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The Anatomy of Unemployment: Determinants During and After the COVID-19 Crisis

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Abstract: Unemployment is a factor that heavily influences the output of each economy. It is, therefore, one of the main concerns of any government worldwide. This study identifies key determinants of unemployment. By constructing an econometric model for the registered unemployment rate in Slovakia, the period from 2013 to 2022 was under scrutiny, while the impact of the COVID crisis was considered in the model through a dummy variable. Potential determinants of unemployment were selected based on theoretical knowledge and other scientific works, that is, average interest rates, gross minimum wage, GDP, inflation, exports, imports, government spending, corruption index, COVID-19 crisis, and month of the year. The final relevant factors for unemployment were tested and validated: interest rates, GDP, inflation, government spending, and exports. These study results may be valuable for the government when designing targeted interventions to optimise the unemployment rate in Slovakia or similar economies by influencing other macroeconomic indicators.

Keywords: COVID-19; crisis; unemployment; determinants of unemployment; dynamics; development.

Introduction

Unemployment is a complex problem that economists around the world have been dealing with for a very long time, mainly because of the various far-reaching consequences that high (and sometimes too low) unemployment brings with it. Individuals, society, and market economies worldwide feel the consequences of unemployment. Knowing the determinants of unemployment and the extent of their influence is, therefore, very important.

Among the basic consequences of unemployment are the following: a. felt by individuals: increased likelihood of alcohol and smoking abuse (Amiri, 2022), loneliness and social isolation – in the case of males (Eckhard, 2022), psychological distress (Achdut & Refaeli, 2020) and negative changes in individual well-being (Weckstrom, 2012); b. felt by society: increased dissatisfaction in marriages (Nikolova & Ayhan, 2019), excessive suicides (McIntyre & Lee, 2020) and slowed down the development of society (Nallo & Oesch, 2021); c. felt by economies: decreasing GDP (Louail & Riache, 2019), long-lasting wage losses in an economy (Jost, 2022) price instability - too high or low inflation, or even deflation (Answer el al., 2021). Most negative consequences on an entire economy or society come from long-lasting and too high unemployment.

However, it is important to note that not only too high unemployment but also too low unemployment can be undesirable. This is a rare phenomenon in most market economies,

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though it sometimes happens, and the manifestation of negative consequences in a case of low unemployment can be much faster than in a case of high unemployment (Keinsley & Rangaraju, 2021). Unemployment rate lower than the natural unemployment rate causes inflation growth (Maximova, 2015). It is, therefore, important to know the level of the natural unemployment rate and to try to use the determinants to ensure that the registered unemployment rate is maintained at similar values. According to Cho and Rho, (2019) and Pisulewski (2019), the natural unemployment rate is a long-term equilibrium and deviations from that value in the unemployment rate are temporary.

In this article, we focused on discovering the determinants of unemployment, creating a model with the potential of use for predictions of the development of unemployment and quantifying the impact of the COVID-19 crisis on unemployment in the Slovak Republic. Therefore, the results are applicable in creating government measures and predicting the development of unemployment and the entire economic growth.

The article is divided into the following parts. The literature review section provides an overview of the current state of the issue by referring to relevant studies that focus on the topic of this study. The methodology and data section briefly outlines the econometric approach used in the study and characterizes the data used for analysis. The main outputs of the analysis, including the created econometric model, are highlighted in the results section. In the discussion section, the coefficients of the determinants of unemployment and the quantitative impact of COVID-19 are interpreted. This section also contains suggestions for continuing research in the future. The final part summarises the most important results of this study.

Literature review

The link between unemployment and other macroeconomic factors has been studied by many authors around the world. Among the most well-known factors related to unemployment are GDP growth and inflation. The connection between GDP dynamics and unemployment is described by the well-known Okun's law, and the connection between inflation and unemployment is described by the Philips curve. The impact of the combination of these macroeconomic factors was verified by Irushad et al. (2023) recently in the Maldives. The work used the Autoregressive Distributed Lag (ARDL) model to capture long-term and short-term associations between selected variables. The empirical results indicate that, except for foreign workers, all variables are significant determinants of the unemployment rate in the long run. The study found that if combined, economic growth and inflation would contribute negatively and significantly to the unemployment rate. This explains the unemployment relationship that follows the Phillips curve, and Okun’s law relationship provides the presence of both these hypotheses in the Maldives in both the short and long run.

In addition, the increase in population and external debt worsens the unemployment situation in the Maldives. Motyovszki (2013) states that a low unemployment rate will inevitably increase wages, thus leading to increased prices, which confirms an indirect dependence between unemployment and inflation. The study also points to the fact that not only a high but also a low unemployment rate can be undesirable and have negative consequences. The relationship between GDP and unemployment is well documented. Dependence is, in general, indirect. However, it is unclear which factor is dependent and which independent. In search of determinants of unemployment, we chose GDP as the regressor. Papik et al. (2022) have demonstrated that GDP per capita is one of the determinants of unemployment.

Recher (2020) demonstrated significant differences in unemployment in terms of gender in the Croatian labor market, thereby contributing to the understanding of the complexity of the given issue. Leightner (2021) points out the considerable complexity and ambiguity

of the connection between the registered unemployment rate and the liberalization of international trade. The author found several countries where dependence is direct, but also several where it is indirect. It points to possible causes and finds differences in countries. King and Morley (2007) examined in their study the determinants of the natural unemployment rate and concluded that higher interest rates in the market make capital more expensive for companies, reducing profitability and consequently slowing down recruitment, which can increase the natural unemployment rate. According to Guell and Lafuente (2022), the majority of the variation in unemployment length may be attributed to labor market frictions, which are more pronounced during recessions. After heterogeneity, which accounts for 18% of the variation, duration dependency makes up about 25% of the variance overall. Duration dependency is more prevalent among women and college graduates.

A comprehensive and extensive analysis of the determinants of unemployment was conducted on the European labor market (Bosna, 2022). The analysis was specifically carried out in Poland, Slovakia, the Czech Republic, Hungary, Romania, Bulgaria, and Croatia. The period of 2012 - 2020 was monitored. The most important result of the study was that the active labor market policy had the strongest impact on unemployment trends from the monitored groups of countries, which confirms the effective implementation of this policy. The GDP growth rate did not have a statistically significant impact on unemployment. Regarding unemployment, the duration of unemployment is important in terms of many consequences. A comparison of the consequences of short-term and long-term unemployment and an evaluation of the particularly serious consequences of unemployment were analyzed in the study of Abraham et al. (2019). Lim (2010) attempted to estimate the psychological impact of unemployment on young people graduating from university. There was evidence of negative psychological impact of unemployment. The author also tried to find effective measures in order to deal with this drawback.

The COVID-19 pandemic has affected virtually all markets around the world, including the labor markets. Therefore, many authors have already tried to quantify and evaluate this impact. Januri et al. (2022) analyzed the impact of the COVID-19 crisis on GDP in the Malaysian labor market. The author's results showed that the COVID-19 crisis caused an increase in unemployment, resulting in GDP growth taking on negative numbers. Tang and Abosedra (2023) addressed the impact of the COVID-19 pandemic in combination with corruption and other factors. The analysis used a panel data set for 89 developing countries from January to December 2020. According to their results, the COVID-19 pandemic and corruption are the main variables explaining the unemployment rate. In addition, the COVID-19 pandemic and corruption significantly limit and change the role of outputs and human capital in influencing unemployment. Therefore, the harmful effects of the COVID-19 pandemic and corruption on the economies and labor markets of the countries under study should not be underestimated. Also, for this reason, we included the corruption index in our work as one of the explanatory variables. Mirahmadizadeh et al. (2022) investigated the relationship between the unemployment and COVID-19 mortality. According to their findings, increased pandemic mortality may have been linked to unemployment before this epidemic began. The authors' research employed unemployment as a predictor and COVID-19 mortality as a predicted variable.

Methodology and data

In this study, econometric modeling was the main tool used in the analysis, supported by graphical and correlation analysis for exploring the relationship between the unemployment rate and other macroeconomic factors and also for quantifying the impact of the COVID-19 crisis. We selected potential predictors based on proven and confirmed relationships. Studies confirming these relationships are listed in the literature review section.

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Given our assumptions of the autoregressive nature of the unemployment rate time series, we employed the autoregressive (AR) model. This model incorporates time lags of the time series of the unemployment rate with the appropriate lag order. The suitability of the lag order was analyzed using the partial autocorrelation function (PACF) and by testing the significance of time lags of the unemployment rate in the regression model. However, none of the time lags were statistically significant; therefore, we finally did not incorporate any time lag for the dependent variable – the registered unemployment rate. Since one of our goals was to apply a model that can be used to predict unemployment three months ahead, macroeconomic predictors were delayed in the model by three months.

Furthermore, to account for potential seasonal variations in the unemployment rate, we introduced a set of dummy variables representing the months of the year to capture the seasonal fluctuations. Anyway, none of them turned out to be statistically significant in the regression model, so we did not include them in the resulting model.

The data for the analysis was obtained from the web page Trading Economics (2023), which includes data from various sources, including the websites of the National Bank of Slovakia, the Central Office of Labour, Social Affairs and Family (COLSAF) of the Slovak Republic (SR), the World Bank, the World Trade Organization, the Statistical Office of the SR, Transparency International, and more. Data on selected factors, including unemployment, were available for the period 2000-2022. The unemployment rate exhibited a predominantly downward trend throughout this period, with temporary reversals during crises. Specifically, around 2009 (during the global financial crisis) and 2020 (during the COVID-19 pandemic), unemployment experienced temporary increases, likely due to these crises. Since unemployment increased during crises, we expected the crisis as a dummy variable to be statistically significant and affect unemployment by increasing it.

Another important aspect to consider for setting the analyzed period is the change in the methodology used for calculating the registered unemployment rate in Slovakia in May 2013. Therefore, our model included data from May 2013 to February 2022 to ensure objectivity. The development of the unemployment rate in Slovakia during the monitored period is shown in Figure 1.

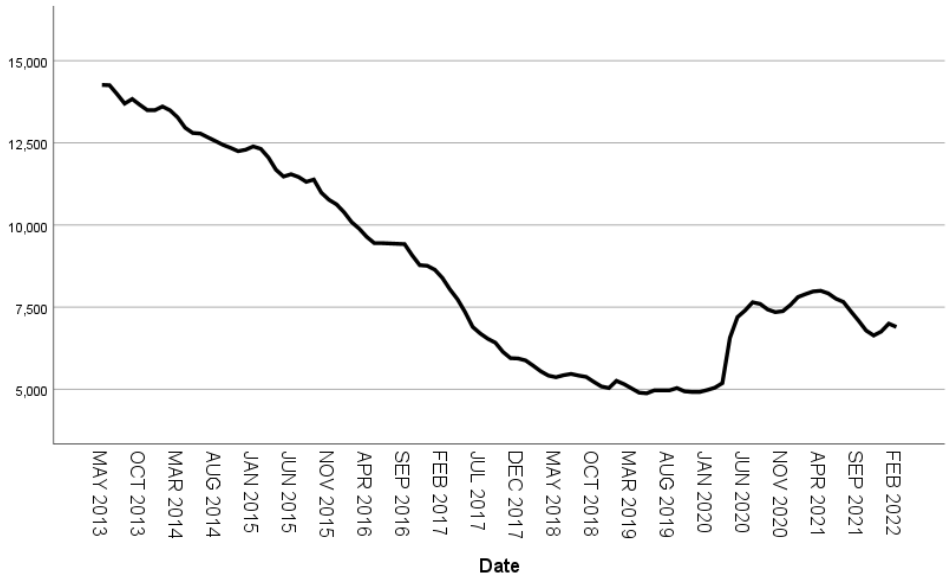

Figure 1. Development of the unemployment rate in Slovakia
Source: own processing

Figure 1 shows that the registered unemployment rate during the monitored period does not show seasonality, which confirms that the dummy variables representing the months of the year are statistically insignificant. In summary, the following factors were considered in the analysis as potential determinants of unemployment, serving as explanatory variables in the model:

- COVID-19 crisis: The crisis period was defined as the period from March 2020 (when the first cases of infection in the Slovak Republic occurred) to the end of the monitored period, i.e., February 2022. Based on Figure 1, we assume that this factor causes a growth in the unemployment rate. The COVID-19 crisis was used in the model as a dummy variable and was delayed by one month. The reason for this delay was that by graphical analysis of the unemployment rate time series (Figure 1), we found out that the impact of the pandemic on the unemployment rate was visible immediately next month after the start and implementation of the first anti-pandemic government measures in Slovakia.
- Average interest rates on loans from commercial banks: We expect a direct relationship with the registered unemployment rate. Increasing interest rates signify higher costs of foreign capital, which may cause some entrepreneurs to lay off employees in order to reduce personnel expenses.
- Gross minimum wage: We expect an inverse relationship, as the gross minimum wage has consistently increased while the recorded unemployment rate has largely decreased. However, it is important to note that raising the minimum wage stimulates the labour market supply while simultaneously reducing the demand for work. This can lead to varying effects in different periods.
- GDP: We anticipate an indirect relationship whereby, as GDP grows, we expect a decrease in unemployment.
- Inflation rate: The inflation rate primarily decreased during the analysed period, coinciding with the decrease in the recorded unemployment rate, indicating a direct relationship. However, the Philips curve suggests an opposite relationship. Therefore, predicting the relationship between inflation and unemployment during the selected period is challenging.
- Export and import: Export and import serve as important indicators of the performance of the economy and international trade functioning. A stronger economy with well-functioning international trade should facilitate job availability, implying an indirect relationship between exports and imports and the registered unemployment rate.
- Government spending: Government spending is expected to stimulate both the demand for and the supply of work in the market as required, thus suggesting an indirect relationship with the unemployment rate.
- Corruption Index: Transparency International Agency annually assigns this index to 180 countries worldwide. A value of 0 indicates the highest possible level of corruption, while 100 represents the absolute absence of corruption. We anticipate an indirect relationship between the corruption index and the registered unemployment rate.

The equation will have the following structure:

$$y_t = \beta_0 + \gamma_1 x_{1_{t-3}} + \cdots + \gamma_8 x_{8_{t-3}} + \delta_1 y_{t-1} + \cdots + \delta_k y_{t-k} + \theta C_{t-1} + \mu_1 M_1 + \cdots + \mu_{12} M_{12} + \varepsilon_t \quad (1)$$

where y_t is the unemployment rate in a period t, $y_{t-1}, \dots, y_{t-k}$ are is its lags of the appropriate order (later not used in the model), C_{t-1} is a dummy for the COVID-19 crisis delayed by one month, $M_1, \dots, M_{12}$ are dummies for months of the year (later discarded from the model) and $x_{1_{t-3}}, \dots, x_{8_{t-3}}$ are the potential determinants of the unemployment mentioned above; $\beta_0, \gamma_1, \dots, \gamma_8, \delta_1, \dots, \delta_k, \theta, \mu_1, \dots \mu_{12}$, are regression coefficients, and ε_t is an error term.

Before creating the regression model, we verified the correctness of our estimates about the direction of dependencies between endogenous and exogenous variables through graphical and correlation analysis. The results of the graphic analysis are in the dependency matrix in the following figure, together with a trend line that points to the direction of the dependency (Figure 2).

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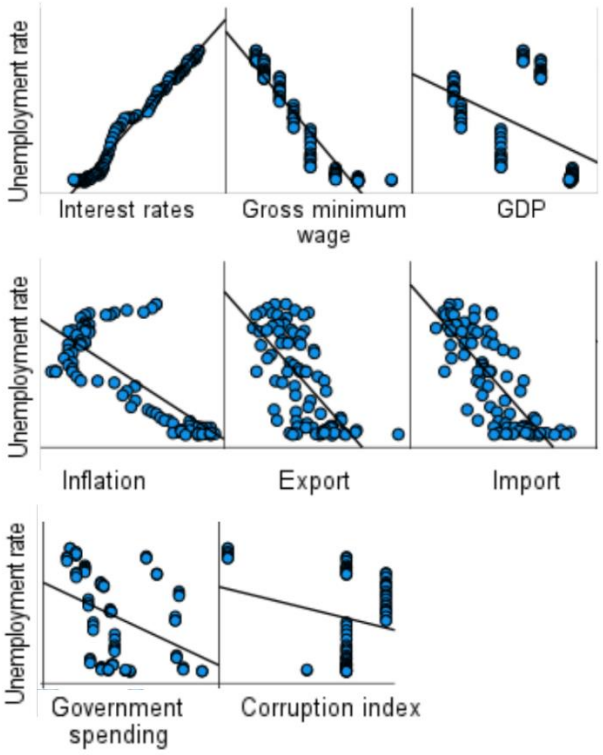

Figure 2. Dependency matrix
Source: own processing

Graphical analysis confirmed our estimates and, in addition, also confirmed the functionality of the Philips curve on our data in practice. We also can claim that during the period under review, the increase in the minimum wage contributed to the reduction of unemployment, so probably the effect of the increase in the minimum wage on the labor supply on the market was stronger than the effect on the demand for labor. The graphs suggest that the relationships between the unemployment rate and its determinants have different strengths.

For creating the regression model, the assumption of stationarity of the modeled time series must be fulfilled. We verified this assumption using the autocorrelation (ACF) function. The registered unemployment rate showed non-stationarity (see the left side of Figure 3); therefore, we used the time series transformation by the first difference. This transformation caused the new values to show stationarity (see the right side of Figure 3). Therefore, the regression model estimates of changes in the unemployment rate, not the unemployment rate itself.

The final model was evaluated using evaluation measures:

- Mean Absolute Error (MAE) shows how much inaccuracy we can anticipate on average in our estimations, as it measures the average absolute difference between predicted and actual values. The lower the MAE value, the better the model; a value of zero indicates that the estimates are error-free. In other words, the model with the lowest MAE is deemed superior when comparing many models. However, because MAE does not reveal the proportional scale of the error, it can be difficult to distinguish between large and small errors.
- Mean Squared Error (MSE) is often used to compensate for the MAE's shortcomings. MSE indicator is defined as the average of the squares of the errors between actual and estimated values. MSE is always positive, and lower values are preferable. This measure

penalizes large errors or outliers more than minor errors due to the square term (Figure 3).

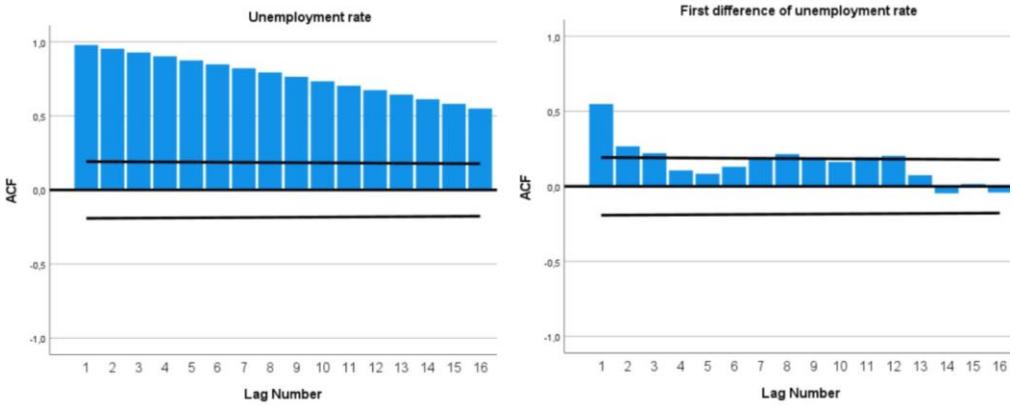

Figure 3. Stationarity of unemployment
Source: own processing

The quantitative evaluation of the quality of the model was supplemented by graphic tests. All calculations were performed using IBM SPSS Statistics software. A significance level of 0.05 was used for statistical hypothesis testing.

Results

To verify the correctness of the direction of dependencies but also to determine the strength and statistical significance of these dependencies, a correlation analysis was carried out. We also evaluated interdependencies between regressors to detect possible multicollinearity problems. The results of the correlation analysis are shown in Figure 4.

Correlations

Pearson Correlation

	Unemployment rate	Interest rates	Gross minimum wage	GDP	Inflation	Import	Government spending	Corruption index	COVID-19 crisis
Interest rates	,882**								
Gross minimum wage	-,730**	-,949**							
GDP	-,472**	-,661**	,785**						
Inflation	-,608**	-,683**	,725**	,765**					
Import	-,642**	-,737**	,724**	,613**	,702**				
Government spending	-,386**	-,445**	,354**	,210*	,271**	,511**			
Corruption index	-,237*	-,382**	,371**	,138	,182	,409**	,122		
COVID-19 crisis	-,236*	-,642**	,796**	,661**	,474**	,454**	,284**	,283**	
Export	-,545**	-,641**	,633**	,547**	,581**	,958**	,475**	,333**	,408**

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

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

Figure 4. Correlation analysis
Source: own processing

The results of the correlation analysis confirm the directions of the dependencies from the graphic analysis, but in addition, they also revealed possible problems with multicollinearity. After analyzing multicollinearity between the explanatory variables using variational inflation factors (VIF), we noted a high degree of dependence between the dummy variable COVID-19 crisis and the other explanatory variables. This result was probably due to the fact that the COVID-19 crisis affected not only the recorded unemployment rate but also the other macroeconomic factors themselves. In order to

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solve the multicollinearity problem and retain the dummy for the crisis in the model to obtain the quantification of its impact, we replaced the individual factors in the regression model with their interactions with the COVID-19 crisis dummy. Thus, we get the product effect of the macroeconomic indicators in co-action with the COVID-19 crisis. The corruption index was the only variable that was not collinear with any factor. Therefore, this variable remained in the model in its original state. Several variables were also removed from the model due to their very low statistical significance, verified by the test of significance or regression coefficient. The resulting regression model is shown in the following table (Table 1).

Table 1. Regression model for the unemployment rate.

Factor		Estimate	SE	t	Sig.
Unemployment rate	*Constant*	1.46	0.76	1.92	0.06
	Difference	1			
Corruption index	Delay	3			
	Numerator	-0.03	0.02	-2.06	0.04
COVID-19 crisis	Delay	1			
	Numerator	0.94	0.11	8.31	<0.01
Inflation · COVID – 19 crisis	Delay	3			
	Numerator	0.02	0.03	0.74	0.46
Export · COVID – 19 crisis	Delay	3			
	Numerator	-0.07	0.04	-1.84	0.07
Government spending · COVID – 19 crisis	Delay	3			
	Numerator	-0.30	0.20	-1.50	0.14

Source: own processing

The quality of the model can be verified using multiple methods. One way is to create a graph of the development of the registered unemployment rate and the unemployment rate estimated by the model. The more similar these measures are, the higher the quality of the model. The estimated and registered unemployment rates for the analyzed period are shown in the following figure (Figure 5).

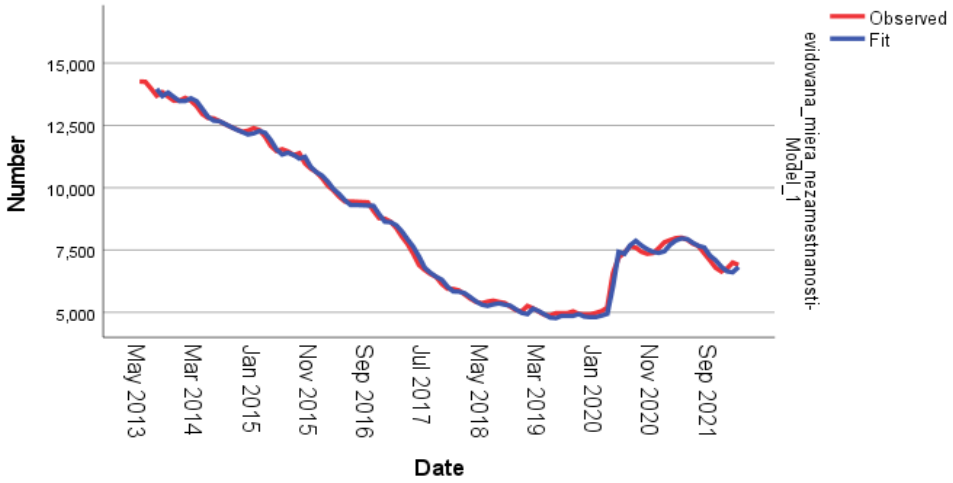

Figure 5. Development of estimated and registered unemployment rate

Source: own processing

As shown in Figure 5, both lines are similar and close to each other, which means that model estimates are very close to real unemployment development. Based on Figure 5, we can claim that our regression model is fairly accurate.

Another graph that can be used to verify the quality of the model is a dot graph of the dependence of the actual values of the registered unemployment rate and the estimates

from the model. The more similar these values are, the closer the points will lie to the line of absolute linear dependence. Such a graph is shown in Figure 6.

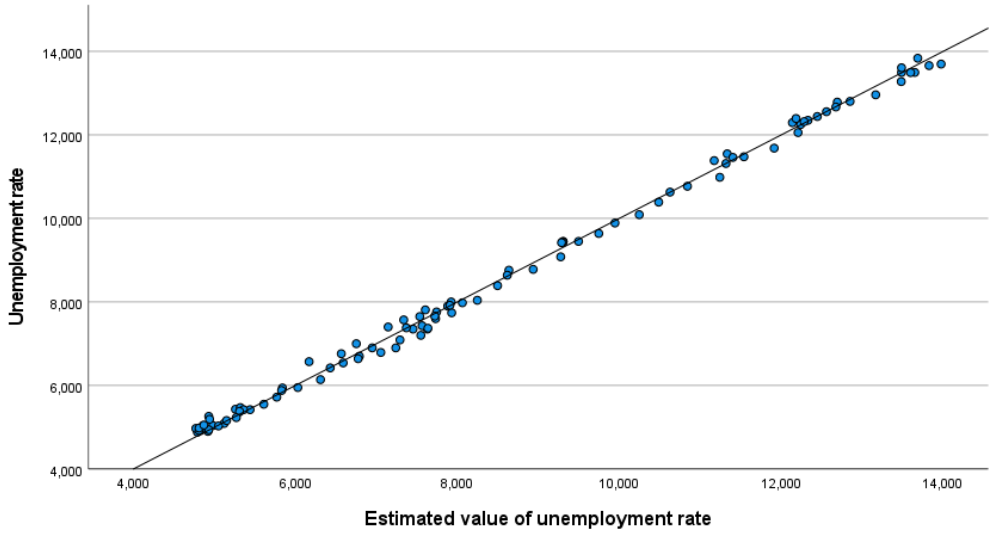

Figure 6. Dependence of estimated and registered unemployment rate
Source: own processing

As Figure 6 suggests, estimated values are very similar to actual. Subsequently, we verified the quality of the model using quantitative indicators: MAE with a value of 0.13 and MSE with a value of 0.03. All quantitative indicators confirmed the sufficient quality of the model.

Discussion

Based on the created regression model, it is possible to quantify the impact of the COVID-19 pandemic on unemployment in Slovakia. The effect of the predictors in the model is as follows. The corruption index has a regression coefficient of -0.03, which confirms the indirect relationship from previous analyses between unemployment and this index. Furthermore, this factor is the only predictor that is not collinear with the COVID-19 crisis dummy, which means that this crisis did not have a statistically significant effect on Slovakia's corruption level. Moreover, it can be claimed (ceteris paribus) that an increase in the value of the corruption index (which means the decreasing level of corruption in Slovakia) by one percentage point will bring a decrease in the registered unemployment rate by 0.03 percentage points with a lag of 3 months. The COVID-19 crisis had a statistically significant effect on the registered unemployment rate. Based on the created regression model, it can be argued (ceteris paribus) that if a crisis with the magnitude of the impact of the COVID-19 crisis occurs and we suppose its impact on unemployment immediately in the consequent month, it causes a growth in the unemployment rate by on average 0.94 percentage points per month.

Another factor in the created regression model is the interaction of inflation and the COVID-19 crisis. An increase in inflation by one percentage point in conjunction with the COVID-19 crisis will bring (ceteris paribus) an increase in the registered unemployment rate by 0.02 percentage points. The relationship between inflation and the registered unemployment rate has changed to a direct one compared to the graphical and correlation analysis results, but this may be due to the synergy with the COVID-19 crisis. At the same time, however, it is important to point out the fact that the regression coefficient of this

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predictor is statistically insignificant. The interaction of exports and the COVID-19 crisis indirectly affects the registered unemployment rate. During the crisis, an increase in exports by €1 billion (ceteris paribus) will cause a decrease in the registered unemployment rate by an average of 0.07 percentage points. The interaction of government spending and the COVID-19 crisis also indirectly affects the registered unemployment rate. During the crisis, an increase in government spending by €1 billion (ceteris paribus) reduces the registered unemployment rate by an average of 0.30 percentage points monthly. Using the regression model, it is possible to quantify the impact of the COVID-19 crisis on unemployment in Slovakia. The crisis contributed to an increase in the registered unemployment rate by 0.94 percentage points per month. However, the crisis also demonstrably affected the macroeconomic factors in the model. All selected predictors, except the corruption index, were collinear with the factor COVID-19 crisis; therefore, it was necessary to consider this fact using the interaction terms in the regression model.

The impact of the COVID-19 crisis on unemployment may, therefore, be even more extensive and should be the subject of further research. Though, for practical reasons, this model is applicable mainly in times of crisis to predict the development of unemployment three months ahead since the majority of the model's predictors are macroeconomic factors in the interaction with the crisis with a delay of their impact on the unemployment rate of three months. Nevertheless, because of this delay, it is now feasible to use the model to forecast the unemployment rate over the next three months using data on the present values of macroeconomic indicators. In addition to the macroeconomic variables and the COVID-19 crisis, we also looked at how specific months of the year affected the development of the registered unemployment rate.

During the observed period, the registered unemployment rate did not exhibit a seasonal pattern, and the effect of each month was statistically insignificant. One rationale is that the economically active population, excluding students, determines the registered unemployment rate. When the majority of students leave school, not only does the number of job seekers rise, but also the number of the economically active population, which can attenuate the rise in the official unemployment rate to some extent. The number of job seekers is likely to fluctuate over the year more than the official unemployment rate.

As mentioned in the literature review, many authors have already investigated the dependence and connection between unemployment and other factors. Irushad et al. (2023) and Motyovszki (2013) investigated unemployment determinants and found an indirect relationship between unemployment and inflation, confirming the Phillips curve. In our work, graphic and correlation analysis confirmed such a direction of dependence, but in the resulting model, the dependence was direct. This is where our results differ. This happened probably due to the fact that inflation in the model was examined in conjunction with the COVID-19 crisis. Moreover, this variable was statistically insignificant in the regression model. Januri et al. (2022) and Papik et al. (2022) confirmed the indirect dependence between GDP and the unemployment rate. This direction of dependence was also confirmed by Bosna (2022), who, however, found a statistically insignificant dependence in her study. In our study, in combination with the COVID-19 crisis, we also found an indirect relationship. Hashemi et al. (2017) analyzed the effect of changes in economic output on the unemployment rate. The authors examined addiction in Brazil, Russia, India, China, and South Africa using aggregated and disaggregated data from 1991 to 2018.

To examine the relationship between changes in the unemployment rate and in GDP before and after the 2007–2008 global financial crisis, and the authors separated the full sample period into two subsamples: from 1991 to 2008 and from 2009 to 2018. The

authors attest to Okun's law's applicability to the BRICS. The unemployment rate is far more dependent on GDP in the post-crisis period than in the pre-crisis period. According to the results of the disaggregated data, private consumption is the primary driver of the unemployment rate, and its estimate is negative and substantial. Government expenditure, exports, and imports are other factors crucial in predicting changes in the unemployment rate in addition to consumer spending. Therefore, their findings and the results of our study are rather similar. However, the authors observed how the Great Financial Issue altered the relationship between GDP and the unemployment rate, but in our study, we explicitly measured the influence of the COVID-19 crisis on the growth of the unemployment rate. Using the fractional regression models, Koc et al. (2021) investigated the factors influencing unemployment rates for 35 OECD nations between 2000 and 2017. Using panel data and the GMMbgw and GMMpre estimations, a fractional regression model was used to identify the variables influencing the unemployment rate. As a consequence of fractional regression models, empirical findings identified important factors determining unemployment.

The rate of savings, as well as the growth rates of imports and exports, were discovered to have a considerable influence on the unemployment rate. In our study, one of the export/import variables had to be removed due to the significant degree of collinearity, leaving just export as a determinant. Since these components are so closely related, it is safe to say that even if we had maintained import instead of export in the model, a comparable one would have been developed. Consequently, there is some overlap between our findings and those of the aforementioned study. In their study, Azolibe et al. (2020) the determinants of unemployment in developing countries and compared the extent of their influence in Nigeria and South Africa. They concluded that South Africa's banking system credit counts more than Nigeria's in reducing unemployment rates. Additionally, other macroeconomic variables, including the interest rate, inflation rate, government spending, and population growth, had a bigger impact on South Africa's unemployment rate than Nigeria's. This study is valuable because there are not many studies aimed at the determinants of unemployment in developing countries in Africa.

This study proves that the determinants of unemployment in developing countries are largely similar not only to those in European countries but also in Asia or America. Minor differences compared to our study can be seen, for example, in the influence of the bank credit system or population growth, which were not considered in our analysis. Olowu et al. (2019) also looked for the determinants of unemployment in several countries in South Africa during the years 1995-2015. They identified agricultural added value as a key determinant of unemployment, with the impact being significant in the short term but even more significant in the long term. This factor probably has a more significant impact on developing economies than developed ones. From 1995 to 2019, Mimi et al. (2022) examined the impact of Bangladesh's human capital investments on unemployment. The authors used the ADF and PP tests to determine the study's unit root. The study's findings demonstrate that government health spending on human capital significantly impacts Bangladesh's long-term unemployment rate.

The study found no evidence of a short-term link between unemployment rates and human capital investment. In our study, we didn't concentrate on the long-term effects of macroeconomic indicators; instead, we analyzed the impact of their change on the unemployment rate in three months. Our analysis, however, did not break down government spending into more particular categories, which would be a useful addition in the future. Yu et al. (2023) examined how the corruption index, foreign direct investment (FDI), unemployment, corruption, and crime rate impacted Bangladesh's economic growth from 1988 to 2019. The findings indicate that, in addition to crime, unemployment, and other factors, the corruption index has a considerable negative

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influence on economic growth. Simply expressed, economic growth is increased by declining levels of crime, unemployment, and corruption. In our work, we chose the registered unemployment rate as the dependent variable, and the determinants were the GDP, corruption index and others. These subtle distinctions suggest a two-way causal relationship and the potential for future FDI research expansion. The authors found an indirect link between GDP growth and levels of corruption, which is in congruence with our findings. Because the growth of the corruption index we used in our research indicates a lower level of corruption, we have confirmed that a rising level of corruption causes an increase in unemployment. In our analysis, the relationship between the corruption index and the registered unemployment rate was direct. Fagbemi et al. (2023) also looked at how corruption affects unemployment. As indices of unemployment, they utilized corruption control and corruption index. The study was carried out in the Nigeria region from 1996 to 2020. They also found that there is a clear link between rising levels of corruption and unemployment.

Conclusions

Numerous authors from all around the world have discussed the link between unemployment and the COVID-19 disease or the crisis itself. We discussed the potential consequences of unemployment in the introduction section of the article, noting that it may exacerbate the disease's progress and raise mortality. The COVID-19 crisis' effects on unemployment in Spain, Italy, Germany, Great Britain, and France were examined by Su et al. (2021). Except for Italy, where unemployment was shown to be inversely connected with the COVID-19 crisis at the 10% significance level, they all had a positive and statistically significant correlation. Indirect relationships also existed between the number of deaths caused by COVID-19 disease and the unemployment rate in Italy. These results are unexpected, and more research on the effect of the entire Italian crisis on unemployment is necessary.'

Except for Italy, our findings in this study agree with those in the other nations. Svabova et al. (2021) dealt with calculating the effect of a pandemic, or more accurately, anti-pandemic measures, on the development of the registered unemployment rate in Slovakia. Their findings point to a 2-3% rise in 'the unemployment rate in 2020 compared to its estimated trajectory' which would have happened in the absence of the pandemic. Despite that both studies were carried out in Slovakia, our findings point to a greater impact of the COVID-19 crisis on the unemployment rate. The methodologies employed and the length of the studied period are the two key areas where the research differs.

Our focus was on several macroeconomic factors as the potential determinants of unemployment in Slovakia, emphasizing their impact during the COVID-19 crisis. Several macroeconomic factors were considered: average interest rates, gross minimum wage, GDP, inflation, exports, imports, government spending, corruption index, COVID-19 crisis, and month of the year. However, not all factors are retained in the resulting model. Some of them were discarded due to the multicollinearity or due to the low statistical significance. The resulting model contains the COVID-19 crisis, inflation, government spending, and exports as significant determinants of unemployment in Slovakia during the analyzed period.

The COVID-19 crisis affected unemployment with a 1-month delay and contributed to growth by 0.94 percentage points per month. The impact of the crisis may actually be even more extensive, as the crisis affected both endogenous and exogenous variables considered in the analysis. The results of this research are of practical importance, especially in predicting the development of the unemployment rate during the crisis and

can help create measures and decisions during the crisis in an effort to mitigate its consequences.

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