The Impact of the COVID-19 Pandemic on the Situation of the Unemployed in Poland. A Study Using Survival Analysis Methods

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Abstract: Many studies point to the impact of the COVID-19 pandemic on the socio-economic situation of countries and, consequently, on the achievement of sustainable development goals. Although termed a health crisis, the pandemic has also had an impact on the labour market. The imposed restrictions caused companies to close or reduce their operations. Employees switched to remote work, but also often lost their jobs temporarily or permanently. However, the impact of the pandemic on the labour market is not so obvious. This is indicated by our research and that of other researchers. In this paper, we used individual data on the unemployed registered at the labour office in Szczecin (Poland) and were thus able to apply survival analysis methods. These methods allowed us to assess changes in the duration of unemployment and the intensity of taking up work for individual cohorts (unemployed people deregistered in a given quarter). The results indicate, on the one hand, the problems in the labour market during the pandemic and, on the other hand, the adapted reaction of the unemployed to the situation and the acceleration of the decision to accept an offered job.

Keywords: registered unemployment; COVID-19 pandemic; survival analysis

1. Introduction

Even before the pandemic emerged, the global economy had slowed down. According to The Sustainable Development Goals Report 2021 [1], the health crisis caused by COVID-19 disrupted economic activity worldwide and caused the worst recession since the Great Depression. COVID-19 created a heightened adverse impact on human life, the economy, the environment, and the energy and transport sectors compared to the pre-COVID-19 scenario [2]. In 2020, 255 million full-time jobs were lost. This is about four times the number lost during the global financial crisis in 2009. The pandemic has placed informally employed workers, young workers, workers with disabilities, and women at a particular risk. There is a high probability of job loss for temporary agency workers, marginal part-time workers, on-call workers, and independent contractors in sectors that are heavily affected [3]. The authors of the Sustainable Development Goals Report 2022 [4] found that in 2021 the global economy started to rebound and effected some improvement in terms of unemployment. However, this recovery varied considerably across regions, countries, sectors, and labour market groups. In low- and lower middle-income countries, small firms were particularly disadvantaged. The conflict in Ukraine is expected to seriously slow global growth in 2022.

In the face of all these events, the process of achieving the Sustainable Development Goals is threatened. The COVID-19 pandemic increased unemployment as manufacturing and other industries closed due to mandated social isolation, resulting in a descent into poverty [5]. Adverse changes have affected many spheres of human life. Environmental
pollution increased due to an increase in organic and inorganic waste [6]. With the development of the COVID-19 pandemic, very severe economic degrowth and imbalances began [7–10]. Among other things, the achievement of SDG Goal 8—to promote sustained, inclusive, and sustainable economic growth; full and productive employment; and decent work for all—was threatened. Alibegovíc et al. [11] ranked this goal among the most threatened by the pandemic. High unemployment rates in the EU suggested labour market imbalances and signalled an economic recession. A study by Gavriluță et al. [12] suggests that the labour market situation in Poland during the pandemic was not bad. The unemployment rate increased between 2020 and 2021 but was much lower than in many EU-27 countries (below average). Poland’s employment rate was only slightly lower than the average set for the EU-27. Poland’s relatively good position is also confirmed by a study by Lee et al. [13]. In the ranking of economic resilience for 52 countries worldwide, Poland achieved an average score. However, as Lee et al. [14] point out, the labour market indicators in the initial phase of the pandemic should be viewed with caution. Unemployment does not indicate the actual scale of disruption for workers, as many people keep their jobs but are not working (therefore, they are considered employed), have lost their jobs but do not search for jobs (therefore, they are considered inactive), or are working shorter hours (therefore, they are considered employed again). In the longer term, the impact of the pandemic on labour markets in the EU will become evident once protective labour market policies are abolished [15]. Currently, the labour market situation in Poland is good considering the situation in EU countries (Figure 1). In terms of the harmonised unemployment rate, Poland ranks third among the countries with the lowest rates.

The unemployment rate in Poland has been steadily decreasing since the beginning of its EU accession. In May 2004, it was 19.4% and in October 2019 it was only 5.0%. This trend was unfortunately bucked during the pandemic period. At the end of 2020, the unemployment rate was 6.3% and at the end of 2021 it was 5.4%. The year 2020 was unique due to the global COVID-19 pandemic. This also severely influenced the labour market, which, similar to a lens, concentrates the effects of the major changes taking place in both the economy and social life. In Poland, a state of epidemic was announced in March 2020. Both its course and the measures taken to prevent the spread of the virus disrupted the typical market game of supply and demand for labour [16].

In this emergency situation, many companies closed down or reduced their activities. Of course, this translated into job losses, increased unemployment, and a decrease in the

![Figure 1. Harmonised unemployment rate in EU countries in the 1st quarter of 2022. Source: own elaboration on the basis of data from Statistics Poland—registered unemployment quarter 2022 (https://stat.gov.pl/en, accessed on 1 June 2022).](image-url)
population’s income. As we have already noted, this situation was temporary. In many countries, legislation, online learning, and work opportunities have been put in place to reduce the negative effects of the pandemic. Nevertheless, it has been pointed out that 2020 was of a specific significance to the labour market situation. In Poland, the situation before the pandemic was systematically improving (the working population was increasing, and the unemployed population was decreasing). The positive trends in the labour market, as indicated by the increasing employment rate, the stabilisation of the activity rate, and the decreasing unemployment rate, were disrupted after the announcement of the epidemic in March 2020.

As Statistics Poland points out, the largest changes in the economic activity of the population—resulting from the circumstances accompanying the fight against the COVID-19 pandemic—took place in the second quarter of 2020. The introduction of remote work and the reduction in the average weekly working time were important aspects. It should be noted that in the years of an economic boom, the second and the third quarter of a year compared to the fourth and the first quarter are usually characterised by decreasing unemployment, whereas this seasonal periodicity was not maintained in 2020.

We put forward the following research hypotheses:

**Hypothesis 1 (H1): An increase in unemployment as a result of the health crisis.**

**Hypothesis 2 (H2): A longer job search time after the onset of the pandemic.**

**Hypothesis 3 (H3): A reduced intensity of taking up work after the onset of the pandemic.**

These hypotheses were based on the belief that the pandemic, as a crisis phenomenon, would have a negative impact on the labour market. The closure of companies or the reduction in their activities clearly indicates a reduced demand for labour during a difficult period.

The aim of the research is to assess the impact of the COVID-19 pandemic on the situation of the unemployed in Szczecin. The study uses individual data on the duration of unemployment for people registered with the Poviat Labour Office in the period from Q1 2019 to Q1 2022. Such data enable the use of survival analysis methods to indicate whether the duration of a job search by the unemployed changed during the period of the pandemic’s emergence. Thanks to the possibility of using censored data, it was possible to include people who were deregistered for work and those who were deregistered for other reasons.

It should be added that Szczecin is a large voivodeship city. It is located in the north-western part of Poland. It has around 400,000 inhabitants. As in other cities, it is not only a place of work for the inhabitants of Szczecin, but also for the inhabitants of the region. Its location on the Bay of Pomerania makes Szczecin a port city with access to the Baltic Sea. Szczecin used to be a shipbuilding city. Today, employment in the shipyards is marginal. However, Szczecin still has a port that forms a single entity with the port of Świnoujście. It is dominated by the growing e-commerce sector, the logistics sector, the information technology sector, and modern business services. Special economic zones and large warehouses (Zalando, Amazon, etc.) are being established in the vicinity of Szczecin. This creates jobs for the capital of the region. Thus, the directions of the development of the labour market in Szczecin are the same as in other cities and the research results obtained may be helpful in creating labour market policies in crisis periods in other cities, Poland, and other countries.

The manuscript is organised as follows: Section 2 presents the literature review. In Section 3, we present the data and research methods. Section 4 presents the results of the empirical analysis. In Section 5, we present the discussion of the obtained results. The manuscript ends with our conclusions.
2. Literature Review

The dynamics of the COVID-19 pandemic and its impact on the socio-economic situation have become the subject of many scientific studies [17–25]. The results of these studies have been published in a number of journals [26]. These studies include the impact of COVID-19 on the efficiency of healthcare systems [27], on energy markets [28,29], on labour markets [30–32], on capital markets [33–35], and on selected industries [36,37]. For the most part, the results of the studies indicate a negative impact of the pandemic on the socio-economic situation. The emergence of COVID-19 caused an economic shock in many countries on an unprecedented scale. This manifested itself as a decline in the value of the GDP. For example, during the first wave of the pandemic, the decline in the value of the GDP in the UK was 21%—the largest in over 60 years [38]. The decline in the value of the GDP in the USA during the same period was 31.7% [39]. However, some researchers also highlight the positive impact of COVID-19 on sustainable development. This refers to the reduction in greenhouse gas emissions [40]. The level of greenhouse gas emissions could have decreased by about 10%. According to Cortes and Forsythe [41], the pandemic has exacerbated pre-existing inequalities in the Canadian labour market. The employment losses were widespread. They more intensely affected the lower-paying occupations and industries. People from disadvantaged groups were in a particularly difficult situation in the labour market, such as Hispanics, younger workers, those with lower levels of education, and women. Blustein et al. [42] also report that the pandemic reveals and exacerbates existing inequalities in the labour market. They think that the COVID-19 pandemic grants the opportunity to define and describe how precarious work creates physical, behavioural, relational, economic, psychological, and emotional vulnerabilities that worsen outcomes from crises. The authors also postulate the application of rigorous quantitative methods to develop a new understanding of the nature of unemployment during this period and to develop and assess interventions. Antipova [43] studied economic impacts in the context of social disadvantage. This work specifically considers economic conditions in regions with pre-existing inequalities and examines labour market outcomes in already socially vulnerable areas. More marginalised regions may have broader economic damages related to the pandemic. The outcomes of the study in [44] highlight that the pandemic increases the unemployment rate robustly mostly in European economies. The results show that Germany, Spain, and the UK have experienced a positive and significant change in unemployment due to COVID-19. France and Italy are experiencing a better employment situation with respect to the COVID-19 pandemic. That is one of the rare negative effects of the virus on the European labour market. Botha et al. [45] analysed the impact of COVID-19 on the labour market in Australia. They showed that the introduction of a wage subsidy (JobKeeper) and increased welfare benefit payments were unable to eliminate the uncertainty felt by individuals about their future financial situation. Mangan [46] analysed the labour market in India during the pandemic. He pointed out that those at risk of losing their jobs during this period were mainly migrant workers, self-employed, small traders, daily wage labourers, youth, and women, with the latter two being the worst affected, as they mostly work in the grey zone of the Indian economy. The agricultural sector absorbed surplus labour. The author points out that in addition to measures aimed at improving the current labour market situation, the skill/reshuffling of the labour force to work in post-COVID-19-changed situations is important. According to Edwards et al. [47], the U.S. labour market continued to recover in 2021 from the recession caused by the coronavirus pandemic. Both the number of people who were unemployed and the unemployment rate decreased over the year, although both measures were still above their pre-pandemic levels. At the start of the pandemic in the USA, the number of unemployed in each category separated by the duration of unemployment increased. In 2021, the number of short-term unemployed persons declined. That number began to decrease as people either returned to work, stopped looking, or moved into the longer duration categories. This is evidenced by the number of long-term unemployed and their share of total unemployment in 2021. Both these indicators remained well above the levels
seen before the pandemic. Gherghina et al. [48] showed that e-commerce has largely saved jobs, reduced spending, and provided employment.

Of course, the pandemic is one of many factors affecting the labour market in Poland. Geopolitical factors, which can be external and internal, have a large impact. Among the external factors, the labour market in Poland is influenced by its EU membership [49,50]. The internal factors may include the efficiency of the use of funds earmarked for counteracting unemployment [51]. Dmytrów and Bieszk-Stolorz [52] analysed the relationship between the unemployment rate and the median duration of unemployment in the Visegrad countries between 2001 and 2017. The research indicated the existence of a lag in the response of the duration of unemployment to changes in the unemployment rate. The authors showed that in the analysed years, Poland had the shortest lag (1 year) and the highest correlation between these indicators. The implication is that an increase in the duration of unemployment can occur even one year after an increase in the unemployment rate. Thus, the effects of the pandemic may still be felt after the fluctuations caused by the pandemic, i.e., in 2022 or even 2023. However, the study of this relationship will be hampered by the rapid changes in the Polish labour market caused by the outbreak of the war in Ukraine.

During the pandemic, a remote form of working became widespread. In Poland, these changes were not that favourable. In 2018, before the pandemic, the share of remote work was 4.6%, lower than the EU average of 5.2%. In 2021, the share in Poland increased to 8.9%, while the EU average was 12.3% [32]. However, the percentage has varied from quarter to quarter. The research conducted by Statistics Poland showed that the percentage of people working remotely in Poland was 11% in Q1 of 2020, 2.8% in Q3 of 2020, and 14.2% in Q1 of 2021 [53].

Pavolová et al. [7] analysed the impact of COVID-19 on the economic development of selected EU countries in terms of selected macroeconomic indicators. The selected countries were the Visegrad group countries. They found that during the pandemic years (2020–2021), Poland showed the best economic development and Slovakia showed the worst. Abrhám and Vošta [8] assessed the selected economic indicators in the Member States of the EU in the period from 2010–2020. They showed that in 2020, the unemployment rate for the EU27 countries increased by 5.9%, while in 2021 it decreased by 2.8%. In some countries, including Poland, it was the opposite. The unemployment rate in Poland decreased by 3% in 2020 and increased by 6.2% in 2021.

In order to discuss unemployment in Poland during the pandemic, it is necessary to mention the determinants of this phenomenon. At the turn of the 20th and 21st centuries, unemployment in Poland was characterised by fluctuations. At the end of the 20th century, there was a large increase in unemployment as a result of the economic slowdown and the transformation of the economy (16.4% in 1993). After Poland’s accession to the EU (2004), unemployment fell steadily from 19.0% as a result of economic recovery. By the onset of the pandemic, unemployment was decreasing (to 5.2% in 2019). It is emphasised that this decline is the result of an increase in demand for labour and that state policy should be directed towards the creation of new jobs. In Poland, the situation on the labour market until the pandemic was very favourable. The number of unemployed was decreasing. The unemployment rate in Poland in 2019 was at the lowest level in the EU, just after Czechia. During the pandemic, the registered unemployment rate rose from 5.2 per cent to a maximum of 6.6 per cent in February 2021. During a health crisis, a policy of increasing labour demand is difficult or even impossible. Existing jobs are shrinking, no new jobs are being created, and no new companies are being established. This situation applies to all countries.

The labour market has undoubtedly suffered during the pandemic both in Poland and elsewhere. Research shows that employment in U.S. fell by 21% in April 2022 compared to February and an increase was seen in June [54]. Research also confirms that the pandemic is the cause of increased unemployment in Slovakia [55]. Since March 2020, the
registered unemployment rate has increased (from 6.2% to 8.4% in July) and there was a large influx of jobseekers in April.

3. Materials and Methods

3.1. Data

Our research is based on the individual data from the Poviat Labour Office (Polish abbreviation PUP) in Szczecin (Poland). The study, therefore, focused on registered unemployment. It should be noted that only Poviat Labour Offices in Poland are the source of such data. The Central Statistical Office in Poland and Eurostat only have aggregated data, which are not useful for studies using survival analysis models. For this reason, the data used in the study are unique. The data extracted included 31,961 people deregistered from the labour office in the period 01.01.2019–31.03.2022. The data included the date of registration and the date of deregistration, as well as the reason for deregistration. The reasons for deregistration can vary, and there are dozens of them. Since we analysed the event of taking up a job, we divided all the unemployed into two groups: those who took up a job and those who were deregistered for other reasons (e.g., resignation from the agency of the office, going abroad, or retirement). Based on the date of registration and deregistration, we determined the duration of registered unemployment—the random variable $T$. The end event of the observation is taking up a job. Deregistration for other reasons was taken as a censored observation. The analysis was conducted for the 13 quarters comprising the research period. The size of each subgroup is shown in Table 1.

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Complete Observations</th>
<th>Censored Observations</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I 2019</td>
<td>1490</td>
<td>1853</td>
<td>3343</td>
</tr>
<tr>
<td>II 2019</td>
<td>1429</td>
<td>1826</td>
<td>3255</td>
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<tr>
<td>III 2019</td>
<td>1402</td>
<td>1788</td>
<td>3190</td>
</tr>
<tr>
<td>IV 2019</td>
<td>1499</td>
<td>1589</td>
<td>3088</td>
</tr>
<tr>
<td>I 2020</td>
<td>1426</td>
<td>1337</td>
<td>2763</td>
</tr>
<tr>
<td>II 2020</td>
<td>1000</td>
<td>309</td>
<td>1309</td>
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<tr>
<td>III 2020</td>
<td>1529</td>
<td>332</td>
<td>1861</td>
</tr>
<tr>
<td>IV 2020</td>
<td>1518</td>
<td>449</td>
<td>1967</td>
</tr>
<tr>
<td>I 2021</td>
<td>1359</td>
<td>632</td>
<td>1991</td>
</tr>
<tr>
<td>II 2021</td>
<td>1467</td>
<td>727</td>
<td>2194</td>
</tr>
<tr>
<td>III 2021</td>
<td>1417</td>
<td>1041</td>
<td>2458</td>
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<tr>
<td>IV 2021</td>
<td>1424</td>
<td>913</td>
<td>2337</td>
</tr>
<tr>
<td>I 2022</td>
<td>1188</td>
<td>1017</td>
<td>2205</td>
</tr>
<tr>
<td>Total</td>
<td>18,148</td>
<td>13,813</td>
<td>31,961</td>
</tr>
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</table>

The observation was terminated in the first quarter of 2022. There were two reasons for this:

1. Reduction in the number of cases and deaths due to COVID-19. Accordingly, the Polish government lifted sanitary regime restrictions in 2022.
2. The labour market in Poland in the next quarter, i.e., Q2 2022, was undoubtedly heavily influenced by the start of war in Ukraine. Poland has taken in several million refugees, who have had a major influence on the labour market, also in Szczecin.

3.2. Methodology

In the study of the duration of unemployment, we used the survival analysis methods. These methods enabled the use of censored data. The basis of the survival analysis is
a random variable $T$ describing the duration (survival time) of an individual in a particular state. The observation of an individual continues until an event occurs that ends the observation. If the event does not occur within the specified time interval, such an observation is assumed to be censored. The inclusion of censored observations in subsequent analyses is one of the many advantages of survival analysis. Originally, these methods were used in demography, medicine, and reliability theory. In the case of the duration of a person’s life or the operating time of a device, certain regularities have been observed that make parametric methods possible. In the case of the duration of socio-economic phenomena, the distribution of the duration of the phenomenon is mostly unknown, so non-parametric or semiparametric methods are used. Methods of the survival analysis are used in the real estate market [56,57], in the capital market [29,34] in the study of the duration of firms [58,59], in the study of duration of trade relationships [60], and in the labour market [61,62]. The cumulative distribution function of random variable $T (F(t))$ describes the probability of an event occurring no later than time $t$. The basic function in survival analysis is the survival function $S(t)$, which describes the probability that an event will not occur by time $t$. It is described by the following formula [63]:

$$S(t) = P(t > T) = 1 - F(t)$$  \hspace{1cm} (1)

where

- $T$—duration;
- $F(t)$—cumulative distribution function of random variable $T$.

Since for most socio-economic phenomena the distribution of duration is not known, studies often use the non-parametric Kaplan–Meier estimator [64]:

$$\hat{S}(t_i) = \prod_{j=1}^{i} \left(1 - \frac{d_j}{n_j}\right) \text{ for } i = 1, 2, \ldots, k,$$  \hspace{1cm} (2)

where

- $t_i$—the point in time when at least one event occurs, $t_1 < t_2 < \cdots < t_k$, $t_0 = 0$;
- $d_i$—number of events in time $t_i$;
- $n_i$—number of units observed in time $t_i$, $n_i = n_{i-1} - d_{i-1} - z_{i-1}$;
- $z_i$—number of censored observations in time $t_i$.

Quartiles of the random variable with the cumulative distribution function $F(t)$ are determined from the relation: $F(t) = 0.25$, $F(t) = 0.50$ and $F(t) = 0.75$. Duration quartiles are moments of time for which the survival function $S(t)$ takes the following values: $S(t) = 0.25$, $S(t) = 0.50$, and $S(t) = 0.75$. Not all quartiles of duration can exist. This is because of the existence of censored observations. During the observational period, not all individuals belonging to the cohort experience the event. These ones still remain in the cohort.

Two survival curves can be compared. Appropriate tests can be used for this purpose. They allow us to analyse the significance of differences between two survival curves. There are many of them, and we do not have a consistent set of criteria to decide which test has the greatest power and should be used in the analysis. Some of them are more sensitive to the course of the survival curve in its initial part and others in its final part. The sample size, probability density of the survival function, and censorship mechanism determine the power of these tests [65]. We used two tests in the study: the log-rank test and Gehan’s generalised Wilcoxon test. The log-rank test (also known as the Mantel log-rank test, the Cox Mantel log-rank test, and the Mantel–Haenszel test) is the most commonly used test for comparing survival distributions. It can be applied to data with progressive censoring and gives equal weight to early and late failures. It assumes that survival curves for the two groups are parallel. In practice, this is often not the case. Then, the generalised Wilcoxon Gehan test (also known as the Breslow’s test and Gehan’s test) can be applied. It is applicable to data where there is progressive censoring. When the
survival functions are not parallel and when there are few censored data, the Wilcoxon Gehan test has greater power than the log-rank test. It has low power when the degree of censoring is high. It gives more weight to early failures [66]. If we are comparing survival curves in the initial run, we should use this test.

The survival analysis examines the intensity of occurrence of an event in the moment \( t \) under the condition of survival until time \( t \). This intensity is described by the hazard function \( h(t) \). It is the second most important function in the survival analysis. It is given by means of the formula [63]:

\[
h(t) = \lim_{\Delta t \to 0} \frac{P(t \leq T < t + \Delta t | T \geq t)}{\Delta t}
\]

Another non-parametric model in survival analysis consists of the duration tables. These are called a tabular model and assume intervals of a fixed length. In the study of unemployment duration, we assume a monthly period for the empirical cohort tables created. The tables present different quantities and functions [67]. Of great importance in the study of socio-economic phenomena is the hazard function (event intensity), which determines the risk of a specific event occurring in a short time interval \( (t; t + \Delta t) \), provided that it has not occurred by time \( t \). The estimator of the hazard function is determined as [68]:

\[
h^*_t = \frac{z_t}{(n^*_t - \frac{c_t}{2}) a_t}
\]

where

\( z_t \) — number of units experiencing the analysed event per time interval \( (t, t + 1) \);  
\( n^*_t \) — number of units exposed (at risk) in the interval, \( n^*_t = n_t - c_t/2 \);  
\( n_t \) — number of surviving units, \( n_t = n_{t-1} - (z_t + c_t) \);  
\( c_t \) — number of censored units, i.e., units that had not experienced an event by the end of the observation period of the cohort;  
\( a_t \) — duration of the interval (1 month in the study).

To determine the average hazard, we used the formula [63]:

\[
\bar{h}_2(t) = \frac{\# \text{failures}}{\sum_{j=1}^n t_j}
\]

where

\( \# \text{failures} \) — the total number of failures;  
\( \sum_{j=1}^n t_j \) — the sum of the observed survival times \( t_j \).

4. Empirical Results

The survey was conducted in three stages, as shown in Figure 2. In stage 1, aggregated data were used, and in stages 2–3, individual data on the registered unemployed were used. In the first stage, the overall unemployment situation in Szczecin was assessed against the background of Poland. The registered unemployment rate (the ratio of registered unemployed persons to the economically active civilian population) and inflow into registered unemployment rate (the percentage share of inflow into those registered unemployed in the total economically active population, at the end of the reporting period) in Poland and in Szczecin in the quarters of 2019–2022 are presented in Figure 3. It appears that in Q2 2021, the unemployment rate increased slightly, and the inflow rate decreased during this period. This situation is observed both in Szczecin and in Poland in general. This indicates a reduced outflow from unemployment during the initial period of the pandemic.
In fact, when comparing the inflow into and outflow from unemployment, we can see a clear predominance of inflow and a reduction in outflow in Q2 2020 in Poland (Figure 4). This was also the case in Szczecin and throughout 2020 until Q1 2021 (Figure 5). Thus, during the COVID-19 pandemic, the inflow of unemployed people did not increase, but the outflow from unemployment decreased markedly. It became more difficult to obtain work.
In the second stage of the study, we obtained the Kaplan–Meier estimators for persons deregistered from the labour office in subsequent quarters. As a result, 13 survival curves were obtained. From these, the duration quartiles were determined (Figure 6). Figure 7 shows the estimators of the survival curves for the selected quarters (for better clarity of the figure): the first (I/2019) and last (I/2022) and for III/2019 and II/2020 (specific results). In quarter III/2019, there was an increase in the median and third quartile of duration. Quarter II/2020 had the lowest median and third quartile of duration values.
In the second stage of the study, the obtained survival curves were also compared pairwise. Two tests were used for this purpose: the log-rank test and the Gehan’s test. The first test allowed for the comparison of the duration curves over their entire course. In most cases, the differences between them were statistically significant. This shows that the situation of the registered unemployed was not stable over the analysed period. The probability of exiting unemployment changed from quarter to quarter. The Gehan’s test allowed for the comparison of the duration curves over the initial duration period. This test produced similar results. We have presented the results of both tests in Table 2. In several cases, the log-rank test showed no significant differences in the duration curves, while the Gehan’s test showed differences. It follows that in these cases, the probability of exiting unemployment for the long-term unemployed did not differ.
The third stage of the study is the assessment of the intensity of deregistration of the unemployed in individual subgroups, i.e., the unemployed that deregistered from the labour office in Szczecin in the subsequent quarters of the years 2019-2022. In this part of the analysis, an empirical hazard (formula 4) was applied, which indicates the intensity of taking up work by the existing unemployed in the subsequent months of unemployment. The starting point was the determination of cohort tables of the duration of unemployment for the established subgroups. These assumed monthly intervals. Therefore, the determined hazards values indicate the intensity of exiting from unemployment. It is the ratio of the number of people deregistered due to taking a job in a given duration interval of unemployment to the number of unemployed in the middle of the interval (the number exposed to the defined event). Thus, the more people who take up work, the higher the value of the empirical hazard. In Figure 8, the determined empirical hazard in the first 12 months of unemployment for the subgroups according to the quarter of deregistration of the unemployed from the register is presented. These first 12 months are a period of short-term unemployment, which is a period of intensive job search by the unemployed person. In general, discouragement due to a long search, nervousness, or frustration does not yet appear at that time. When analysing the magnitude of the hazard for individual subgroups, it is important to note the predominance of its values for two subgroups. It turns out that the unemployed deregistered in Q2 2020 in the first five months of unemployment were characterised by a higher intensity of taking up work, while from the sixth to ninth months, the advantage applied to the unemployed deregistered in Q3 2020. Therefore, it

### Table 2. Log-rank test and Gehan’s test (in parentheses) for pairs of survival curves.

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Note: *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively; -, (−) denote lack of significance; x – not applicable
can be concluded that in the period of the beginning of the pandemic, when the spread of the virus was already confirmed and the future of the economy was uncertain, the unemployed were quicker to decide to take up the job offered by the office. It seems that the spectre of a worsening situation in the labour market caused the acceleration of decisions among the unemployed.

**Figure 8.** Empirical hazard in the first 12 months of unemployment for subgroups of the unemployed deregistered in particular quarters in 2019-2022 in Szczecin.

As already indicated, the hazard values were analysed precisely for the first twelve months of unemployment. After the first year, i.e., entering long-term unemployment, no major differences in the magnitude of the hazards were noticeable. However, the average monthly hazards (formula 5) were determined for the entire duration of unemployment of the individuals in each subgroup. The results are presented in Figure 9. This confirmed that the highest intensity of taking up a job was experienced by those deregistered in Q2 2020, regardless of the duration of their unemployment.

**Figure 9.** Average monthly hazard for subgroups of the unemployed deregistered by quarters 2019-2022 in Szczecin.

5. **Discussion**

The results of the research carried out did not confirm the proposed hypotheses. It is true that the unemployment rate in Szczecin increased at the beginning of 2020. This was an obvious consequence of the emergence of the health crisis, but the increase was not as large as might have been expected. Very importantly, it turned out that the duration of
unemployment for those in the Q1 2020 cohort (the deregistration period) was not longer, as assumed in H2, but was actually shorter. In addition, there was a slight increase in the intensity of taking up work in the first five months of unemployment (in H3, we assumed the opposite). Thus, the study did not fully confirm the negative impact of the pandemic on the situation of the unemployed. It appeared that in a difficult and unexpected economic situation, the unemployed were quicker to decide to accept a job offered by the office. The threat of a worsening situation in the labour market, likely alongside fewer opportunities to work in the grey economy, influenced the acceleration of decisions among the unemployed.

Cortes and Forsythe [41] also indicate that the influence of the COVID-19 pandemic on the labour market is heterogeneous in the United States. This heterogeneity applies to various occupations and industries as well as demographic subgroups. The authors concluded that the pandemic has had the effect of exacerbating pre-existing inequalities. Lofton et al. [69] highlight the particularly difficult situation of mothers in the labour market during the pandemic (due to school closures). According to Groshen [70], the impact of the pandemic on the labour market in the U.S. was significant. The initial shock was very abrupt and deep by all historical standards. The author used two indicators, the national unemployment rate and the change in payroll jobs, in the study. The COVID-19 pandemic has had a particularly strong impact on the tourism sector. It has affected the countries of the Mediterranean area to the highest degree. In addition to the high number of infections and deaths, there have been significant economic losses in the region [71]. The impact of the COVID-19 pandemic on the labour market has encouraged many scientists to examine and quantify its consequences in this area. The literature mainly presents macroeconomic analyses. There is a lack of studies aimed at examining the impact on the labour market in the individual municipalities. In addition, Kotera and Schmittman [72] used macro and micro data to study the labour market. They concluded that the pandemic in Japan had a large negative impact on employment, labour force participation, earnings, and labour market mobility. Our research is also part of this trend, and it concerns the labour market of smaller areas of the country (regarding the specifics of business and demographic characteristics). It is the peculiarities of both the local and national labour markets that are important in the processes of response and adaptation in a pandemic situation [73,74]. Zieliński [75] analysed the impact of the pandemic on the labour market in the Visegrad Group (V4) countries, including the Polish labour market. He compared the years 2018–2019 to 2020–2021, and the results of his study coincide with our observations. He showed that the pandemic affected labour market imbalances relatively moderately. Importantly, it stopped the trend of decreasing unemployment rates observed in all V4 countries in 2018–2019. The highest unemployment rate in Poland in Q1 2021 corresponded to the lowest number of hours worked per week (usual weekly hours of work). Poland experienced a return to pre-pandemic unemployment rates in Q4 2021.

The speed at which jobs are taken up during a pandemic depends on the type of job. Research indicates that the greatest negative impact of a pandemic is on the catering industry and sales and customer service jobs. In contrast, jobs in warehousing and transport may increase as a result of the increase in e-commerce and the delivery of goods to customers [76]. The research shows that in Australia and Canada, the increase in the number of vacancies being posted online mentioning ‘work from home’ arrangements was especially strong [77].

Losing a job or not being able to obtain one are particularly acute situations during a crisis. The pandemic fuels unemployment, whose source is usually exogenous to the individual and can affect mental health [78]. The fear of a difficult situation may mobilise individuals to intensify their job search and to accept any kind of job.

Different findings from ours are presented by Hensvik et al. [79]. According to these authors, the COVID-19 pandemic particularly affected labour markets. There was a sharp increase in unemployment and a decline in job vacancies. Depending on how the intensity of job search changes after the shock, the supply side of the labour market may exacerbate
or mitigate the effects of the shock on the demand for labour. The authors analysed how jobseekers in Sweden adjusted the intensity and direction of their search at the onset of the crisis. They found that job search intensity fell by 40% in March and April 2020 and returned to its previous level in July 2020. They explain the drop in search intensity by a decline in the number of vacancies and by fears of illness on the part of both employers and potential employees (the Swedish government’s preventive measures were extremely mild). According to Sheldon [80], unique to the current crisis in Switzerland is the sharp upsurge in both the incidence and duration of unemployment. These two variables have never increased so quickly in such a short period. Hensvik et al. [79], similarly to Bernstein et al. [81], indicate a change of direction with respect to job searches. Both studies point to the phenomenon of ‘a flight to safety in labour market’ occurring during a health crisis. Small firms or self-employment are less frequently chosen as places/forms of work. We also find that the increase in the intensity of the unemployed taking up work during the pandemic is a result of changes in the direction of the search for employment. Many companies are closing down or scaling back their operations, new entrepreneurial initiatives are not being created, and there is a lack of casual or informal work. This contributes to a greater propensity to accept jobs in the office.

6. Conclusions

Our study confirmed the findings of other researchers who found that the impact of the pandemic on the labour market had not been unequivocal and varied according to the economic situation of the country studied. This is also highlighted by the authors of The Sustainable Development Goals Report 2022. Developed economies are experiencing a more robust recovery. Of particular concern is the confluence of crises, dominated by COVID-19, climate change, and conflicts. Research conducted by Statistics Poland [82] shows a decline in labour demand in 2020 and a large increase in 2021. This shows that the initial uncertainty associated with the outbreak of the pandemic was contained fairly quickly. However, we must emphasise here that the Polish labour market in 2022 and beyond will be influenced by current political and economic events. How this will affect the Szczecin labour market will only become apparent in a few months’ time. This will be a stimulus for us to conduct further research.

The limitation of our study was the use of data from only one large city, Szczecin. However, due to the state policy, regional analyses are more important than an overall analysis (concerning Poland as a whole). We must point out that the applied survival analysis methods require the use of individual data. Public statistics only provide aggregated data. Therefore, the added value of our study is the acquisition of such data and their use in the study of registered unemployment. On the other hand, another advantage of the methods we have chosen is the possibility of using the censored data.

The obtained empirical results may prove valuable for scientists interested in the influence of the pandemic on the labour market. These analyses are also important for political decision-makers involved in the efforts of mitigating the negative effects of the COVID-19 pandemic within national and regional economic systems. The study presented here could also be useful in the effort to refine the theoretical approach to the economic crisis caused by the spread of the virus. Our research showed that the registered unemployed took up work relatively quickly, but there are always people on the registers who often move into long-term unemployment. Political decision-makers can reduce the negative impact of COVID-19 on the unemployed by promoting more training and active labour market policies to facilitate their return to work at a decent job, which would be particularly beneficial for those who have been unemployed for a long-term. The study presented here could also be useful in the effort to refine the theoretical approach to the economic crisis caused by the spread of the virus.

After a significant increase at the start of the pandemic, unemployment is falling in many OECD countries [83]. However, unemployment is projected to be higher in most of
them than before the crisis. However, in the context of this pandemic and the accompanying labour market policies, unemployment alone provides only a partial picture. In the early phases of the crisis, a large number of people withdrew from the labour market due to constraints on their job search and the increased burden of their household responsibilities. At the same time, many people who maintained employment experienced a reduction in working hours (job retention programmes). It is warned that in the future, many of the workers most affected by the pandemic may find it difficult to return to their previous jobs due to a lack of appropriate skills (e.g., due to new technologies in production). Support in the form of upskilling and retraining is needed to ensure that the recovery is socially inclusive. An interesting solution is the introduction of a temporary increase in unemployment benefits in Sweden [79]. This is certainly a large help for the people in difficult situations, but it is a solution for wealthy countries. The full impact of the crisis on the labour market is not yet behind us [83]. There is, therefore, a need for continued labour market research. Medical sources point to the possibility of further waves of pandemics, although we expect these to be much smaller in scope due to the prevalence of vaccination and treatment experience. We will also observe changes that are driven by the experience of entrepreneurs, such as the increased prominence of e-commerce at the expense of traditional trade.


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