

Other income dynamics such as initial income level, different income sources, and expectations also play a crucial role in household income changes. Initial income of the household head is a primary variable influencing per capita income changes, with variability in real income occurring due to different sources, including labour and capital income (Chang and Hanna 1994; Fields et al. 2003). Furthermore, the type of income, whether from wages, property, or social benefits, contributes to overall income mobility, with social benefits often stabilising income during economic fluctuations (Ayala and Sastre 2008).

2.1.2. Macro Level Factors Affecting Household Income

Four key factors affect household income at the macro level, encompassing cities or provinces. It delves into the roles of crises and shocks, government policies, population dynamics, and sectoral composition in influencing household income.

Crises and shocks play a pivotal role in affecting household income at the city or province level. Idiosyncratic and covariate shocks, such as natural disasters, can deeply impact the economic stability of communities. These shocks, along with pressures like rising costs of living, can lead to a gradual descent into poverty (Lázár et al. 2020). Additionally, economic crises, as experienced globally in 2009, can lead to fluctuations in household incomes despite political and social measures (Dachin and Mosora 2012).

Government policies, particularly those focused on investment in education and infrastructure, are instrumental in shaping household income at a regional level. Educational attainment and workforce skills are key drivers of regional economic development, with regions boasting higher levels of education and skilled labour forces better positioned to attract investment, foster innovation, and achieve economic growth (Tselios 2009). This investment in human capital positively affects income collectively, as it enables the workforce to acquire skills relevant to the modern economy, thereby enhancing productivity and economic potential. The impact of education on income distribution is significant, particularly in reducing the income share of the rich and increasing that of the poor, although it does not significantly impact the middle class (Abdullah et al. 2015). Moreover, the distribution of education plays a crucial role, where more equitable distribution leads to lower income inequality. Secondary education, in particular, is noted for its importance in reducing inequality compared to primary schooling. Furthermore, regional economic policies and structural funds, especially in the European Union, play a significant role in promoting economic growth and reducing regional disparities through investments in underdeveloped areas and infrastructure development (Solarin et al. 2023; Tselios 2009).

Population dynamics: The growth and diversity of a population, particularly through migration driven by factors like quality of life and accessibility, also have a profound impact on household income at city or provincial levels. Supply-induced growth, fuelled by migration for reasons such as natural beauty or cultural appeal, not only increases the local labour supply but also directly influences the economic vitality of a region, thereby affecting average household incomes (Carruthers and Mulligan 2008). The presence of a diverse and highly educated immigrant population exemplifies the intricate link between demographic dynamics and income levels. The varied skills and educational backgrounds of these residents contribute to the economic complexity of the region, influencing average household income (Kalogirou and Hatzichristos 2007).

Sectoral composition and development of industries within a city or province are fundamental to understanding and influencing household income at the macro level. Demand-induced growth, resulting from increased labour demand due to business or industry expansion, can lead to significant job creation and attract people from other areas, thereby affecting household income levels (Carruthers and Mulligan 2008). The type of dominant

economic activities in a region and sector specialisation significantly affects regional income disparities (Dachin and Mosora 2012). The spatial distribution of economic activities, including the concentration and clustering of industries, also affects their average income (de Dominicis et al. 2007). Furthermore, the influence of working hours and specific high-paying industries on household income highlights the importance of sectoral specialisation in regional economic performance (Kalogirou and Hatzichristos 2007). These aspects highlight the significant impact of sectoral growth, specialisation, and industrial clustering on the economic development of cities and provinces, ultimately influencing household income at a macro level.

2.2. Economic Sectors' Effect on Income

This research primarily focuses on the impact of sectoral composition and industrial development, as outlined earlier. While the influence of various factors on income has been widely studied, the effect of productivity across different economic sectors on income is not as well-explored. Previous studies have identified infrastructure development within the construction sector as a robust predictor of economic growth across various regions (Resende 2011; Rodríguez-Pose et al. 2012). Additionally, sectoral shifts, particularly from low-productivity activities like agriculture to higher productivity activities, often result in increased GDP per capita (Dachin and Mosora 2012). However, a study by Gebremariam et al. (2010) found that the level of employment in the manufacturing sector, traditionally linked with robust economic growth, did not significantly impact median household income growth.

The transition from manufacturing to service sectors has also led to broader structural changes in the economy, affecting job types and income distribution (Canas et al. 2003; de Dominicis et al. 2007; Petrakos and Saratsis 2000). The influence of sectors such as wholesale and retail trade, finance, insurance, real estate, health, and construction on regional income dynamics is complex and multifaceted. Gebremariam et al. (2010) also noted that employment levels in sectors often seen as indicators of economic maturity, like wholesale, retail, finance, insurance, real estate, and health, do not consistently show significant effects on employment or median household income growth, highlighting their ambiguous role in economic development.

This issue is particularly relevant in the case of Thailand, a developing nation that distinguished itself in the 1990s with a notably higher per capita income compared to other middle-income countries. However, Thailand's income growth has stagnated since the Asian economic crisis in 1997, struggling to achieve a significant breakthrough. This stagnation is evident in the comparison chart provided in the Appendix A (Figure A1), illustrating Thailand's income trajectory in relation to other similar economies.

To the best of our knowledge, there is a notable lack of comprehensive studies directly linking the diversity of economic sectors to average household income in Thailand. Most existing research on regional economic development in the country emphasises the role of specific policies, such as the One Tambon One Product (OTOP) initiative, and their impact on fostering entrepreneurship and growth (Kamnuansilpa et al. 2023). The OTOP initiative has been pivotal in harnessing local skills and resources for the development and commercialisation of products, primarily in sectors like food and beverage, and local craft manufacturing (Moore and Donaldson 2016). However, the predominance of OTOP products in these limited sectors may inadvertently overlook other economic sectors with significant growth potential.

Moreover, a significant study modelled Gross Provincial Product (GPP) as an outcome variable, highlighting labour in the formal system and the level of investment as key factors influencing GPP (Vajrapatkul 2023). This finding indicates the potential impact of public and private investment in specific economic sectors on the long-term welfare of citizens. Yet, the effects of various economic sectors on household income remain largely unexplored. This gap highlights the necessity to examine the influence of sectoral productivity on

income dynamics. Such an investigation could provide valuable insights into Thailand's economic challenges and identify viable avenues for sustainable growth.

This research addresses a research gap stemming from the limited understanding of how specific sectors or the characteristics of sectoral composition affect household income. While shifts from agriculture to industrial sectors are generally understood to improve economic conditions, and the importance of advanced technological sectors is recognised, a comprehensive, comparative analysis of different sectors' impacts on household income is lacking. This research aims to fill this gap by offering a detailed comparative analysis of various sectors and their effects on household income in Thailand. Understanding the specific characteristics of sectoral composition that influence income is crucial for guiding strategic investments and improvements by both public and private sectors.

Therefore, the first research question is: RQ1, what are the effects of changes in various economic sectors on average household income?

2.3. Spatial Effects on Economic Sectors and Household Income

Understanding the effects of economic sectors on household income also requires a comprehensive understanding of spatial influence. The roles of spatial interdependencies from spillover and mobility and regional variations in spatial correlation are significant in shaping economic sectors and impacting household income.

Spatial Interdependencies from Spillover and Mobility: The intricate web of spatial interdependencies is evident in the way regional economies are not only influenced by local factors but also by the economic health of their neighbours through various channels such as trade, labour migration, and sectoral employment concentrations (Basile 2009; Garrett et al. 2007; Gebremariam et al. 2010). Technological diffusion and knowledge spillover play pivotal roles in shaping regional economic landscapes. Studies have shown that these interdependencies, particularly in the context of technological spillovers and factor mobility, are crucial for understanding the dynamics of regional development and the formation of business environments (Basile 2009; Fischer 2011; Gebremariam et al. 2010). Spatial economic policies and developments should be considered within broader, interconnected networks, recognising that changes in one region can have significant ripple effects on others (Patacchini and Rice 2007; Tselios 2009).

Regional Variation from Spatial Correlation: Due to spatial interdependencies, the spatial impact on economic growth shows notable regional variations. This variation is not only a response to different economic stimuli but also reflects the geographic and structural economic differences among regions (Kocornik-Mina 2009; Le Gallo and Ertur 2003). For example, the spatial characteristics of productivity and occupational composition indices demonstrate significant variations in regional income levels (Patacchini and Rice 2007). Studies in China and Japan have highlighted how spatial factors, such as geographical location and proximity, lead to diverse growth patterns and income disparities across regions, challenging the efficacy of traditional non-spatial economic models (Li 2009; Seya et al. 2012; Yu and Wei 2008).

These spatial factors add complexity to economic interactions and growth dynamics at both regional and local levels. In Thailand, studies on spatial effects have been somewhat limited. A particular study highlighted that the concentration of multinational enterprises (MNEs) with advanced technological sophistication is predominantly in the Bangkok Metropolitan Area and a few other provinces like Chonburi, with limited spillovers to first and second-level neighbouring provinces (Sajarattanochote and Poon 2009). Similarly, economic productivity, as measured by Gross Provincial Product (GPP), is concentrated in these regions (Vajrapatkul 2023).

However, there exists considerable potential for economic improvement. The public and private sectors are uniquely positioned to influence Gross Provincial Product (GPP), as the key factors driving GPP have been identified as labour in the formal system and investments (Vajrapatkul 2023). This potential is further underscored by the observation that local governments have been relatively passive in adopting strategies aimed at attracting

businesses (Kamnuansilpa et al. 2023). Additionally, it is important to note that economic productivity, as measured by GPP, exhibits a spatial correlation (Vajrapatkul 2023). This correlation suggests a targeted approach by these sectors, particularly in areas lagging behind, could have a substantial impact on regional economic productivity.

Insights from this research could inform local and national governments to implement policies that attract businesses and investments to disadvantaged provinces to spur household income. Thus, addressing the second research question becomes imperative for a comprehensive analysis of regional economic performance and its impact on households. The second research question is: RQ2, what are the roles and characteristics of spatial dependencies on the effects of economic sectors and the dynamics of household income?

3. Data and Method

3.1. Data

Dependent variable: In Thailand, a crucial dependent variable for assessing economic conditions is the average household income by province, as compiled by the National Statistical Office (NSO).[8] This dataset encompasses data from 2004 to 2021, covering Thailand's 77 provinces. The NSO typically gathers this information biennially in odd-numbered years. However, an exception occurred in the early years of the dataset, with data for 2004 and 2006 collected prior to 2007. To ensure continuity and consistency in the dataset, the average household income for 2005 was imputed by averaging the incomes of 2004 and 2006. This methodology resulted in a total of eight distinct time periods, each spanning two years. The NSO defines household income broadly, including earnings from employment or self-produced goods, revenue from property, and any form of assistance received from others. This measure serves as a vital indicator for evaluating the financial health and well-being of Thai households, providing insights into regional economic disparities and trends over time. Of the 77 provinces, Bueng Kan was excluded from the analysis because it was established as a new province in 2011, resulting in incomplete data and calculations based on a different annual basis.

Independent variable: Regarding the independent variable, GPP in Thailand serves as a critical economic indicator, mirroring the concept of Gross Domestic Product (GDP) but on a provincial level. The compilation and calculation of GPP is a collaborative effort involving multiple agencies.[9] The GPP encompasses various economic parameters, including returns on primary production factors such as land rent, labour compensation, interest, and profits. It accounts for total "value added" from all economic activities within each province. The value added, a central element in GPP, represents the net output of a province, calculated as the difference between the production value (Gross Output) and the costs of intermediate goods and services (Intermediate Cost). The NSO adopts the Chain Volume Measures (CVMs) method for calculating GPP. This method, which adjusts for inflation, offers a more accurate depiction of real changes over time through a chain-linked approach.[10] The 19 economic sectors included in Thailand's GPP are categorised into 1 agricultural, 4 industrial, and 14 service sectors, as detailed in Appendix A.

3.2. Spatial Weight Matrix

A spatial weight matrix is a tool used in spatial analysis to represent the spatial relationships among different locations. It quantifies how much influence one location has on another, based on factors like distance, connectivity, or other relationships. This matrix is crucial for spatial econometrics, helping to understand and model spatial dependencies and interactions.

The most commonly used spatial weight matrices in spatial econometrics are the contiguity-based (neighbour) matrices, the inverse distance, and the inverse distance raised to some power or exponential distance decay matrix (Bulty et al. 2023). The selection of spatial weight matrices is characterised by a great deal of arbitrariness, which causes a problem in inference. As the spatial weight matrix should also be theoretically grounded, this

research produced the metrics based on the three methods to visually analyse and decide on the one that is most suitable. Each matrix is then row-normalised to ensure comparability.

The contiguity-based (neighbour) method is effective in accounting for provinces in close proximity, emphasising immediate spatial relationships. The inverse distance method, on the other hand, ensures coverage of the entire nation, diminishing the influence of distance but considering all regions. Conversely, the inverse distance-decay method combines the advantages of both the neighbour and inverse distance approaches. While maintaining a focus on nearby provinces, this method also accounts for more distant provinces, thus providing a more comprehensive view of spatial relationships.

The efficacy of the inverse distance-decay method, particularly in highlighting regional influences, is further corroborated by visual maps in the Appendix A (Figure A2). These maps display the weights of three sample provinces—Bangkok, Chiang Mai, and Phuket—and are shown in the Appendix A. The visualisation reveals that the inverse distance-decay weights are superior in illustrating regional influence, especially in cases like Bangkok, which is surrounded by many other provinces. Therefore, in our analysis, a distance-decay parameter, denoted as α (alpha), was employed to emphasise regional influences over nationwide effects, setting α to 0.01%. This value was chosen to balance the focus between local and broader geographical Impacts, aligning with the literature that regional factors are significant in the context of economic interdependencies and regional variation.

3.3. Spatial Econometric Tests

In the field of spatial econometrics, particularly in handling panel data, several tests are conducted to determine the most appropriate model. A key test is the Hausman test, which is essential for choosing between fixed or random effects models. This test evaluates the consistency of an estimator under random effects in comparison to its efficiency under fixed effects. The Hausman test produced a chi-square statistic of 34.016 with 19 degrees of freedom, leading to a significant p-value of 0.0183. This result suggests that the fixed-effects model is more suitable for this analysis.

The Baltagi, Song, and Koh LM2 marginal test, applied using the "splm" package in R (Millo and Piras 2012), is utilised to detect spatial lag or autoregression in the data (Baltagi et al. 2003). Specifically, it aids in addressing RQ2 by allowing us to detect the extent to which economic outcomes in one province are potentially conditioned by those in its vicinity. The robust statistic of 27.854 and the highly significant p-value (<0.001) from the LM2 test in our analysis provide compelling evidence that spatial dependencies are present and influential.

Lastly, the Granger causality test for the panel data, as suggested by Dumitrescu and Hurlin (2012), is employed to assess potential causal relationships. This test is crucial in determining whether one variable can predict another. Identifying these relationships is vital, as they significantly influence the choice of model estimation method. The panel Granger causality test is available in the "plm" package in R (Croissant and Millo 2008). The test uncovered complex interactions between average household income and various economic sectors, exhibiting direct, inverse, and bi-directional Granger-causality relationships. A notable limitation of this analysis is the biannual frequency of household income data, necessitating its pairing with biannual sectoral GDP data. This limitation restricts the availability of figures to the year immediately preceding the year of the outcome variable. While the results are insightful, caution should be exercised in interpreting their implications due to the discontinuity in data. Nevertheless, the findings suggest potential "simultaneity" between sectoral GDP and household income, highlighting the importance of incorporating appropriate spatial econometric estimators.

3.4. Spatial Lag Model (SLM) with Fixed Effects

The Hausman test indicates the need to incorporate a fixed effect into the selected model. Additionally, the Baltagi, Song, and Koh LM2 marginal test suggests the essential inclusion of a spatial lag. Consequently, this study adopts the Spatial Lag Model (SLM)

(Bivand et al. 2021). The SLM, also known as the Spatial Autoregressive Model (SAR), is a fundamental component of spatial econometric models. It focuses on incorporating spatial dependence by including a spatially lagged dependent variable. SLM or SAR is a robust econometric model that has been insightfully used to analyze a variety of outcomes, including economic growth (Álvarez et al. 2016; Amidi et al. 2020), crime (Chanci et al. 2023), COVID-19 cases (Guliyev 2020), and pollution (Xie et al. 2019). In this model, the dependent variable for each spatial unit is regressed not only on the independent variables but also on the values of the dependent variable of nearby provinces (see Equation (1)).

$$Y_{it} = \lambda W Y_{it} + X_{it}\beta + \alpha_i + \gamma_t + \varepsilon_{it} \quad (1)$$

where Y_{it} is the dependent variable for province i at time t. λ is the coefficient for the spatial lag. W is the spatial weights matrix. X_{it} is a matrix of independent variables for province i at time t. α_i is the province-specific fixed effect. γ_t is the time-specific fixed effect. ε_{it} represents the error term for each province at each time point.

The inclusion of temporally lagged dependent and independent variables was considered. However, this approach posed a potential risk of exacerbating multicollinearity. To address these concerns while still exploring the temporal dynamics of the data, the SLM model was adapted to include temporally lagged independent variables, resulting in $\mathrm{SLM_t}$. In the $\mathrm{SLM_{t-1}}$ model, sets of independent variables from previous time periods ($t-1$) were used to predict outcomes in subsequent periods. For instance, in $\mathrm{SLM_{t-1}}$, sectoral Gross Provincial Product (GPP) data from 2020 were utilised to model the average household income of 2021. This approach of employing separate temporally lagged models allows for an enhanced understanding of the temporal impact of economic sectors on average household income, providing valuable insights into the temporal dimension without further complicating the model structure. Additionally, one-period temporally lagged independent variables are used as instrumental variables, a technique that is elaborated upon in the following section. This method further incorporates the temporal dimension into the model without presenting more independent variables.

3.5. Estimation of the Models

In the estimation of SLM model with fixed effects, the Maximum Likelihood (ML) method was initially considered. However, this approach was subsequently dismissed due to signs of simultaneity in the data as shown in the Granger test results. To address these concerns, the Two-Stage Least Squares (2SLS) method was employed as an alternative to ML (Kapoor et al. 2007). The 2SLS approach is particularly adept at mitigating simultaneity issues, making it a more suitable choice for the data at hand (Reed 2015).

In the implementation of the 2SLS method for the panel data model with fixed effects, a specific strategy was adopted for dealing with the endogenous variables, which in this case were the 19 economic sectors. The independent variables were treated as endogenous, and their one-period temporally lagged values were utilised as instrumental variables in the 2SLS method (see Reed 2015). The Two-Stage Least Squares method for panel data with fixed effects was applied to fit all the models in this study, utilising the "splm" package in R.

3.6. Spatial Autocorrelations

Additional tests conducted to answer RQ2 include the use of Moran's I, an index that depicts the spatial autocorrelation characteristics of average household income among provinces from 2005 to 2021. In this paper, the global Moran's I is employed, which typically ranges between -1 and 1. A value greater than zero signifies positive autocorrelation, whereas a value less than zero indicates negative autocorrelation. This analysis was performed using the "spdep" package in R (Bivand et al. 2015).

The global Moran's I measure, commonly used to assess spatial autocorrelation, offers a general indication of how similar or dissimilar values are across a geographic space. However, it is limited in identifying specific local patterns, as it summarises the entire

spatial distribution into a single statistic. While it can detect overall clustering of high-value and low-value areas or the juxtaposition of high and low values, it cannot discern if both types of clustering coexist. To overcome this, Local Indicators of Spatial Association (LISA) decomposes the global Moran's I, allowing for the assessment of local spatial patterns (Anselin 1995). LISA can identify local clusters of high values (hot spots) or low values, as well as outliers and regions that deviate from the expected spatial pattern. This method enhances the interpretation of spatial data by highlighting local clusters where similar values are geographically concentrated (HH or LL) or where contrasting values are adjacent (HL or LH), thus providing an intricate understanding of the spatial distribution of economic activities (de Dominicis et al. 2007).

4. Findings

4.1. Descriptive Statistics and Moran's I of Variables

Table 1 provides a breakdown of the Gross Provincial Product (GPP) for each of the 76 provinces in Thailand, categorised by 19 economic sectors for the year 2021, with all values expressed in million Baht. The sectors range widely from agriculture to other services, with average monthly household income as a dependent variable. The manufacturing sector stands out with the highest mean GPP across the provinces (37,626 million Baht), indicating a strong presence of manufacturing activities throughout Thailand. On the opposite end, the water supply, sewerage, and waste management sector shows the lowest mean (724 million Baht), suggesting a smaller economic footprint in the provinces.

Table 1. Descriptive Statistics, Mean, and Standard Deviation, of the Independent and Dependent Variables of the Year 2021 in million Baht.

Sector	Mean	SD	Min	1st Qu.	Median	3rd Qu.	Max
Agriculture	8447	5773	1208	3974	7104	10,779	27,130
Mining	2595	14,329	0	84	163	605	124,005
Manufacturing	37,626	77,202	290	2195	5225	17,573	353,793
Electricity	3902	7353	147	608	1167	3143	47,664
Water	724	2518	28	100	169	367	21,181
Construction	3964	9354	660	1449	2017	3330	81,588
Retail	21,902	99,299	751	2675	4823	11,047	866,546
Transport	6880	29,289	270	826	1390	2526	248,752
Food	4856	26,770	13	148	385	2074	232,937
Information	8492	56,928	231	564	997	1694	496,946
Finance	11,492	62,048	586	1885	3052	5535	544,070
Real estate	5804	13,546	731	1804	3313	5482	117,443
Professional	2662	18,298	1	15	35	191	159,036
Support	1799	10,214	4	29	87	281	87,715
Public	7064	34,780	502	1324	2060	4424	305,008
Education	4455	7848	433	1483	2626	4475	66,012
Health	3393	8328	408	997	1472	2810	68,858
Leisure	1453	8244	34	106	184	322	68,551
Others	2082	11,506	116	232	391	755	100,478
Household Income (Baht per month)	24,671	5800	15,496	20,671	23,596	27,000	41,129

The substantial standard deviation in the retail (99,299 million Baht) and manufacturing (77,202 million Baht) sectors implies significant disparities in GPP between provinces within these sectors, possibly due to the varying presence of industrial and commercial hubs. The vast range between the minimum and maximum values across most sectors indicates a heterogeneity in economic activity, with some provinces showing very high GPP and others much lower.

The time series chart (Figure 1) tracks the average Gross Provincial Product (GPP) of 76 provinces across 19 sectors from 2005 to 2021. It illustrates a pronounced growth trend

in the manufacturing sector, which shows a steady and substantial increase over the years. The wholesale and retail sector also exhibits a significant upward trajectory, reflecting the sector's expansion over the period. Financial and insurance alongside information and communication, though not as pronounced as manufacturing and retail, demonstrate notable growth trends, indicative of Thailand's strengthening service economy.

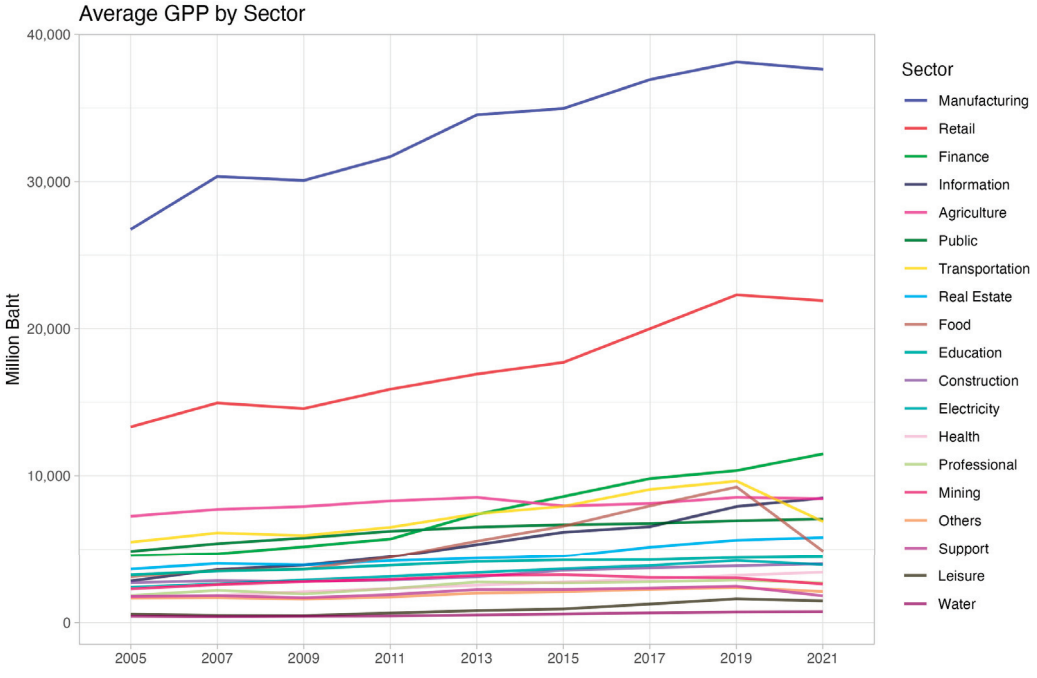

Figure 1. Time Series Chart of the Average GPP by Sector (2005–2021).

However, the chart also captures the impact of the pandemic, particularly on the transportation and accommodation and food services sectors, which experienced sharp declines, reflecting global travel restrictions and reduced consumer spending in these areas during this period. The remaining sectors, including agriculture, education, and health, among others, display relatively stable trends with no significant fluctuations, suggesting resilience or steadiness in their economic output throughout the years.

Regarding the dependent variable, the Moran's I statistics were computed (Table 2). The analysis, underpinned by a distance-decay spatial weighted function revealed significant positive spatial autocorrelation in all observed years (2005–2021), with Moran's I values ranging from 0.306 to 0.451 and p-values consistently below 0.001. These results indicate that provinces with similar income levels tend to be geographically clustered. The variation in Moran's I values across different years suggests fluctuating degrees of this clustering effect. For instance, the highest value in 2005 (0.451) points to a stronger geographic clustering of provinces with similar income levels, whereas the value in 2011 (0.306), though lower, still indicates a significant but less pronounced clustering pattern. Consequently, due to the observed autocorrelation as indicated by Moran's I, spatial econometric modelling is deemed more appropriate than conventional econometric methods.

Table 2. Moran's I Test for Spatial Autocorrelation of Average Household Income.

Year	Moran's I	*p*-Value
2005	0.451	<0.001
2007	0.401	<0.001
2009	0.355	<0.001
2011	0.306	<0.001
2013	0.378	<0.001
2015	0.311	<0.001
2017	0.400	<0.001
2019	0.321	<0.001
2021	0.376	<0.001

The map of Thailand displaying the average household income by province in 2021 vividly illustrates the income disparity across different regions (Figure 2). The colour gradient represents various income levels, with lighter shades indicating higher income. Bangkok metropolitan appears as a significant area of high income, as expected due to its status as the capital and economic hub. Additionally, the Eastern region and certain parts of the Southern region also display elevated income figures. Conversely, the provinces in the Northern and Northeastern regions are broadly marked with darker shades, signifying lower average household incomes. The LISA cluster map reinforces these observations by presenting clusters of high-income provinces (H-H) in darker shades, particularly in the Bangkok metropolitan area, some Central region provinces, and the Eastern Economic Corridor. Conversely, clusters in the Northern region, as well as a large area in the Northeastern region, exhibit low-income clusters (L-L).

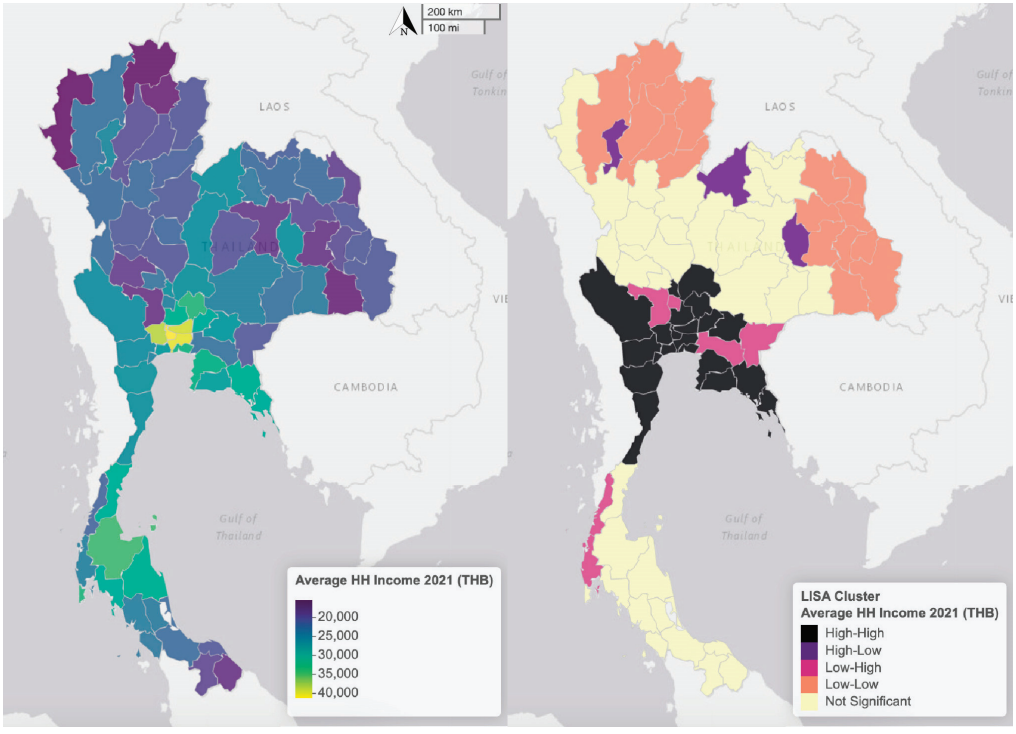

Figure 2. Average Monthly Household Income in Baht by Province and LISA Cluster Map.

4.2. Results of the Spatial Econometric Models

Table 3 presents the empirical results from the application of the SLM and its lagged version, SLM_{t-1}. These models play a pivotal role in shedding light on the impact of sectoral economic activities on income, particularly focusing on the spatial lag effect, denoted by lambda (λ). The consistently positive and statistically significant λ values in both models (0.989 and 0.994, with *p*-values < 0.001) reveal the presence of spatial spillover effects. Specifically, they indicate that household income in one province is positively correlated with the income levels in nearby provinces. This finding implies that the economic health of a region can be, in part, influenced by the financial success of its surrounding areas.

Table 3. The Results of Spatial Lag Models.

Independent Variables	SLM	SLM_{t-1}
Spatial lag coeff. (λ)	0.989 ***	0.994 ***
Agriculture	0.172 **	0.188 **
Mining	−0.038	−0.018
Manufacturing	0.001	0.009
Electricity	−0.016	−0.075
Water	−0.714	−0.140
Construction	0.034	−0.028
Retail	−0.056	−0.061
Transport	−0.022	−0.040
Food	0.024	0.041
Information	−0.034	−0.007
Finance	−0.031	0.026
Real estate	0.560 ***	0.705 ***
Professional	0.471 ***	0.051
Support	0.175	0.470 **
Public	0.071	0.038
Education	0.207	0.076
Health	−0.379 **	−0.514 **
Leisure	0.289 *	0.561 **
Others	−1.030 **	−1.581 ***
Pseudo R^2	0.872	0.874
RMSE	2457	2444

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.001$.

The analysis indicates that certain sectors consistently exhibit a positive correlation with average household income. Notably, the *agricultural* sector—which includes a range of activities from farming to fishing—displays a strong positive link with household income across both models. This relationship highlights the essential role of agriculture in sustaining rural economies and suggests that variations in agricultural output are directly connected to the economic health of provincial households. However, the earlier Granger causality tests cautions against interpreting this link as strictly predictive or causal. It likely points to a symbiotic relationship, where the success of the sector and the growth in household income are mutually reinforcing. Additionally, the *real estate* sector, encompassing property development and sales, shows a significant positive association in both models. This relationship may reflect the immediate economic benefits derived from real estate activities, which could suggest the sector's impact on employment opportunities and local income levels in the short term—and the potential feedback effect of these economic conditions on the real estate sector itself.

Professional, scientific, and technical services, which range from legal and accounting to architectural services, exhibit variability in their influence on household income. They are significantly associated with the average household income in the SLM model. *Administration and support services*, essential to the functioning of both public and private sectors, also show a positive association with income in the SLM_{t-1} model. Finally, the

leisure sector, which includes arts, entertainment, and recreation, presents a significant positive relationship with household income in the SLM_{t-1} model. This pattern indicates a short-term relationship between leisure-related economic activities and income.

While the SLM and SLM_{t-1} models' results point to significant sectoral associations with household income, the simultaneity and the presence of bidirectional causality emphasise the need for careful interpretation. The two-stage least squares (2SLS) regression employed helps to address simultaneity concerns but does not eliminate them entirely. Thus, while sectoral GPP may be associated with household income, this relationship is intricate and possibly co-determined by income levels themselves.

4.3. Spatial Correlation and Regional Variations in Selected Economic Sectors

The analysis of spatial correlation in five key economic sectors significantly associated with average household income provides valuable insights into how these sectors are geographically distributed and interrelated across regions. Moran's I was computed for two key features of each sector: the Compound Annual Growth Rate (CAGR) from 2005 to 2021, and the sectoral productivity (Gross Provincial Product, GPP) per capita in 2021 (Table 4). The benefit of such an analysis is multifaceted; it not only highlights regions with similar growth patterns or productivity levels but also helps in identifying potential areas of spatial dependency or autocorrelation. This information is crucial for policymakers and investors aiming to understand regional economic disparities and for devising strategies to foster balanced regional development.

Table 4. Moran's I of the CAGR and Productivity Per Capita of the Five Sectors.

Sector		Moran's I	*p*-Value
Agriculture forestry and fishing	CAGR	0.262	<0.001
	Per Capita	0.353	<0.001
Real estate activities	CAGR	0.051	0.044
	Per Capita	0.316	<0.001
Professional scientific and technical activities	CAGR	−0.059	0.897
	Per Capita	0.074	<0.001
Administrative and support service activities	CAGR	0.045	0.059
	Per Capita	0.173	<0.001
Arts entertainment and recreation	CAGR	0.202	<0.001
	Per Capita	0.063	0.001

The Moran's I results reveal varying degrees of spatial correlation across sectors and attributes. For example, the agriculture, forestry, and fishing sectors exhibit a significant positive spatial correlation in both CAGR (Moran's I = 0.262, $p < 0.001$) and per capita productivity (Moran's I = 0.353, $p < 0.001$). This suggests that regions with high growth or productivity in this sector tend to be geographically clustered. Similar patterns are observed in the real estate activities and arts, entertainment, and recreation sectors, indicating that regions with high productivity or growth in these sectors are likely to be near other regions with similar characteristics.

Conversely, sectors such as professional, scientific, and technical activities, and administrative and support service activities show no significant spatial correlation in their CAGR (Moran's I = −0.059, $p = 0.897$ for the former and Moran's I = 0.045, $p = 0.059$ for the latter). This suggests a more dispersed spatial distribution of growth rates across regions.

Figure 3 offers a comprehensive visual analysis of five key economic sectors in Thailand, showcasing the CAGR from 2005 to 2021, productivity per capita in 2021, and LISA cluster maps for each sector. In the *agricultural* sector, the CAGR maps reveal a pronounced cluster of high growth across the entire Northeastern region, contrasting with low growth in the Central region and the deep South of Thailand. However, the productivity per capita maps indicate a starkly different scenario; the Northeastern region is identified as a low productivity cluster in agriculture, while the Southern region boasts high productivity. This

contrast suggests that although the Northeastern region has seen substantial growth, it still lags in productivity, indicating a potential area for targeted development. The *real estate* sector presents a strong dichotomy. The Bangkok Metropolitan area and the Eastern provinces are highlighted as regions of high productivity per capita. The Eastern region also emerges as a high-growth area, pointing to a significant divergence in growth and prosperity within the real estate sector across the country.

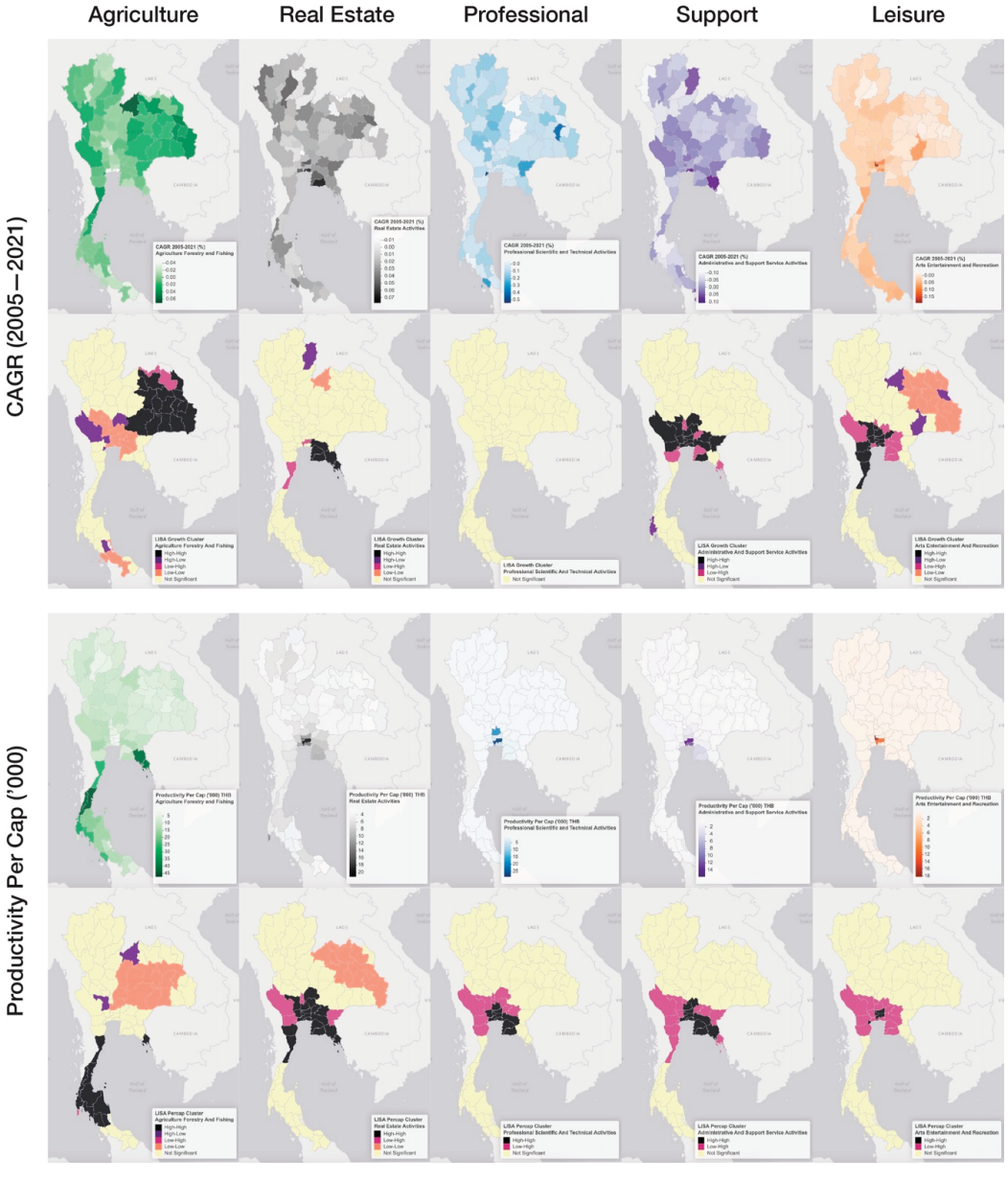

Figure 3. CAGR and Productivity Per Capita of the Five Sectors and the LISA Maps.

The *professional, scientific, and technical services* sector does not exhibit a clear growth pattern according to the global Moran's I results. Nevertheless, the productivity per capita is highly concentrated in the Bangkok Metropolitan area and the Eastern region, reinforcing these areas as economic hubs for advanced services. *Administrative and support service* activities' growth, while lacking spatial correlation globally, demonstrates regional high-growth clusters in the Bangkok Metropolitan area and parts of the Central and Eastern regions through the LISA Cluster maps. The pattern for productivity per capita mirrors that of professional activities, with high values clustered in Bangkok and the Eastern region. For the *leisure* sector, encompassing arts, entertainment, and recreation, there is a consistent concentration of high productivity per capita in Bangkok and its neighbouring provinces, Nonthaburi and Pathum Thani. The central area of Thailand is noted for the sector's growth, whereas the Northeastern region is distinctly marked by low growth.

The LISA cluster maps presented in Figure 3 are invaluable for discerning the distinctive characteristics and trends within Thailand's key economic sectors. These maps highlight the spatial variability and disparities that exist, providing crucial insights that can inform and shape development policies by public sector entities.

5. Discussion and Conclusions

5.1. Discussion of the Findings

In the analysis of RQ1, "what are the effects of changes in various economic sectors on average household income?", the study leverages the data from official sources to develop predictive models. Specifically, it employs Spatial Lag Models (SLM) and their temporally adjusted variants (SLM_{t-1}) to delve into the effects of sectoral Gross Provincial Product (GPP) on household income. The findings indicate a potential simultaneity issue, suggesting that sectoral productivity (GPP) and average household income may be mutually reinforcing, rather than exhibiting a straightforward causal relationship.

To mitigate the simultaneity issue, a 2SLS estimator with fixed effects was employed. The analysis revealed that five sectors—agriculture, real estate, professional services, support services, and leisure—demonstrate a significant association with average household income in either or both models. Conversely, health-related sectors and other services show a negative association with average household income. These findings contribute to an expanded understanding of sectoral effects on income.

In the context of Thailand, the growth of key economic sectors is often seen as indicative of increased household income. Agriculture, for instance, employs about 30 percent of the labor force. However, this sector is characterised by relatively low income and productivity.[11] Therefore, improvements in agricultural productivity are strongly associated with an increase in average household income. Additionally, the sectors of professional, scientific, and technical activities, along with administrative and support activities, can be viewed as integral to enhancing 'business capacity' within a province. These sectors contribute significantly to innovation, competitive advantage, and management efficiency, all of which are closely linked to average household income.

The real estate and leisure sectors also emerge as distinct markers of increased average household income. However, there may be a bi-directional relationship at play, as these sectors are likely to benefit from the increased disposable income of the populace. The study observes no direct correlation between sectors such as retail, wholesale, and food services, and average household income, which calls for more in-depth analysis. Nonetheless, this absence of apparent relationships should be interpreted with caution due to the potential for multicollinearity in datasets of this nature.

Traditional economic theories often outline a linear transition from agriculture to industrial, service, and knowledge sectors, highlighting the transformative impact of each stage on economic development (Kuznets 2019). This paper presents an original examination of the impact of sectoral GDP at a provincial level on household income. While this study is contextually bound to Thailand, and its applicability to other settings may be limited, it provides critical lessons for economic policy. The findings serve as

an empirical foundation for strategies aimed at fostering household income growth and highlight the importance of sector-specific policies.

In response to RQ2, "what are the roles and characteristics of spatial dependencies on the effects of economic sectors and the dynamics of household income?", the application of SLM and subsequent analysis have been instrumental. The findings demonstrate a pronounced spatial autoregression, suggesting that the household income of one province can be significantly influenced by the income levels in nearby provinces. This aligns with existing literature that emphasises spatial correlation (Basile 2009; Garrett et al. 2007).

The study also conducted global Moran's I and LISA analyses on household income, growth, and GPP per capita across five key sectors. These analyses yield a two-part answer to RQ2. First, there is an apparent spatial autoregressive effect on household income, with a cluster of high-income provinces centred around the Bangkok Metropolitan region and the Eastern region, confirming a previous study (Sajarattanochote and Poon 2009). This reflects agglomeration principles outlined in the literature, including backward linkages, innovative activity, and skilled labour pooling, which foster economic activity concentration in specific regions (Barrios et al. 2009).

Second, sectors such as agriculture, real estate, professional and support services, and leisure, identified as potential income drivers, are predominantly clustered in this same high-income region. While existing literature discusses the convergence hypothesis, where lower-income regions gradually align with higher-income counterparts (Chambers and Dhongde 2016; Gebremariam et al. 2010), this study reveals a contrasting scenario in Thailand's economic landscape. The spatial concentration of key sectors around affluent areas like Bangkok and the Eastern region signals enduring spatial inequality. However, this could be viewed through the lens of a "Kuznets-like" structural process, characterised by a shift from agricultural to industrial and service-based sectors and an initial increase in income inequality, potentially reducing over time (Kuznets 2019). Thailand may not have reached the point where spatial inequality begins to diminish.

Despite theoretical frameworks suggesting otherwise, this study's evidence implies that the spatial concentration of wealth and economic activities in already prosperous areas might not adequately address regional income disparities, given the low growth trajectories of these sectors across different regions. Consequently, addressing spatial inequality emerges as a critical task, necessitating collaborative efforts from both public and private sectors. The subsequent section delves deeper into strategies and recommendations, underlining the vital role of policy interventions in promoting equitable regional development.

5.2. Policy Implications

The findings of this research raise questions about the long-term effectiveness of Thailand's digital wallet scheme. The SLM models demonstrated no direct association between the wholesale, retail, and food service sectors and household income throughout the study period. While these results do not entirely dismiss the value of the economic stimulus or downplay the importance of these sectors—which are integral to Thailand's economy and interconnected with other sectors—they do highlight the need for a more considered approach in policymaking. The lack of direct influence between these sectors and the improvement of household income suggests that a more strategic sector- and place-based policy could be more effective.

5.2.1. Accelerating Industry Clusters and Innovation Districts

The sectoral and spatial insights from this research highlight the need for policies that specifically address these issues. The first key implication centres on accelerating economic clusters to boost household income throughout Thailand while concurrently addressing the spatial inequality identified in the study. The findings entail the crucial role of industry clusters in regional development, a strategy globally recognised for promoting economic growth (Stimson et al. 2006).

In Thailand, economic clusters, especially in advanced manufacturing within affluent regions like the Eastern area, have been a focus for decades (Klaitabtim 2016). However, the existing top-down approach often misses the distinctions of local realities (Kamnuansilpa et al. 2023). This study's insights, particularly concerning five key sectors—agriculture, real estate, professional services, support services, and leisure—suggest a more refined approach to implementing cluster policies.

Firstly, the sectors of professional, scientific, and technical services, along with administrative and support services, can be simultaneously regarded as sectors aimed at driving 'business capacity' in a province and are strongly associated with average household income. This research found that the improvement of business capacity is related to increased income. These findings echo the calls within Thailand for improvements in business processes, strategic planning, technical expertise, and coordination to bolster the functioning of industry clusters (Lengwiriyakul and Jarernsiripornkul 2017; Phochathan 2016; Thongprasert et al. 2023; Vanarun 2019).

This leads to the concept of "innovation districts", a variant of small-scale economic clusters, which can significantly enhance the business capacity of enterprises and other sectors within a province. Innovation districts, leveraging the presence of universities and colleges as anchors, can facilitate public, private, and community collaborations. The integration of these educational institutions is pivotal for enhancing clusters in Thailand (Abhinorasaeth et al. 2021; Hansamorn et al. 2019). The existing literature also links the role of higher education institutions to regional income growth (Liu et al. 2018; Ramos et al. 2010; Su and Heshmati 2013; Teslenko et al. 2021). The innovation districts not only drive innovation and business capacity but also contribute to the vibrancy of real estate and leisure sectors (Taecharungroj and Millington 2022).

Innovation districts in Thailand should aim to break away from a one-size-fits-all, prescriptive nationwide policy. Different regions may require distinct types of innovation districts, tailored to their unique economic landscapes and resource availability. The effectiveness of small-scale, place-based development has been recognised as crucial for regional progress in Thailand (Moore and Donaldson 2016; Suranartyuth 2011). These districts would provide a conducive environment for nurturing new businesses, fostering research and development, encouraging collaboration across various sectors and fostering specialisation which is important for regional growth (Piras et al. 2012). In this context, a strategic focus on high-value agriculture as a spearhead project in innovation districts nationwide could be highly beneficial. Such a focus would leverage Thailand's agricultural strengths, driving innovation in a sector that directly affects a large portion of the population. By integrating advanced technologies and practices into agriculture, these districts could significantly enhance household income, particularly in rural areas.

5.2.2. Improving Regulatory Framework and Province Branding

While Thailand already has various business-friendly regulations, such as tax incentives and streamlined licensing processes, these benefits have predominantly been geared towards top-down clusters in wealthier regions, with a focus on attracting large-scale investments and enhancing export opportunities (Klaitabtim 2016). To foster more inclusive economic growth, it is essential for government policies to extend support to businesses within the five strategic sectors, especially small-scale enterprises. In addition to offering tax breaks and reducing regulatory burdens, there is a need to provide more comprehensive support, including human capital development and funding opportunities.

Another crucial aspect of place-based policy that could significantly enhance strategic sectors and income levels is the concept of "place branding" for provinces. Place branding goes beyond merely attracting tourists; it can be a powerful tool in drawing investment, entrepreneurs, and businesses to targeted provinces (Che 2008; Cleave et al. 2016; Mabillard and Vuignier 2021; Roozen et al. 2017; Rothschild et al. 2012; Sparvero and Chalip 2007; Wisuchat and Taecharungroj 2022). By effectively presenting the unique business opportunities and quality of life each province offers, place branding can play

a pivotal role in mitigating spatial inequality and boosting income. The combination of business and quality of life factors has been recognised as an important driver of regional growth (Carruthers and Mulligan 2008). In Thailand, where place branding has traditionally focused on tourism, pivoting towards promoting it for business, investment, and talent attraction could direct resources to and stimulate agglomeration within key economic sectors.

5.3. Conclusions

This research offers significant insights into the dynamics of household income and spatial economic interactions in Thailand, with a focus on the effects of various economic sectors and spatial dependencies. Notably, agriculture, real estate, professional services, support services, and leisure sectors emerge as significant predictors of household income. The study's exploration of spatial effects reveals critical spatial autocorrelation patterns. This emphasises the importance of considering regional interdependencies and variation in economic policymaking. The identification of high-income clusters around the Bangkok Metropolitan and Eastern regions, juxtaposed with the enduring spatial inequality in other areas, calls for a more progressive approach to economic development. Policy implications drawn from this research suggest alternatives to the substantial digital wallet scheme and emphasise the need to accelerate industry clusters and innovation districts, especially in less affluent regions, to promote equitable economic growth. The research advocates for a more inclusive regulatory framework and strategic use of place branding to attract investment and encourage regional development.

The limitations of this research are primarily rooted in its data constraints and the choice of econometric model. A key limitation is the temporally limited nature of the biannual average household income data spanning from 2005 to 2021. This biannual frequency restricts the temporal resolution of the analysis and may overlook subtler year-to-year variations that could offer deeper insights. Another notable limitation is the challenge posed by the often less normally distributed data, particularly with provinces like Bangkok exhibiting outsized levels compared to others. While a log transformation could have normalised the data distribution, it was not performed due to the presence of zero values in some sectors of certain provinces. Also, the potential multicollinearity among the independent variables is another limitation. The interpretation, especially regarding the size of the effects and the absence of certain relationships, should be approached with caution. Further study utilising machine learning (ML) techniques is advisable. The SLM employed in this study is a robust spatial econometric model for panel data that effectively accounts for spatial autoregressive characteristics. However, it is important to acknowledge that there are alternative models and techniques that could further enrich the analysis. These alternatives, potentially offering different perspectives and insights, could be considered in future research to overcome some of the limitations of the current study and provide a more comprehensive understanding of the phenomena.

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Appendix A

Appendix A.1. Nineteen Sectors Comprising Thailand's Gross Provincial Products

Appendix A.1.1. Agriculture

- *Agriculture, forestry, and fishing*: Farming; Animal breeding and stocking, animal hunting and related service activities; Forestry and logging; Fisheries and aquaculture.

Appendix A.1.2. Industrial

- *Mining and quarrying:* Coal and lignite mining; Production of crude oil and natural gas; Mining of metal ores; Mining Nonmetal Mine and other quarries; Service activities that support mining and petroleum production.
- *Manufacturing:* Production of food products, beverage, tobacco products, textile, clothing, leather goods, wood and products from wood and cork, paper and products processed from paper, coke and petroleum products, chemicals and chemical products, pharmaceutical products, rubber and plastic products, products made from non-metallic minerals, aluminium alloy, products made from fabricated metal, computer products, electronics and optical equipment, electrical equipment, machinery and tools, vehicles, trailers and semi-trailers, other transportation equipment, furniture, and other types of products; Repair and installation of machinery and equipment; Printing and reproducing recording media
- *Electricity, gas, steam, and air conditioning supply*
- *Water supply, sewerage, waste management, and remediation activities:* Water storage, supply, and distribution; Waste management; Waste collection, treatment, and disposal; Recycling of waste; Treatment activities and other waste collection services

Appendix A.1.3. Services

- *Construction:* Building construction; Civil engineering work; Special construction work
- *Wholesale and retail trade and repair of motor vehicles and motorcycle*
- *Transportation and storage:* Land transport and pipeline transport; Water transportation; Air transportation; Warehouse-related activities and transportation support; Postal and delivery of documents/items.
- *Accommodation and food service activities*: Accommodation; Guesthouses; Food and beverage services.
- *Information and communication:* Publishing, selling, or distributing; Film, video, and television program production, Recording and distribution of music; Television program management and broadcasting; Telecommunications; Computer program preparation and consulting; Information services.
- *Financial and insurance activities:* Financial service; Insurance and Pension Funds; Activities supporting financial services and insurance.
- *Real estate activities*
- *Professional, scientific, and technical activities:* Legal and accounting; Head office activities; Management consulting; International trade business representative; Architecture and engineering, testing and technical analysis; Scientific research and development; Advertising and market research; Other professional, scientific, and technical activities; Veterinary.
- *Administrative and support service activities:* Renting and leasing; Recruitment; Travel business agent, travel organising and reservation business; Security and investigative service activities; Service activities for buildings and landscaping; Business support services.
- *Public administration and defence; compulsory social security*
- *Education*
- *Human health and social work activities:* Human health activities; Caregiving; Social welfare.

- *Arts, entertainment, and recreation:* Creative arts and entertainment; Library, archives, museum, and cultural activities; Gambling; Sports and recreation activities.
- *Other service activities:* Activities of member organisations; Religious organisations; Repair and maintenance; Personal services; Household services; Homemade products; Activities of international organisations

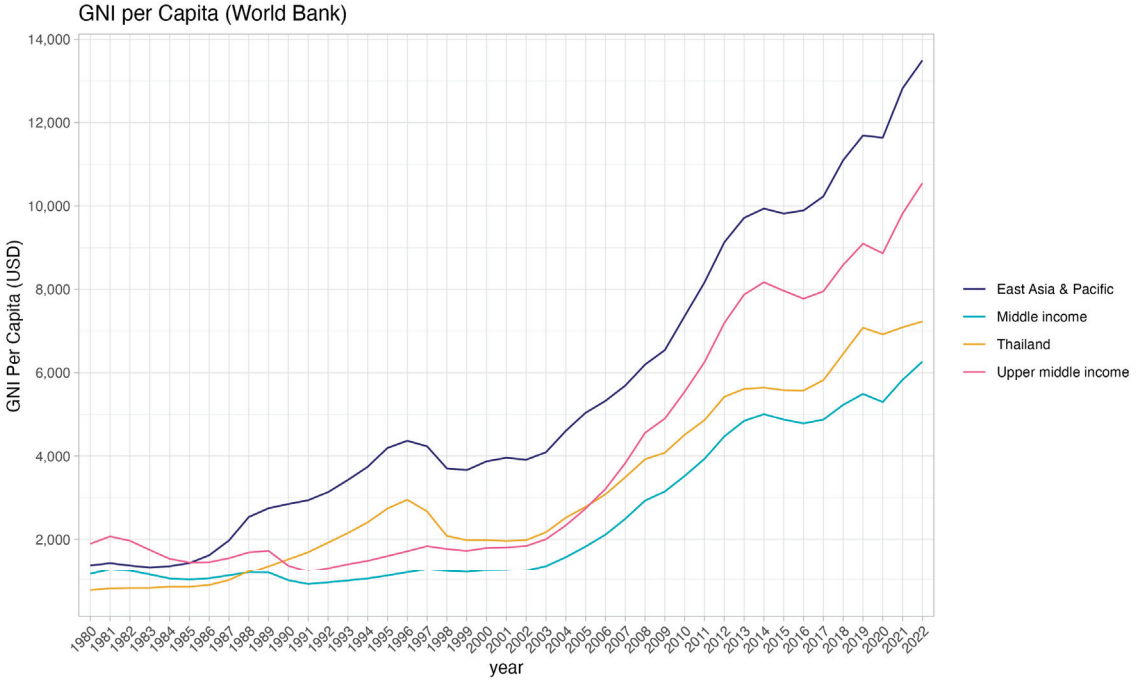

Figure A1. GNI Per Capita Comparison between Thailand, East Asia & Pacific, Middle Income, and Upper-Middle Income Countries.

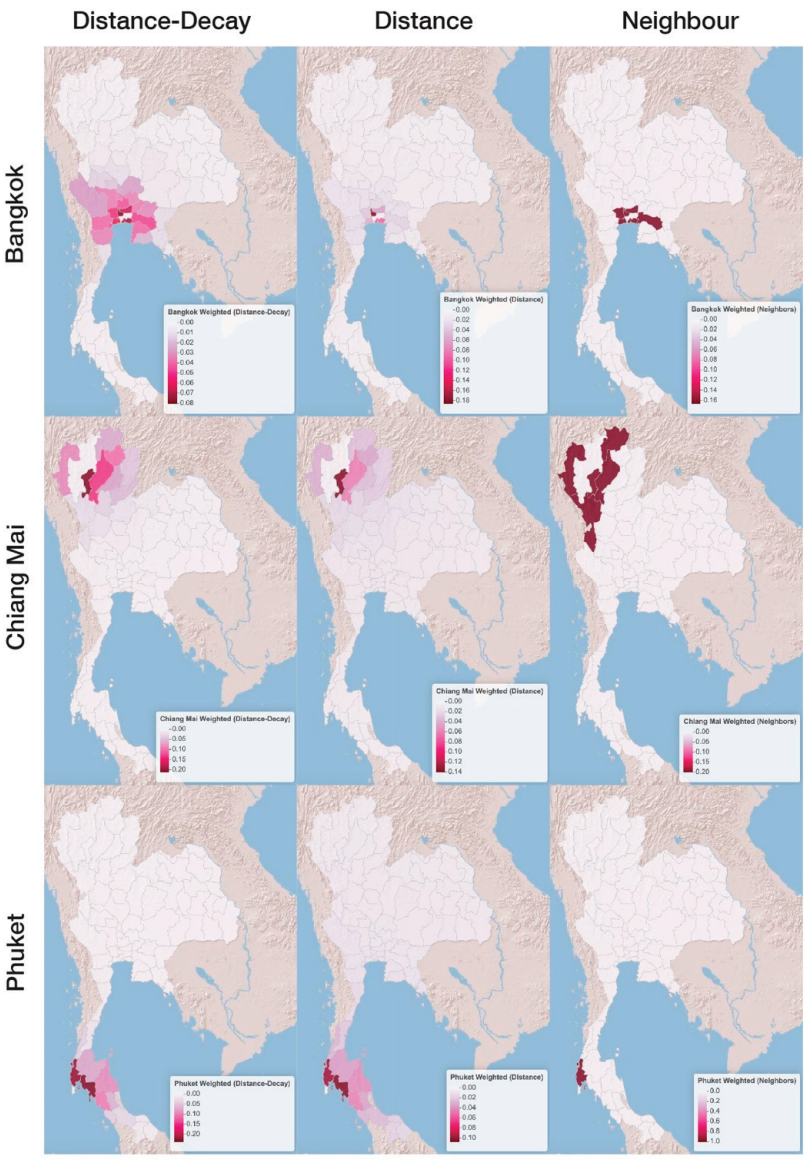

Figure A2. The visual representation of spatial weights on Bangkok, Chiang Mai, and Phuket using the three methods.

Notes

1 https://www.thailand-business-news.com/economics/111713-digital-wallet-scheme-aimed-at-boosting-businesses-and-stimulating-the-economy (accessed on 13 January 2024).

2 See note 1 above

3 https://plus.thairath.co.th/topic/politics&society/103921 (accessed on 13 January 2024).

4 https://ptp.or.th/ (accessed on 13 January 2024).

5 https://www.dbs.com/in/corporate/aics/templatedata/article/generic/data/en/GR/112023/231114_insights_thailand.xml (accessed on 13 January 2024).

6 https://time.com/6333748/thailand-digital-wallet-cash-handout/ (accessed on 13 January 2024).

[7] https://www.nationthailand.com/thailand/politics/40032219 (accessed on 13 January 2024).

[8] The average household income by province in Thailand can be accessed at http://statbbi.nso.go.th/staticreport/page/sector/th/08.aspx (accessed on 13 January 2024).

[9] The GPP data of Thailand can be accessed at https://www.nesdc.go.th/main.php?filename=gross_regional (accessed on 13 January 2024).

[10] The collection and calculation of GPP can be retrieved from Office of the Official Information Commission (OIC) at http://webcache.googleusercontent.com/search?client=firefox-b-d&q=cache:oic.go.th/FILEWEB/CABINFOCENTER4/DRAWER052/GENERAL/DATA0002/00002224.PDF (accessed on 13 January 2024). The document was produced by the Comptroller General's Department.

[11] https://thailand.un.org/en/103307-thai-agricultural-sector-problems-solutions (accessed on 13 January 2024).

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Urbanization and Health Expenditure: An Empirical Investigation from Households in Vietnam

Hang Thu Nguyen-Phung [1,2,*] and Hai Le [3]

[1] Research Division, Asian Growth Research Institute, Fukuoka 803-0814, Japan
[2] Faculty of Information Technology, Hanoi University, Hanoi 100000, Vietnam
[3] Department of Business, Swinburne Vietnam, FPT University, Hanoi 700000, Vietnam; hailv16@fe.edu.vn
* Correspondence: nguyen@agi.or.jp

Abstract: This study examines the effects of urbanization on household health expenditure. Using a unique bi-annually household-level dataset from 2012–2016 from Vietnam, we obtain key findings as follows. To mitigate possible endogeneity concerns, we utilize a two-stage least squares regression (2SLS) approach, employing the development of information and communication (ICT) infrastructure at the province level as an instrumental variable (IV). The key findings can be summarized as follows. First, urbanization significantly reduces Vietnamese households' inpatient and outpatient health expenses. Second, the self-treatment expenses of households increase as the process of urbanization advances. In addition, we perform various robustness checks, encompassing different measures of urbanization, the use of lag of urbanization as an additional IV, and the plausible exogenous IV. The outcomes derived from these rigorous sensitivity analyses substantiate the reliability and consistency of our key results. Finally, we propose different ways to explain these results, including health insurance expenses and household income.

Keywords: urbanization; health expenditure; health insurance; instrumental variable; ICT; VHLSS

Subject Classification Codes: D10; I10; I15; I31; O10; O18

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1. Introduction

Industrialization, along with the rapid development of technology, has fueled the expansion of urban areas globally (see, e.g., Shao et al. 2022; Zheng and Walsh 2019; Gollin et al. 2016). Urbanization is now considered an inevitable and essential trend for the progress of human society (see, e.g., Wang and Xu 2023; Zhu et al. 2022). It stimulates economic growth by creating demand and generating opportunities for innovation and development. According to the World Cities Report 2022 of the United Nations Human Settlements Programme (UN-Habitat), the world will continue to urbanize for the next 30 years, with urban areas accounting for all population growth. Additionally, although there has been some temporary migration from urban to rural areas due to the COVID-19 pandemic, this is not expected to change the overall trend toward urbanization. This means that the percentage of the world's population living in urban regions is expected to rise by 12% from 56% in 2021 to 68% in 2050, representing an additional 2.2 billion urban residents, with Africa and Asia experiencing the most remarkable growth. All regions of the world will become more urbanized, but developed regions may experience a decline in urban growth rate. Urbanization refers to the process of transformation from rural living to an urban lifestyle that can have significant implications for people's health and well-being.[1] The effects of urbanization on health can be intricate and diverse, including both favorable and unfavorable outcomes (Yang et al. 2013). On the one hand, urbanization can provide access to better healthcare resources and services, potentially leading to improved health outcomes for residents (Dye 2008). On the other hand, urbanization can also lead to

adverse health outcomes, such as increased exposure to environmental pollutants and the adoption of sedentary lifestyles (see, e.g., Li et al. 2012; Van de Poel et al. 2012). Healthcare expenditure is a vital part of residents' daily expenses that encompasses spending on medicines, medical, and health services and is considered a crucial indicator of the quality of life (Nguyen-Phung and Le 2024). The impact of urbanization on healthcare expenditure is also a complex issue that varies depending on several factors. As urbanization progresses, residents may face higher healthcare costs due to increased demand for healthcare resources and services and changes in health behavior. On the other hand, urbanization can also lead to enhancements in healthcare infrastructure and better public health outcomes, reducing healthcare costs in the long run (Shen and Sun 2023; Shao et al. 2022). Therefore, it is imperative to investigate the impact of urbanization on healthcare expenditure to understand its potential effects on residents' quality of life and economic development.

Urbanization in Vietnam has been rapid and profound, with the urban population increasing from around 20% in 1990 to over 38% in 2021, according to the 2018 Revision of World Urbanization Prospects of the United Nations Population Division. This growth has been driven by industrialization, urbanization policies, and migration from rural to urban regions. Furthermore, the political reforms enacted during the 1980s facilitated enhanced economic stability in Vietnam over the subsequent decade, thereby fostering heightened levels of urbanization. While larger cities like Ho Chi Minh City and Hanoi have experienced the fastest growth, smaller towns and cities have also witnessed substantial increases in both population and economic activity. One primary driver of urbanization in Vietnam has been industrialization, particularly in the manufacturing and service sectors. As Vietnam has opened up to foreign investment and trade, many multinational corporations have established factories and offices in the country's major cities. This has created job opportunities and driven economic growth but has also led to environmental degradation and social inequality, as low-skilled workers are often concentrated in informal settlements with poor living conditions. Another factor driving urbanization in Vietnam is government policy. The implementation of economic reforms in the 1980s, known as "Doi Moi", brought about increased economic stability in Vietnam. This newfound stability resulted in higher levels of urbanization in the following decade as people began to move from rural to urban areas in search of better jobs and living conditions. This trend was particularly noticeable in major cities such as Hanoi and Ho Chi Minh City, which experienced significant growth during this period. In recent decades, the Vietnamese government has instituted various policies to promote urbanization as a strategy to attain economic growth and modernization. This has involved investment in infrastructure, such as roads, bridges, and public transportation systems, to support urban growth. More specifically, in order to facilitate and manage the development of urbanization effectively, the Vietnamese government introduced the 2009 Adjustment of Orientation Master Plan for Urban Development until 2025 with a vision to 2050 (AOMP). Two national programs for urban development supplement the AOMP. First, the 2009 National Urban Upgrading Program (NUUP) was introduced to support the implementation of the AOMP and to target interventions in disadvantaged urban areas. Second, the 2012 National Urban Development Program (NUDP) was implemented to provide better-defined mechanisms for the AOMP and to align it with the Socio-economic Development Strategy further. Additionally, the Socio-economic Development Strategy 2011–2020 (SEDS) and the Vietnam Sustainable Development Strategy 2011–2020 offer overall guidance for development in Vietnam. Given these well-established urban policy frameworks, Vietnam is expected to experience a continued upward trend in urbanization rates. It is essential to recognize that healthcare expenditure among residents has increased significantly in Vietnam over the past few years alongside the process of urbanization. According to the Global Health Expenditure database of the World Health Organization, the per capita health expenditure in 2020 is USD 180.72, which is equivalent to an increase of USD 71.78 compared to 2012.

Given the significant impact of urbanization on residents' lifestyles, it is crucial to explore the relationship between urbanization and healthcare expenditure. Such research

would be of practical significance for urban management and policy development in Vietnam. As urbanization progresses, residents' healthcare demands and behaviors may change, potentially leading to increased healthcare expenditure. Understanding these potential effects can inform policy decisions related to healthcare infrastructure development and resource allocation. Therefore, research on the relationship between urbanization and healthcare expenditure is crucial for effectively managing the impact of urbanization on residents' quality of life in Vietnam. To the best of our knowledge, this is the first study examining the impacts of urbanization on household health expenditure in Vietnam. Using unique household-level data collection from 2012 to 2016 in Vietnam, we obtain the following key results. First, urbanization leads to a significant decrease in inpatient and outpatient health costs incurred by Vietnamese households. Second, the self-treatment expenses of households tend to rise as urbanization progresses. Several robustness checks conducted on the key findings confirm their validity.

The remainder of this study is structured as follows. Section 2 presents the related literature. Section 3 describes research data and variable definitions. Section 4 reports the research methodology. Section 5 presents empirical findings, including the main results, several robustness checks, and pathways. Section 6 provides conclusions and discusses the main results.

2. Related Literature

2.1. Impacts of Urbanization on Health and Health Expenditure

2.1.1. Impacts of Urbanization on Health

The effects of urbanization on human well-being are dual in nature. On the one hand, urbanization can offer increased accessibility to health services and improved water quality and sanitation infrastructure (see, e.g., Shen and Sun 2023; Shao et al. 2022; Miao and Wu 2016). For instance, Shen and Sun (2023) construct panel data from the China Family Panel Study (CFPS) and use the difference-in-difference approach to investigate the impact of the in situ urbanization policy (IUP) on individual health.[2] They demonstrate that in contrast to other forms of urbanization that have been associated with adverse effects on mental health and increased smoking or alcohol consumption, this policy substantially improves self-reported health status among the affected population. They explain that the implementation of IUP can potentially enhance individuals' optimism for the future, contentment with their present circumstances, and enrollment in medical insurance, ultimately leading to better self-reported health status.

On the other hand, several studies demonstrate that urbanization may give rise to stressful lifestyles, higher mortality, nutritionally imbalanced diets, excessive weight, hypertension, and greater metabolic and cancer risks, all of which can contribute to poor health outcomes (see, e.g., Fu and Land 2017; Danaei et al. 2013; Attard et al. 2012; Gong et al. 2012; Li et al. 2012; Van de Poel et al. 2012). As an example, Li et al. (2012) employ remote sensing image analysis that is based on night light data to study the impacts of urbanization on human health in China. They find that the transformation of the urban environment and residents' lifestyles as a consequence of urbanization and urban expansion leads to health issues. Furthermore, their analysis shows that areas that experience greater degrees of urbanization tend to have a greater prevalence of chronic diseases.

2.1.2. Impacts of Urbanization on Health Expenditure

There have been few studies that have explored the nexus between urbanization and healthcare expenses. For instance, Thornton and Rice (2008) employ US data in 1998 for 50 states to examine the factors influencing healthcare spending. Their analysis reveals solid empirical evidence that states with lower levels of urbanization have higher healthcare spending. Wang (2009) re-examines the factors that influence health expenditure using 5-year US state-level data from 1999 to 2003 and finds that urbanization reduces health expenditure similarly. He demonstrates that the resulting effect of urbanization is understandable, given that providing healthcare to populations living in rural regions is far

more expensive than those in urban areas. Shao et al. (2022), using a fixed-effect framework and annual data from 31 Chinese provinces from 2001 to 2019, examine the effect of urbanization on healthcare expenditure. They find a substantial rise in healthcare spending in Eastern and Central regions, which can be attributed to the process of urbanization. However, the influence of urbanization on healthcare spending in the Western region is negligible, possibly due to the region's low urbanization rate and underdeveloped economy.

2.2. Underlying Pathways of the Effects of Urbanization on Health Expenditure

One notable limitation of existing empirical research on the connection between urbanization and health expenditure is that they do not provide a comprehensive explanation of the pathways through which urbanization affects health expenditure. Nonetheless, two possible mechanisms are explored.

The first channel is health insurance. Health insurance has been found to substantially increase household access to and utilization of health services, thereby facilitating healthcare financing (Anderson et al. 2012; Harmon and Nolan 2001; Ifeagwu et al. 2021). In addition, it functions as a safeguard against excessive healthcare costs, which can lead to financial hardship (Lim et al. 2023). Empirical evidence suggests that enrollment in the health insurance program is closely linked with a reduction in inpatient and outpatient medical expenses across all demographics, with a more pronounced effect observed among individuals with lower socioeconomic status in Vietnam (Thanh et al. 2019; Jowett et al. 2004). The effect of health insurance on health-seeking behavior has yielded inconsistent findings in the literature. While some studies have reported a positive impact (Al-Hanawi et al. 2020; Levine et al. 2016; Waters et al. 2004), others have found no discernible effect (Raza et al. 2016) or adverse effects (Wagstaff and Lindelow 2008). However, empirical evidence suggests that health insurance can enhance the accessibility of high-quality healthcare services for impoverished or marginalized households (Duc Thanh et al. 2021; Sparrow et al. 2013).

The second pathway is household income, which has been proven to enhance health outcomes significantly (Frijters et al. 2005; Marmot 2002; Ettner 1996). Households that experience income growth over time tend to utilize more healthcare services since they are more concerned about the quality of medical care and may be more willing to pay for better healthcare services. Therefore, high-income households usually incur more health-related expenses (Dang 2018).

3. Sample Construction

3.1. Data Source

The primary data source for this research is the Vietnam Household Living Standard Surveys (VHLSS) from 2012 to 2016. These surveys were conducted bi-annually by the General Statistics Office of Vietnam (GSO) in collaboration with the World Bank. They provide various information on households and individuals, such as their demographic characteristics, employment status, and health expenditure. Information on the head of household is also provided in this data.

Data on the urbanization of each province are extracted from the Statistical Yearbook of General Statistics Offices of Vietnam. Other data on province characteristics are collected from different sources. The unemployment rate is extracted from the "Report of Labor and Employment" conducted by GSO. Data on government revenue at the provincial level is collected from the Ministry of Finance of Vietnam.

Information about households' adoption of information communication technology (ICT) is obtained from the "Vietnam ICT Index", a report on assessing and ranking the readiness level for IT development and application in different provinces in Vietnam gathered by the Ministry of Information and Communications and the Vietnam Informatics Association. The ICT index, which has existed since 2005, demonstrates the readiness of Vietnamese provinces for ICT and has been published annually since 2005. The purpose of the index is to assist local governments in improving ICT access for households and businesses, thereby reducing income inequality in the region.

3.2. Variable Definitions

Our main covariate is urbanization, which is collected at the province level. In this study, we employ a share of the urban population to the total population as the main proxy for urbanization. We also use alternative proxies of urbanization, namely the natural logarithm form of urban population and population density, in our robustness check section.

We consider two different aspects of household health expenditure when investigating the impacts of urbanization, including inpatient and outpatient health expenses (IOHEs), which are computed as a sum of hospitalization costs and outpatient costs; self-treatment expenses (STEs), which consist of household's expenditure on purchasing medicines without prescriptions and household's expenditure on purchasing medical appliances and equipment (e.g., blood pressure monitors, phlegm absorbers, clinical thermometers).

In investigating the effects of urbanization on household health expenditure, we control for three main groups of characteristics. The selection of covariates in this study was grounded in both theoretical principles and practical significance, aligning with previous studies (Çetin and Bakırtaş 2019; Zhang et al. 2023). First, we include information on the age, education level, marital status, and male gender of the head of the household. In addition, we gather household data, such as the number of individuals in the household (household size), the proportion of dependents (dependent ratio), the location of residence, the household's total value of assets, and house ownership. Finally, we control province-level characteristics, including the unemployment rate and local government revenue.

To address the potential endogeneity that might occur due to the omitted variable bias, we use the ICT index. The information on ICT is gathered from each province and reflects their level of preparedness for the ICT environment and advancements between 2012 and 2016. The computation of the ICT index considers various aspects, such as technical infrastructure, human resources, applications, manufacturing and business, organization, and the policy environment. Tables 1 and 2 present the variable definition and summary statistics, respectively. On average, nearly 29% of the population lives in urban areas.

Table 1. Variable definitions.

Variables	Type	Description	Source
Inpatient and outpatient health expenses	Continuous	Natural log of a sum of hospitalization and outpatient costs	VHLSS
Self-treatment expenses	Continuous	Natural log of a sum of household's expenditure on medicines without prescription and household's expenditure on medical facilities	VHLSS
Urbanization	Continuous	Average urban population by province	Statistical Yearbook of General Statistics Offices of Vietnam
Relative urban intensity	Continuous	Urban population divided by total population for each province	Statistical Yearbook of General Statistics Offices of Vietnam
Age of the household head	Continuous	Age of the household head	VHLSS
Marital status	Categorical	Marital status of the household head	VHLSS
Level of education	Categorical	Level of education of the household head	VHLSS
Male	Dummy	Gender of the household head	VHLSS
Rural	Dummy	Location of residence: whether rural or urban	VHLSS
Household size	Continuous	Household size	VHLSS
Dependent ratio	Continuous	Ratio of dependent people (less than 6 years old and greater than 60 years old)	VHLSS
Total value of household assets	Continuous	Total value of assets in the household	VHLSS
Home ownership	Categorical	Household owns house or not	VHLSS
Government revenue	Continuous	Government revenue at provincial level	Ministry of Finance
Unemployment rates	Continuous	Unemployment rate at provincial level	Statistical Yearbook of General Statistics Offices of Vietnam
Expenditure on insurance	Continuous	Natural log of household's expenditure on health insurance	VHLSS
Household's total income	Continuous	Household's income in the last 12 months (thousand VND)	VHLSS

Notes: VHLSSs stand for Vietnam Household Living Standards Surveys.

Table 2. Descriptive statistics.

Variables	N	Mean	SD	Min	Max
Log of in/outpatient health expenses	16,786	6.781	2.350	0	13.12
Log of self-treatment expenses	16,786	5.676	2.097	0	17.03
Relative urban population	16,786	29.21	18.70	9.718	87.28
ICT Index	16,786	44.99	12.19	9.130	94.07
Head of household's age	16,786	51.33	13.97	13	105
Head of household's age squared	16,786	2830	1547	169	11,025
Head of household's male	16,786	0.752	0.432	0	1
Head of household's level of education	16,786	1.533	1.192	0	4
Head of household's marital status	16,786	0.803	0.397	0	1
Household size	16,786	3.833	1.570	1	13
Dependent ratio	16,786	0.239	0.217	0	1
House ownership	16,786	0.964	0.185	0	1
Location of residence	16,786	0.709	0.454	0	1
Log of total asset value	16,786	9.922	1.305	3.401	14.85
Log of province's revenue	16,786	15.60	1.497	11.47	19.75
Provincial unemployment rate	16,786	2.216	3.310	0	19

Notes: SD: standard deviation, N: number of observations. Source: Authors' own calculations.

4. Research Methodology

4.1. Baseline Models: Fixed-Effect Regressions

To investigate the effects of urbanization on health expenditure of households, we present the following econometric model:

$$Y_{ipt} = \alpha_0 + \alpha_1 Urb_{pt} + \alpha_2' \boldsymbol{X} + \mu_i + \mu_t + \varepsilon_{ipt} \quad (1)$$

where Y_{ipt} denotes the health expenditure of household i in province p in year t. In this study, we use two measures to proxy for the health expenditure, namely inpatient and outpatient health expenses (IOHEs) and self-treatment expenses (STEs). Urb_{pt}, defined as a share of urban population to the total population in province p in year t, is the main explanatory variable in our model. $\boldsymbol{X}$ denotes a set of control variables. Specifically, we control for: (1) several characteristics of the head of household, including age, squared term of age, gender, education level, and marital status; (2) various characteristics of the household, including household's total assets, household size, house ownership, the ratio of dependent people in the household, location of residence; (3) province-level characteristics, including the unemployment rate and local government revenue. α_0, α_1, and α_2 are unknown parameters. μ_i indicates an individual fixed effect, μ_t is the provincial time trend, and ε_{ipt} is an error term.[3]

4.2. Two-Stage Least Square Regressions

The abovementioned fixed-effect (FE) regressions might suffer endogeneity issues arising from the omitted variable bias (OVB). Therefore, we employ the two-stage least square regression to address any plausible endogeneity problems. Specifically, we use Internet communication technology (ICT) development at the provincial level as an instrumental variable (IV) for our key explanatory variables. The rationale for utilizing this particular instrument is explained as follows. First, a strong correlation probably exists between ICT deployment and the degree of urbanization in each province. For instance, ICT development enables people to access information more easily and quickly. This can help people make informed decisions about where to live, work, and invest, leading to increased urbanization. In addition, ICT deployment can improve communication between people, businesses, and governments, making it easier to coordinate activities and share resources. This can lead to more efficient and effective urbanization. These justifications are confirmed in our sample as indicated in Appendix A Table A1 when the correlation between ICT development and urbanization is relatively high (approximately 0.59). Second,

health expenditure is unlikely to have a direct correlation with the level of ICT adoption. This is confirmed because the correlation between health expenditure and ICT appears relatively low (0.10).

We utilize the two-stage least square framework to estimate the impacts of urbanization on household health expenditure. In the first stage, we extract the exogenous part of urbanization that is not related to the error term by performing a regression of urbanization (Urb_{pt}) on ICT (ICT_{pt}), other control variables ($\boldsymbol{X}$), individual fixed effect (η_i), and time trend (η_t):

$$Urb_{pt} = \delta_0 + \delta_1 ICT_{pt} + \boldsymbol{\delta_2}'\boldsymbol{X} + \eta_i + \eta_t + u_{ipt} \tag{2a}$$

where ICT_{pt} denotes the ICT in province p in year t. δ_0, δ_1, and $\boldsymbol{\delta_2}'$ are parameters and u_{ipt} is an error term. The predicted value of urbanization $\hat{Urb}_{pt}$ obtained from this regression is then employed as the main covariate in the following second stage:

$$Y_{ipt} = \beta_0 + \beta_1 \hat{Urb}_{pt} + \boldsymbol{\beta_2}'\boldsymbol{X} + \zeta_i + \zeta_t + \vartheta_{ipt} \tag{2b}$$

We assume that ICT_{pt} is uncorrelated with the household's IOHEs and STEs. Now β_1 can be referred to as the causal effect of urbanization on IOHEs and STEs of households. Note that this method is often referred to as a fixed-effect instrumental variable (FEIV) framework.

4.3. Plausibly Exogenous IV

Generally, the instrumental variable method may be used to handle endogenous problems, including missing variables, sample selection, spurious relationships, and measurement error, which contradict the standard linear regression assumption to some extent. According to Conley et al. (2012), the classic IV assumption corresponds to exclusion restriction if the instrumental variable ICT_{pt} can only influence the dependent variable Y_{ipt} via the independent variable Urb_{pt}, which means $\gamma = 0$ in the equations below:

$$Urb_{pt} = \delta_0 + \delta_1 ICT_{pt} + \boldsymbol{\delta_2}'\boldsymbol{X} + \eta_i + \eta_t + u_{ipt} \tag{3a}$$

$$Y_{ipt} = \beta_0 + \beta_1 Urb_{pt} + \gamma ICT_{pt} + \boldsymbol{\beta_2}'\boldsymbol{X} + \zeta_i + \zeta_t + \vartheta_{ipt} \tag{3b}$$

However, when the instrument is plausibly exogenous, $\gamma \approx 0$, suggesting that the instrumental variable ICT_{pt} may be slightly associated with Y_{ipt}. In other words, we allow ICT index to affect IOHEs and STEs directly. If γ is known, consistent estimates of the effect of interest, the urbanization, can be obtained via approaches proposed by Conley et al. (2012). We specifically employ the Union of Confidence Intervals (UCI). This framework postulates that $\gamma \in \Gamma$ where Γ is the bounded support of γ and this support $\Gamma = [-\delta, \delta]$ for different values of δ. The magnitude of this δ in our case is based on prior information about the reduced form estimates of the household's health expenditure on ICT Index (Meierrieks and Renner 2023; Guo 2020). We then can consistently estimate β through 2SLS and compute a union of the resulting confidence interval which consists of β for all values γ within the support Γ. Provided that $\gamma \in \Gamma$, the union will encompass the true parameter value of β.

5. Empirical Findings

This section presents the estimated results for the impacts of urbanization on households' IOHEs and STEs. To be more specific, we perform a number of exercises as follows. First, we examine the effects of urbanization using the fixed-effect models. Second, to address the endogeneity problem associated with the fixed-effect regressions, we perform the instrumental variable regressions with fixed effects. We then conduct a series of robustness checks to confirm the sensitivity of our main results. Additionally, we relax the condition of IV of exclusion restriction and conduct a test based on Conley et al. (2012). Finally, we provide potential mechanisms.

5.1. Main Results

Table 3 presents estimated results for the FE and FEIV models. A log transformation is performed on all expense variables. Panel A1 in Table 3 implies a statistically insignificant reduction of 11 percentage point IOHEs for every one percent growth in the urban population. Our A2 model employs the instrument in 2SLS to demonstrate that an additional one percent in urban population results in a 36.4 percentage point decrease in IOHEs. Findings from both the FE and FEIV models indicate, in general, a negative nexus exists between the relative urban population and the amount of money households spend on inpatient and outpatient treatment. The endogeneity of the urban population further collaborates with our hypothesis that FE biases the estimates downward, which is supported by the results from our preferred FEIV model.

Table 3. Effects of urbanization on household's health expenditure.

	FE	**FEIV**
Panel A: Inpatient and outpatient health expenses (IOHEs)	**(A1)**	**(A2)**
Relative urban population	−0.011	−0.364 **
	(0.015)	(0.180)
Number of observations	16,786	16,786
R-squared	0.008	−0.043
Number of households	6582	6582
Kleibergen–Paap rk LM statistic (Underidentification test)		80.2
Kleibergen–Paap rk Wald F statistic (Weak identification test)		78.565
First-stage results		
ICT Index		0.021 ***
		(0.002)
Panel B: Self-treatment expenses (STEs)	**(B1)**	**(B2)**
Relative urban population	0.058 ***	0.344 **
	(0.013)	(0.154)
Number of observations	16,786	16,786
R-squared	0.025	−0.024
Number of households	6582	6582
Kleibergen–Paap rk LM statistic (Underidentification test)		80.2
Kleibergen–Paap rk Wald F statistic (Weak identification test)		78.565
First-stage results		
ICT Index		0.021 ***
		(0.002)

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.[4] Source: Authors' own calculations.

Panel B in Table 3 displays the findings for self-treatment expenses. According to the FE results, model B1 predicts this spending will rise by approximately 5.8 percentage points for an additional one percent of the urban population. The FEIV results in model B2 demonstrate that STEs rise by about 34.4 percentage points for every extra one percent increase in urbanization. Again, FE biases the estimates of the effects of urbanization.

Furthermore, our first-stage findings in Table 3 show that a 10 percent rise in the ICT Index translates into a 0.21 percentage point increase in the urban population. The finding is statistically significant. The reliability of the instrument has been confirmed by a Kleibergen–Paap rk Wald F statistic being over 10. In general, Table 3 shows that FEIV findings point to lower expenditure on inpatient and outpatient treatment and greater spending on self-treatment expenses as a consequence of the increasing urban population. We also present the full results of FEIV estimates in Appendix A Table A2 and re-estimate these findings with different clusters for the standard errors, summarizing the results in Appendix A Table A3.

We conduct an array of robustness tests on the key findings. First, instead of employing the relative urban population, we use the natural log of urban population and the natural log of population density as the instrumented variables. This is to ensure that the obtained outcomes remain unaffected by the definition of variables, or the functional structure of the model being estimated. The estimated results are presented in Table 4. These results further collaborate with our main findings in Table 3.

Table 4. Robustness checks: Different proxies for urbanization.

	In/Outpatient Health Expenses	Self-Treatment Expenses	In/Outpatient Health Expenses	Self-Treatment Expenses
Log of urban population	−5.549 **	5.240 **		
	(2.712)	(2.321)		
Log of population density			−11.160 **	10.539 **
			(5.575)	(4.809)
Number of observations	16,786	16,786	16,786	16,786
R-squared	−0.023	0.014	−0.123	−0.123
Number of households	6582	6582	6582	6582
Under. Id.	174.424	174.424	67.768	67.768
Weak id.	172.159	172.159	67.463	67.463
First-stage results				
ICT Index	0.001 ***	0.001 ***	0.001 ***	0.001 ***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Under. Id. refers to Kleibergen–Paap rk LM statistic. Weak id. refers to Kleibergen–Paap rk Wald F statistic. Source: Authors' own calculations.

We further investigate our main findings by employing the lag of relative urban as an additional IV. Table 5 presents the estimated results. On the whole, our key findings from this exercise are unaltered. Although the estimates of urbanization on IOHEs and STEs under this model are lower (in absolute values) than those under our FEIV, the signs remain unchanged. Specifically, a 1% rise in the relative urban population leads to a 4.4% reduction in IOHEs. Meanwhile, STEs rise by 7.7% when the relative urban population increases by 1%. Our key findings survive this robustness check. Note also that the Kleibergen–Paap rk Wald F statistic illustrates that our IVs are not weak. Furthermore, our models do not suffer an overidentification test as the Hansen J statistics cannot reject the null hypothesis at a 5% level.

Table 5. Robustness checks: Additional IV.

	Inpatient and Outpatient Health Expenses	Self-Treatment Expenses
Relative urban population	−0.044 *	0.077 ***
	(0.025)	(0.020)
Number of observations	16,786	16,786
R-squared	0.007	0.025
Number of households	6582	6582
Kleibergen–Paap rk LM statistic (Underidentification test)	926.43	926.43
Kleibergen–Paap rk Wald F statistic (Weak identification test)	450.797	450.797
Hansen J statistics (Overidentification test)	3.375	3.114
Hansen J statistics (*p*-value)	0.066	0.078
First-stage results		
ICT Index	0.014 ***	0.014 ***
	(0.002)	(0.002)
Lag of relative urban population	0.517 ***	0.517 ***
	(0.017)	(0.017)

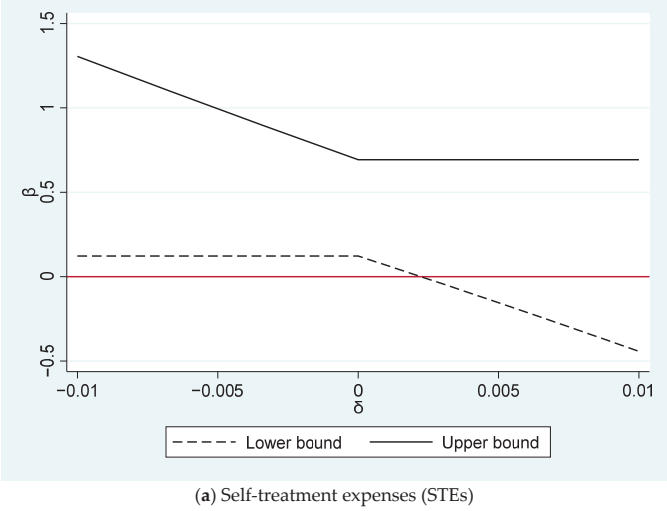
Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: Authors' own calculations.

5.2. Plausible Exogeneous IV

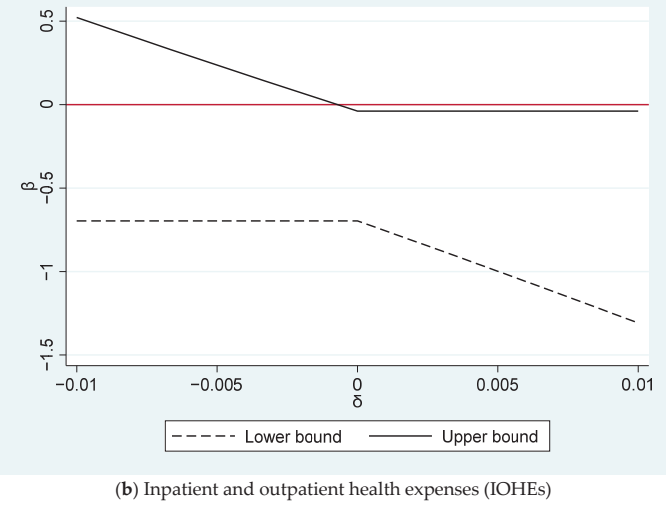
Although our chosen instrumental variables are evidently linked with the key variables, it is impossible to test the exclusion restriction due to the unobservable nature of the error term. As a result, we follow Conley et al. (2012) and utilize the union of all confidence intervals (UCI) approach to check our key findings when relaxing the exclusion restriction. This approach has been employed in previous studies (see, e.g., Zheng et al. 2023; Clarke

and Matta 2018). By permitting the direct effect of instrument variables on the dependent variable to vary within a certain range rather than assuming it to be zero, this approach can help to identify a plausible range of values for the effect of the endogenous variable on the outcome of interest, even in the presence of imperfect instrumental variables.

Figure 1 presents the estimated impacts of urbanization on our two main outcomes of interest (IOHEs and STEs) when the instrumental variable—ICT is plausibly exogenous. The dashed and solid lines illustrate the lower and upper bounds of the 95% confidence interval of urbanization, respectively. Overall, our FEIV estimates of the impacts of urbanization on IOHEs and STEs fall within the 95% confidence intervals computed for distinct values of δ. It is worth mentioning that δ here represents the coefficient of ICT after both the endogenous variable (urbanization) and the instrumental variable (ICT) are incorporated in the second-stage regressions. Accordingly, δ demonstrates the direct effect of ICT on IOHEs and STEs through channels other than urbanization.



(**a**) Self-treatment expenses (STEs)



(**b**) Inpatient and outpatient health expenses (IOHEs)

Figure 1. Plausible exogeneity for our IV–ICT: The 95% confidence intervals using Conley's UCI approach for the impacts of urbanization on inpatient and outpatient health expenses (IOHEs) and self-treatment expenses (STEs).

Figure 1a presents the estimated impacts of urbanization on STEs. When δ is negative, the bounds on the coefficient of urbanization (β) are comparatively further from 0 than the FEIV estimate of β, demonstrating that the conventional FEIV estimate underestimates the true impact of urbanization on STEs when a higher ICT index lowers STEs. Furthermore, we find that the 95% confidence interval for β includes 0 only when δ is larger than 0.002. It is worth mentioning that although we do not report the result here, our reduced form estimates of the impact of ICT on STEs is roughly 0.007. Accordingly, our bound of 0.002, which accounts for nearly 30% of the overall direct impact of ICT on STEs, is appropriate. Guo (2020) allows for significantly smaller deviations (25% of reduced-form coefficient) from perfect exogeneity. Thus, our findings still support the presence of a positive and significant impact of urbanization on STEs, even though we allow for a sizable departure from the assumption of perfect exogeneity.

The FEIV estimate of urbanization on IOHEs when the ICT index is plausibly exogenous is shown in Figure 1b. Clearly, the constraints on the estimated value of urbanization are significantly further away from 0 than the FEIV estimate of urbanization when δ is positive. This indicates that the conventional FEIV approach underestimates the negative impact of urbanization on IOHEs when a higher ICT increases IOHEs. Additionally, we still obtain significantly negative impacts of urbanization provided that δ is larger than -0.001. This limit is acceptable as it is equivalent to 14% of the overall direct effect of ICT on IOHEs from the reduced-form estimation (-0.007). In brief, we confirm our main result of a negative and significant impact of urbanization on IOHEs even though we allow for a reasonable distortion from the perfect exogeneity.

Similar results are obtained when we employ different proxies for urbanization. The results are presented in Figures A1 and A2 of Appendix B. Furthermore, we provide the additional robustness test using the local-to-zero methods of Conley et al. (2012). Overall, our key results are unaltered (see Table A4 of Appendix B).

5.3. Mechanisms

The key results indicate that urbanization lowers household spending on inpatient and outpatient treatment but raises expenditures on self-treatment. Thus, these findings suggest the plausibility of urbanization affecting health expenditure through two different pathways.

First, evidence suggests that urbanization leads to an expansion of health insurance. Results based on health insurance spending are shown in Table 6 model A1. The findings imply that an additional one percent of urbanization increases 118 percentage points in the amount of money households spend on insurance. The second is the household's total income. The results in Table 6 model A2 indicate that an extra percent of the urban population improves household earnings in the last 12 months by VND 9443 thousand (approximately USD 400).

Our main findings shed light on the impacts of urbanization on two aspects of health expenditure. It may seem surprising that urbanization leads to a decrease in hospitalization and outpatient health expenses. An increase in health insurance coverage partially explains this unexpected result. Expanding health insurance coverage can help defray the costs of hospitalization and outpatient care, thereby reducing the financial burden on households.[5] Previous literature also demonstrates that participation in health insurance programs correlates with a decrease in both inpatient and outpatient healthcare expenditures across diverse demographic groups, with a particularly notable impact evident among individuals of lower socioeconomic status in Vietnam (Thanh et al. 2019; Jowett et al. 2004). Furthermore, as household incomes rise, there is a growing concern regarding the quality of medical care, prompting a preference for better healthcare services. As a result, households frequently experience increased health-related expenses (Dang 2018).

Table 6. Possible pathways.

	(A1)	(A2)
	Insurance Expense	**Household's Total Income**
Relative urban population	0.780 ***	9422.991 ***
	(0.213)	(3189.222)
Number of observations	16,786	12,704
R-squared	−0.141	−0.065
Number of households	6582	5046
Kleibergen–Paap rk LM statistic (Underidentification test)	80.2	56.812
Kleibergen–Paap rk Wald F statistic (Weak identification test)	78.565	55.614
First-stage results		
ICT Index	0.021 ***	0.02 ***
	(0.002)	(0.003)

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: Authors' own calculations.

6. Conclusions and Policy Recommendations

The study investigates the relationship between urbanization and household health expenditure using a unique household-level dataset from Vietnam between 2012 and 2016. The study demonstrates that urbanization has a statistically significant influence on healthcare expenses, causing a decrease in inpatient and outpatient costs but an increase in self-treatment expenses. The results are robust across various sensitivity analyses. We also propose two different paths to explain these results. The presence of health insurance attenuates the effect of urbanization on hospitalization and outpatient costs, whereas the impact of urbanization on self-treatment expenses is strengthened in the presence of household income.

The findings of this research have potential policy implications. First, it is imperative to note that urbanization has been correlated with a decrease in hospitalization and outpatient expenses. Therefore, policymakers must prioritize the provision of accessible and cost-effective healthcare services. The study also revealed that the presence of health insurance mitigates the impact of urbanization on inpatient and outpatient healthcare expenses. Consequently, the government must encourage households to obtain health insurance. Third, policymakers can promote the regularity of health check-ups among households as a preventive measure against the development of chronic diseases, thus, potentially reducing hospitalization and outpatient expenses. Finally, in order to guarantee equitable access to healthcare services regardless of income, policymakers must tackle the issue of income inequality.

This study is not without limitations. Given that health expenditure data are solely accessible at the household level, the study is unable to discern the impact of urbanization on individual health behaviors. Further research can conduct surveys and research at the individual level, thus, providing a more comprehensive insight into the linkage between urbanization and health expenditure.

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Appendix A. Supporting Results

Table A1. Correlation matrix.

	In/Outpatient Health Expenses	Self-Treatment Expenses	Relative Urban Population	ICTIndex
In/outpatient health expenses	1			
Self-treatment expenses	0.1918	1		
Relative urban population	0.0418	0.1012	1	
ICTIndex	0.0939	0.1451	0.5863	1
Observations	16,786	16,786	16,786	16,786

Source: Authors' own calculations.

Table A2. Full results of FEIV estimate in Table 3.

	In/Outpatient Health Expenses	Self-Treatment Expenses
Relative urban population	−0.364 **	0.344 **
	(0.180)	(0.154)
Head of household's age	0.017	0.020
	(0.022)	(0.018)
Age squared	−0.000	−0.000
	(0.000)	(0.000)
Head of household's gender	−0.182	−0.131
	(0.146)	(0.134)
Head of household's level of education	0.053	−0.002
	(0.044)	(0.037)
Head of household's marital status	0.379 ***	0.281 **
	(0.139)	(0.135)
Location of residence	−1.460	3.016 ***
	(1.056)	(0.888)
Household size	0.090 ***	0.115 ***
	(0.028)	(0.022)
Dependency ratio	−0.266	0.150
	(0.196)	(0.173)
Home ownership	0.052	−0.209
	(0.153)	(0.131)
Log of total asset value	0.106 ***	0.104 ***
	(0.035)	(0.030)
Provincial unemployment rate	0.004	0.035 **
	(0.020)	(0.017)
Log of province's revenue	0.309 ***	−0.067
	(0.107)	(0.088)
Observations	16,786	16,786
R-squared	−0.043	−0.024
Number of households	6582	6582

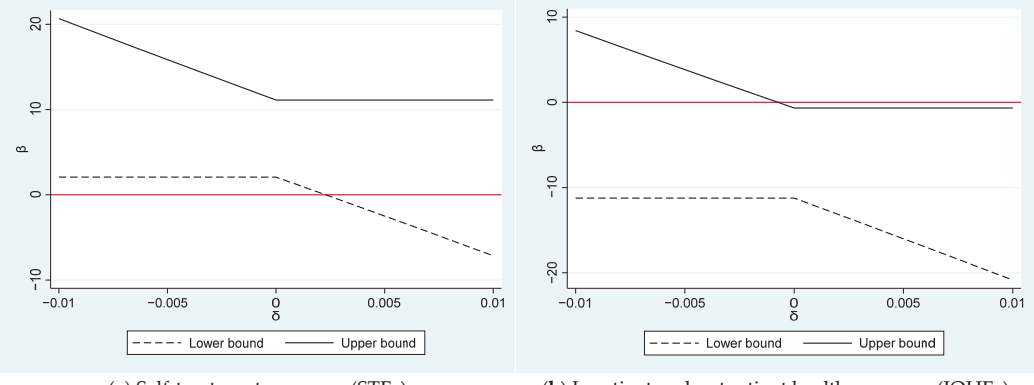
Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: Authors' own calculations.

Table A3. Additional specifications.

	In/Outpatient Health Expenses	Self-Treatment Expenses
Panel A: Standard errors are clustered at household level		
Relative urban population	−0.364 **	0.344 **
	(0.179)	(0.157)
Number of observations	16,786	16,786
R-squared	−0.043	−0.024
Number of households	6582	6582
Under. Id.	72.948	72.948
Weak id.	71.349	71.349
Panel B: Standard errors are clustered at commune level		
Relative urban population	−0.364 **	0.344 **
	(0.169)	(0.165)
Number of observations	16,786	16,786
R-squared	−0.043	−0.024
Number of households	6582	6582
Under. Id.	16.037	16.037
Weak id.	30.468	30.468
Panel C: Standard errors are clustered at district level		
Relative urban population	−0.364 *	0.344 *
	(0.169)	(0.165)
Number of observations	16,786	16,786
R-squared	−0.043	−0.024
Number of households	6582	6582
Under. Id.	27.321	27.321
Weak id.	26.611	26.611

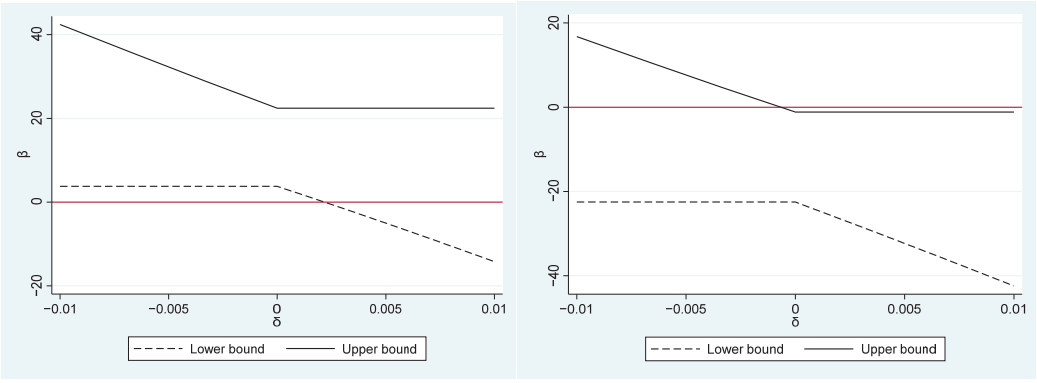
Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Under. Id. refers to Kleibergen–Paap rk LM statistic. Weak id. refers to Kleibergen–Paap rk Wald F statistic. Source: Authors' own calculations.

Appendix B. Additional Results for Conley's Methods



(**a**) Self-treatment expenses (STEs) (**b**) Inpatient and outpatient health expenses (IOHEs)

Figure A1. Plausible exogeneity for our IV–ICT: The 95% confidence intervals using Conley's UCI approach for the impacts of urbanization on inpatient and outpatient health expenses (IOHEs) and self-treatment expenses (STEs) (log of urban population).



(**a**) Self-treatment expenses (STEs) (**b**) Inpatient and outpatient health expenses (IOHEs)

Figure A2. Plausible exogeneity for our IV–ICT: The 95% confidence intervals using Conley's UCI approach for the impacts of urbanization on inpatient and outpatient health expenses (IOHEs) and self-treatment expenses (STEs) (log of population density).

Table A4. Conley's LTZ method estimation for instrumental variable.

Variables	IOHEs			STEs		
	Coef	Ro_std	95% CI	Coef	Ro_std	95% CI
Panel A. Effect of relative urban population on IOHEs and STEs						
Relative urban population	−0.368 **	0.177	[−0.715; −0.020]	0.408 ***	0.156	[0.101; 0.714]
Control variables	Yes			Yes		
Province × Year	Yes			Yes		
Observations	16,786			16,786		
Panel B. Effect of log of urban population on IOHEs and STEs						
Log of urban population	−5.951 **	2.848	[−11.533; −0.369]	6.598 ***	2.484	[1.730; 11.466]
Control variables	Yes			Yes		
Province × Year	Yes			Yes		
Observations	16,786			16,786		
Panel C. Effect of log of population density on IOHEs and STEs						
Log of population density	−11.822 **	5.747	[−23.085; −0.559]	13.108 **	5.094	[3.124; 23.091]
Control variables	Yes			Yes		
Province × Year	Yes			Yes		
Observations	16,786			16,786		

Notes: Coef = Coefficient, Ro_std = Robust standard errors, CI = Confidence interval. Control variables include age, education level, marital status, gender of the head of the household, household size, dependent ratio, location of residence, household's total assets, house ownership, unemployment rate, local government's revenue. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: Authors' own calculations.

Notes

1 It is worth mentioning that urbanization significantly impacts the socioeconomic dynamics of households. The process of urbanization offers numerous advantages, including improved infrastructure, expanded employment prospects, broader markets, and enhanced allocation of resources (Obi-Ani and Isiani 2020). Nonetheless, urbanization can heighten income inequality, widening the gap between affluent and impoverished households (Chen et al. 2016).

2 The in situ urbanization policy is often referred to as the process of converting villages into urban neighborhoods, which is closely connected to the commonly used term "reclassification". This involves changing the nature of settlements from rural to urban areas.

3 It is worth noting that we perform the Hausman specification test as a means to compare the fixed-effect regression with the random-effect counterpart. The associated chi-square statistics are equal to 78.66 and 129.48 for IOHEs and STEs, respectively. Accordingly, the null hypothesis is rejected at the 1% significance level for both IOHEs and STEs. This result demonstrates that when assessing the influences of urbanization on health expenditure, the fixed-effect regression emerges as the most suitable empirical methodology.

[4] The xttest3 command in Stata is utilized for assessing heteroskedasticity, and the results reveal the presence of heteroskedasticity within our sample.

[5] The expansion in health insurance coverage is in line with the efforts of the Vietnamese government to expand health insurance coverage across the whole country, primarily through the national health insurance program.

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