The relationship between unemployment and macroeconomic indicators

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Abstract. The issue of unemployment set in the context of economic development is a crucial issue for ensuring economic growth of a country. The aim of the text is to analyze the relationship between unemployment and basic macroeconomic indicators and to confirm the direct relationship between these variables. The research method used was the analysis of the values of the general unemployment rate, gross domestic product, i.e. GDP, and gross value added, i.e. GVA, and their subsequent comparison. Other research methods include correlation analysis with Pearson's correlation coefficient, which confirmed a high degree of correlation between the general unemployment rate and the values of GDP and GVA. The research confirmed the existence of a correlation between the general unemployment rate and both GDP and GVA. GDP and GVA in the Moravian-Silesian Region were increasing in the sample years 2013-2019, while the general unemployment rate was decreasing. The analysis of the values shows that the values of GDP and GVA were inversely proportional to the values of the general unemployment rate. A limitation of the research was that economic development is not only influenced by the unemployment rate. As a result, it was not possible to establish a precise value that would define the extent of the impact of unemployment on the economic development of the region. The contribution of the paper is the confirmation of the existence of the correlation of unemployment with the mentioned development indicators, and the validity of Okun's Law also on the territory of the Moravian-Silesian Region.

Keywords: unemployment, GDP, GVA, Okun's law, Moravskoslezský region

1 Introduction

The topic of unemployment analysis in the context of the development of the Moravian-Silesian Region was chosen deliberately. Unemployment is a relatively large and long-term social problem in this region. However, according to [1], unemployment is not only a social risk, but also affects the national economy, which does not use the potential of the labour force due to the lack of jobs. The relationship between economic growth and unemployment shows that there is a high degree of correlation between the rate of economic growth and the decline in the unemployment rate [2]. The relationship between economic growth and

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unemployment has been experimentally studied in the economic literature based on what is known as Okun's law, which shows that there is an inversely proportional relationship between a change in the growth rate (GDP) and a change in the unemployment rate [3].

The main research question is the impact of the general unemployment rate on the gross domestic product of the Moravian-Silesian Region. In this research part we try to confirm the validity of Okun's law in the selected area. The second research question is the effect of unemployment rate on gross value added of the same region. In this case, we try to prove the validity of Okun's law using a different economic indicator than gross domestic product. Both GDP, Gross Domestic Product, and GVA, Gross Value Added, are basic macroeconomic indicators used to determine the performance and the economy.

2 Literature research

The topic of unemployment is quite a debated topic and many professional and popular publications have been written about it. Unemployment is a serious social and economic phenomenon that is often perceived as causing a huge burden on society [4]. The impact and reflection of the Great Depression, in which unemployment was a big concept, was the focus of [5]. According to the authors, unemployment will always accompany us and in the future, we will have to deal with unemployment and its impact. The unemployment rate is one of the key indicators of the labour market, which contains information about the activity of the labour market and the overall state of the economy [6]. [7] focused on the sensitivity of unemployment to output as a function of time. According to his research, the latter was increasing, but this was in the context of greater use of fixed-term contracts [7].

The unemployment rate is the main macroeconomic indicator used in forecasting losses. The COVID-19 pandemic has caused an unprecedented level of volatility in labor market variables, leading to new challenges in using the unemployment rate in risk modeling [8].

While economists and academics argue convincingly that a certain natural rate of unemployment cannot be erased, increased unemployment imposes high costs on individuals, society, and the country [9]. Worse, most of the costs are of the deadweight loss type, where there are no offsetting gains with costs that everyone must bear. Depending on how it is measured, the unemployment rate can be interpreted [10].

It is true that: unemployment has costs to society that are more than just financial, unemployed people not only lose income but also face physical and mental health problems and there are social costs of high unemployment [11].

In advanced economies, macroeconomic indicators of unemployment and price indices tend to predict the sustainability of the relationship between them [12].

The topic of the impact of unemployment on mental health was also addressed by [13], whose work focused on different stages of unemployment. "Various fluctuations in mental health during periods of unemployment have been noted. We argue that there is a coping process in this situation" [13, 14]. Insurance can also stave off the fear of unemployment. Its influence has been the focus of [15], who describe the positive effects of unemployment insurance, which has been shown to reduce fears of future unemployment [15].

Macroeconomic variables respond to shocks in the perception of three dimensions of uncertainty (economic, inflation and employment) [16].

The cost of unemployment for individuals is not hard to imagine. When a person loses their job, it often has an immediate impact on their standard of living. Even those who are entitled to unemployment and other social benefits find state assistance insufficient, as these benefits often replace only part of their regular income. As a result, unemployed people consume much less than usual. Prolonged unemployment can lead to an erosion of skills and work habits, depriving the economy of useful talent that could be used in the future. The experience of unemployment (whether direct or indirect) can also change the way workers

plan for the future - long-term unemployment can lead to greater scepticism and pessimism. In a similar vein, the absence of income generated by unemployment can lead families to deny their children educational opportunities, depriving the economy of a quality potential workforce [3]. [17] quantified the costs that are spent annually from the state budget in case of unemployment of young graduates. Analysis was performed using the counterfactual Propensity Score Matching method, followed by measures of employability and job sustainability at the end of the intervention.

The minimum wage is influenced by state intervention, which intervenes in the market mechanism and represents an important indicator when assessing the impacts in the wage area. If the average wage indicator is an endogenous variable, this variable has a positive as well as a negative impact on the remaining analyzed indicators [18].

The gender disparities in unemployment are discussed in [19], who finds that the main cause of these disparities is differences in the composition of the industry itself.

Its actual impact is looked at by [20], who, among other things, explain the basic principle as "the dynamics of output and unemployment that are relevant to markets, policymakers, and the average economic agent." [20] the very dominance of the output growth-unemployment relationship was verified in their paper by [21], who used Okun's Law to analyze these factors in the Netherlands.

Accurately identifying economic recessions is a macroeconomic challenge. The Sahm recession indicator is one of the most reliable early detectors, relying on changes in unemployment subject to labor force misclassification errors [22].

Due to the COVID-19 pandemic, companies, not only in cultural management, and their employees had to deal with a number of changes and people faced new challenges, not only in the workplace, but also in the area of unemployment [23]. The COVID-19 pandemic has affected every aspect of consumer behavior – their spending, investments, and financial reserves, as well as their financial and social well-being [24].

3 Data and methods

As the first data source, will be used data on the general unemployment rate in the Moravian-Silesian Region. The data source is the publicly accessible database of the Czech Statistical Office, which can be found on its website. It will be focused on examining the data for the years 2013-2019, where we will examine the general unemployment rate expressed as a percentage.

The second set of data that will be used as an indicator of the development of the Moravian-Silesian Region will be GDP and GVA, i.e., gross domestic product and gross value added. These are key indicators of economic development. The source of these data will also be the publicly accessible database of the Czech Statistical Office, which, as aforementioned, can be found on the CSO website. In this case will be also focused on data obtained from 2013-2019.

In this thesis, it will deliberately not be used the years 2020-2021, as this is the period when the economy slowed down to a complete halt due to the coronavirus epidemic. Therefore, the obtained data would not be conclusive.

The method of data collection will be compiled in this study of statistical data from the Czech Statistical Office. Subsequently, it will be made a comparison of the data. In this type of data comparison, it will be not necessary for the data to be expressed in the same unit, as it will only be important to express the growth or decline of a given value. The aim of the data comparison will be confirmed that unemployment has a major impact on the development of the region. The results will be displayed in tables.

It will be assumed that unemployment in the Moravian-Silesian Region will have a negative effect on local GDP and GVA. If the general unemployment rate falls, both values

will rise. Therefore, these two indicators will be inversely proportional to the unemployment rate.

The next analysis will be a correlation analysis between the general unemployment rate and the evolution of GDP and GVA over the period 2013 to 2019. This analysis will be used the Pearson correlation coefficient. It will be denoted this coefficient by r. If the correlation (r) = 0, then there is no linear correlation between the correlation variables.

For a linear correlation to exist, $r < 0$, $r > 0$, $r < 1$ and $r > -1$ must hold.

If: $r < 0$, it is a negative correlation and if $r > 0$, it is a positive correlation.

In general, the coefficient r has to be in the interval [1;1] and the following formula will be used:

$$r = \frac{\sum_i (x_i - \bar{x})\,(y_i - \bar{y})}{\sqrt{\sum_i (x_i - \overline{\bar{x}})^2}\,\sqrt{\sum_i (y_i - \overline{\bar{y}})^2}} \quad (1)$$

The analysis will be processed in Microsoft Excel using data tools with the "Correl" function. The correlation coefficient will be divided into four groups of low correlation, medium correlation, high correlation and pure correlation.

Low correlation	r = 0.001 to 0.300 and -0.001 to -0.300
Mean correlation	r = from 0.300 to 0.750 and from -0.300 to -0.750
High correlation	r = 0.750 to 0.990 and from -0.750 to -0.990
Net Correlation	r = [1] and [-1]

4 Results

Based on the study of the unemployment rate in the Moravian-Silesian Region, was found the highest value in 2013. According to the Czech Statistical Office, in that year the unemployment rate was 9.9%. Then in 2014 the unemployment rate dropped to 8.6% and the downward trend continued. In 2015, the unemployment rate was 8.1%, in 2016 it fell to 6.9%, in the following year 2017 it continued to fall to 4.7% and in 2018 the unemployment rate was 3.7%. The lowest unemployment rate in the Moravian-Silesian Region was measured in 2019. In that year, the value fell to 3.6%. The development of the unemployment rate is shown in Table 1. Comparing the data from each year, we can notice that the general unemployment rate in the Moravian-Silesian Region has been decreasing in the long term.

Table 1. General unemployment rate 2013-2019.

General unemployment rate (%)							
Year	2013	2014	2015	2016	2017	2018	2019
Moravian-Silesian Region	9,9	8,6	8,1	6,9	4,7	3,7	3,6

Source: own processing based on data from the Czech Statistical Office.

The next value examined was GDP, i.e. gross domestic product. In 2013, GDP was 390,709 million. CZK. Then in 2014 it rose to CZK 416 291 million. CZK and it increased. In 2015, it reached CZK 435 540 million. In 2016 it reached CZK 450 316 million. In 2017, it reached CZK 471 366 million. CZK 3,366 million. In 2018, the GDP of the Moravian-Silesian Region exceeded CZK 500 000 million. The value in this year was 500 421 mil. CZK. In 2019, GDP reached 509 646 mil. CZK and thus the highest value of the examined years. The development of the value of GDP is clearly shown in Table 2. After comparing

the values from these years, it reported that the value of GDP in the Moravian-Silesian Region was steadily increasing.

Table 2. Gross domestic product 2013-2019.

GDP (million CZK)							
Year	2013	2014	2015	2016	2017	2018	2019
Moravian-Silesian Region	390 709	416 291	435 540	450 316	471 366	500 421	509 646

Source: own processing based on data from the Czech Statistical Office.

The last value dealt with was GVA, gross value added. It amounted to 350 175 million in 2013. CZK. In 2014 it rose to CZK 376 519 million. It continued to grow. In 2015 it was CZK 392 206 million. In 2016, it reached CZK 405,053 million. CZK 423,579 million in 2017 and CZK 423,059 million in 2014. CZK 450 964 million in 2018. CZK. It then reached its peak in the last year under review, reaching CZK 460 479 million. CZK 460 479 million. The value of GVA as well as the value of GDP has been increasing every year. The GVA values in each year were shown in Table 3.

Table 3. Gross value added 2013-2019.

GVA (million CZK)							
	2013	2014	2015	2016	2017	2018	2019
Moravian-Silesian Region	350 175	376 519	392 206	405 053	423 579	450 964	460 479

Source: own processing based on data from the Czech Statistical Office.

Table 4. Correlation analysis between GDP (million CZK) and the Moravian-Silesian Region between 2013-2019.

	Year (2013-2019)	GDP (mill. CZK)
Year (2013-2019)	1	
GDP (million CZK)	0,995704587	1

Source. own processing based on data from the Czech Statistical Office.

In Table 4 was find the value of the correlation coefficient between GDP (in million CZK) and the period 2013 to 2019. The value of the correlation coefficient is 0.995704587. This value was close to the net correlation.

Table 5. Correlation analysis between GVA (million CZK) and the Moravian-Silesian Region between 2013-2019.

	Year (2013-2019)	GVA (million CZK)
Year (2013-2019)	1	
GVA (million CZK)	0,994570331	1

Source. own processing based on data from the Czech Statistical Office.

In Table 5 was find the value of the correlation coefficient between GVA (in million CZK) and the period 2013 to 2019. The value of the correlation coefficient was 0.994570331. This value was close to the next correlation.

The first research question was the impact of unemployment on the development of the Moravian-Silesian Region, where the indicator of the unemployment rate was the general unemployment rate and the indicator of development was the gross domestic product. These values would be inversely proportional. From the measured values and from the analysis it was obvious that the general unemployment rate has been steadily decreasing from 2013 to 2019, while GDP has been increasing. This forecast was therefore confirmed.

The second research question was also the impact of unemployment on the development of the region, but this time the indicator of development was gross value added. As well as GDP, GVA is also growing between 2013 and 2019. Thus, the assumption was confirmed in both cases. Both GDP and GVA are inversely proportional to the general unemployment rate. The higher their value, the lower the share of unemployed persons in the total labour force.

This fact points to a correlation between unemployment and the economic development of the region, which was further examined in Tables 4 and 5. The correlation coefficient was examined between the general unemployment rate and the GDP in the period 2013-2019, and between again the general unemployment rate and the GVA in the period 2013-2019. The resulting value of both coefficients exceeded 0.99, which was close to a net correlation with the chosen methodology and thus the association was confirmed.

The research confirmed the results of the literature and proved the validity of Okun's law. The validity was demonstrated in the relationship of unemployment with gross domestic product as well as in the relationship of unemployment with gross value added.

5 Conclusions

The research achieved its aim by answering both research questions. The first one was the impact of unemployment on the development of the Moravian-Silesian Region, where the indicator of development was the gross domestic product. The second one was the impact of unemployment on the development of the Moravian-Silesian Region, when gross value added was used as the development indicator. The assumption was an inverse relationship between the general unemployment rate and GDP and GVA.

The assumption was confirmed by research. While the unemployment rate declined between 2013 and 2019, gross domestic product and gross value added increased.

Evidence that the objective of the thesis has been met the numerical results that have demonstrated the validity of Okun's law of correlation between the unemployment rate and gross domestic product. It was shown that Okun's law can be applied only to a selected area, in this case the Moravian-Silesian region, and cannot be applied only to the national economy. Furthermore, it was proved that this law can be applied to research with other indicators of economic development than gross domestic product.

A limitation of the research was factors that affecting the economy of the region itself. Thus, the economic growth of the Moravian-Silesian Region was not logically influenced only by the unemployment rate. Due to this, the research method used cannot provide a precise value that would define the extent of the impact of unemployment on GDP and GVA.

The research can serve mainly as a basis for further and deeper investigation of the relationship between unemployment and GDP and GVA in the Moravian-Silesian Region.

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