Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Trade and Finance

Bachelor's Thesis

The relationship between GDP growth and unemployment. Testing the Okun's law in Germany

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The relationship between GDP growth and unemployment. Testing the Okun's law in Germany

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Objectives of thesis

Unemployment is one of the most important macroeconomic factors. What influences the increase in the number of unemployed in the country is a question that requires careful study, because it is also key in solving many other problems – the standard of living in the country, the number of poor people and people on the poverty line. Therefore, this work is very interesting on its topic, since it will study the dependence between two macroeconomic factors – unemployment and the level of GDP.
In 1962, Arthur Melvin Okun, then a professor at Yale University, described the negative relationship between the unemployment rate and real GDP. This relationship became known as "Okun's law." Okun's law says that the unemployment rate depends inversely on the growth rate of domestic product.
In this work, a study will be carried out, which will have a theoretical and practical part. In the theoretical part, unemployment will be described as a macroeconomic indicator, GDP and methods of calculating it, and Okun's law will be explained. The practical part will analyze Germany and the dependence of the unemployment rate on GDP. Germany was chosen because it is a very developed country that has been showing economic growth for several decades. In addition, Germany has a very low unemployment rate, which increased only after the 2008 economic crisis, but returned to its previous low values a few years later.
The work will conduct a correlation analysis and reveal the relationship between unemployment and GDP in Germany over the past 15 years, that is, from 2005 to 2020.
The main hypothesis that will be confirmed or refuted in this work is the following: The development of the unemployment rate and GDP in Germany confirmes the Okun's law.
The aim of the thesis is to find correlation between the unemployment rate in Germany and the GDP growth.

Methodology

The main methods used in this thesis will be: literature research – compilation of academic sources, books and articles in the professional economic literature. Then there will be statistical analysis of how unemployment rate and GDP have fluctuated in Germany in the last 15 years (timelines analysis). After that correlation analysis will be conducted where unemployment will be the independent variable and the GDP will be dependent variable.

The proposed extent of the thesis

60-80 stran

Keywords

Unemployment, GDP growth, Okun's law, Germany

Recommended information sources

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Declaration

I declare that I have worked on my bachelor thesis titled "The relationship between GDP growth and unemployment. Testing the Okun's law in Germany" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break any copyrights.

In Prague on 27.11.2022 _____

Acknowledgement

I would like to thank doc. Ing. Inna Čábelková, Ph.D. and all other persons, for their advice and support during my work on this thesis.

The relationship between GDP growth and unemployment. Testing the Okun's law in Germany

Abstract

The aim of the thesis is to find a correlation between the unemployment rate in Germany and the GDP.

The main hypothesis that will be confirmed or refuted in this work is the following: The development of the unemployment rate and GDP in Germany confirms Okun's law.

The author concludes that it is possible to say that Okun's law does its job of predicting the nature of the relationship between the two negatively correlated variables well indeed, but the percentual effect on the real GDP in Germany is far from being equal to 2%. Hence, the development of the unemployment rate and the real GDP in Germany only partially confirms Okun's law since the change in the unemployment rate is only responsible for a 1.19% change in the real GDP.

Keywords: Unemployment, GDP growth, Okun’s law, Germany

Vztah mezi růstem HDP a nezaměstnaností. Testování okunova zákona v Německu

Abstrakt

Cílem práce je najít korelaci mezi mírou nezaměstnanosti v Německu a HDP.

Hlavní hypotéza, která bude v této práci potvrzena nebo vyvrácena, je následující: vývoj míry nezaměstnanosti a HDP v Německu potvrzuje okunův zákon.

Autor dochází k závěru, že je možné říci, že okunův zákon dělá svou práci předpovídat povahu vztahu mezi dvěma negativně korelovanými proměnnými skutečně dobře, ale procentní účinek na reálný HDP v Německu zdaleka není roven 2%. Vývoj míry nezaměstnanosti a reálného HDP v Německu tedy jen částečně potvrzuje okunův zákon, protože změna míry nezaměstnanosti je zodpovědná pouze za změnu reálného HDP o 1,19%

Klíčová slova: Nezaměstnanost, růst HDP, Okunův zákon, Německo

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1 Introduction

Unemployment is one of the most important macroeconomic factors. What influences the increase in the number of unemployed in the country is a question that requires careful study because it is also key to solving many other problems – the standard of living in the country, the number of poor people and people in the poverty line. Therefore, this work is very interesting on its topic, since it will study the dependence between two macroeconomic factors – unemployment and the level of GDP.

In 1962, Arthur Melvin Okun, then a professor at Yale University, described the negative relationship between the unemployment rate and real GDP. This relationship became known as "Okun's law." Okun's law says that the unemployment rate depends inversely on the growth rate of domestic product.

In this work, a study will be carried out, which will have a theoretical and practical part. In the theoretical part, unemployment will be described as a macroeconomic indicator, GDP and methods of calculating it and Okun's law will be explained. The practical part will analyze Germany and the dependence of the unemployment rate on GDP. Germany was chosen because it is a very developed country that has been showing economic growth for several decades. In addition, Germany has a very low unemployment rate, which increased only after the 2008 economic crisis but returned to its previous low values a few years later.

2 Objectives and Methodology

2.1 Objectives

The aim of the thesis is to find a correlation between the unemployment rate in Germany and the GDP.

The main hypothesis that will be confirmed or refuted in this work is the following: The development of the unemployment rate and GDP in Germany confirms Okun's law.

2.2 Methodology

The main methods used by the author of the following thesis involve the splitting of the work into two equally important parts – the literature review and the practical part. Whereas the first part primarily concentrates on the analysis of the relevant framework related to two important concepts used in the thesis – real GDP, measured in national currency (amount of goods and services produced over one year in a given country) and unemployment, measured in percentage points (the number of unemployed workforces divided by the number of the total workforce), the practical part is represented by the empirical analysis where the author analyzes the recent development of macroeconomic indicators of Germany, and also created an econometric linear model with two variables – change in real GDP in percentage points in Germany (dependent) and change in the unemployment rate in Germany in percentage points (independent).

3 Literature Review

As was already mentioned above unemployment is maybe one of the key phenomena in the world economy that influence and has a negative effect on different directions: individuals, families, society and the entire economy itself. The problems related to the job loss and, of course, the circumstances related to the finding of new jobs can create a basis for pessimism in the society of the country and respectively can put down all the figures linked to the health and financial problems in the community. With the increasing unemployment index, the economy grows much more slowly and even sometimes has a negative effect as well as the level of GDP is also reflected in that case. There is also an according effect on the country's budget as the income tax revenues paid by people are also reduced.

Many authors and researchers made analyses of the relationship between the GDP of the country and the unemployment rates and the respective influence on the future development of the region. The key analysis of this kind of relationship shows several linkages with the GDP, unemployment rates, and common economic problems of the country which include the basic development and again the unemployment rate in the short and long term. It means that the level of prosperity, living standards and poverty are among the key elements of analysis of the country's development. That is why governments all around the world pay critical attention to the living standards and unemployment rates in the framework of the economic development of the country.

Hereby in this section, there will be a literature review aimed at the different aspects and two related functions the unemployment rate and the economic growth rate which basically could be taken as GDP.

3.1 Unemployment

To begin with, it is essential to mention that unemployment is generally expressed in percentage points, and it is calculated as the total number of unemployed people divided by the total number of workforce and multiplied by 100.

Unemployment has various types, which are:

Seasonal (workers lose jobs due to the changes in seasons)
Cyclical (workers lose jobs due to the change in the business cycle)
Structural unemployment (workers lose jobs due to shifts in economic tendencies)
Frictional unemployment (workers are temporarily jobless while they are in search of another job) (Kitov, 2011)

The traditional or neoclassical approach stated that the economic development of the country and the respective economic growth depends mostly on technological progress, especially during the technological revolution in western countries, while the unemployment rate does not have a significant effect (Zagler, 2004, p. 3). The new inventions in such countries as the USA, UK, Germany, France, Italy, Russia, and Japan in IT, machinery, technology, and manufacturing pushed forward the technological progress that had a significant effect on the country's development in common and, of course, the influence on the economic growth in figures. Nevertheless, technological progress also pushed firms to accept integrating new practices into their enterprises.

This view was changing over time and the authors of different research more and more often mentioned the various factors that reflect the economic growth among the well-known ones and the unemployment rate was pointed out also. On the other side, the authors took the position of somehow creating the linkage between the unemployment rate and economic growth, and in that case, this matter took a different form of understanding (Gruchelski, 2013, p. 23). That is why the relationship between GDP, economic growth of the country itself and unemployment rate is the subject of many different kinds of research

and analyses all around the world as the authors try to find the correlation in the framework of the theoretical and empirical analyses.

The sensibility of unemployment to economic development and fluctuations in economic growth was one of the key elements of Keynesian theory. In addition to this, the representatives of neoclassical economics also accepted the possibility that the changes in the unemployment rate in the short term can cause cyclical fluctuations in the country's economy (Kwiatkowski, 2002, p. 100). In principle, Keynesian economics argued that inadequate overall demand could be followed by prolonged periods of high unemployment rate. Inadequacy could be in the economy's outputs and services in the direction of several components:

- consumption;
- investment;
- government purchases;
- net exports.

The net exports hereby are the difference between the import and export of the country which could be positive as well as negative depending on the economic direction, size, technological development, needs etc. of the country. The positive net export creates a trade surplus while the negative – trade deficit for the country. At the same time, the Keynesian theory argues that demand drives supply and the healthy economies in developed countries invest more than they save. In that situation, the unemployment rate also plays a critical role here. Because of the high unemployment rates and decreased level of the economy during the recessions, the Keynesian theory allows the increasing of government spending to prevent the increase in demand that spurs inflation.

The other authors, the professors of Stanford University, Robert E. Hall and John B. Taylor (Hall, Taylor, 1991, p. 211) in their work "Macroeconomics" mentioned that the negative correlation between the GDP and the unemployment rate is one of the most important and reliable rules and generalizations formulated by the economists. One of the

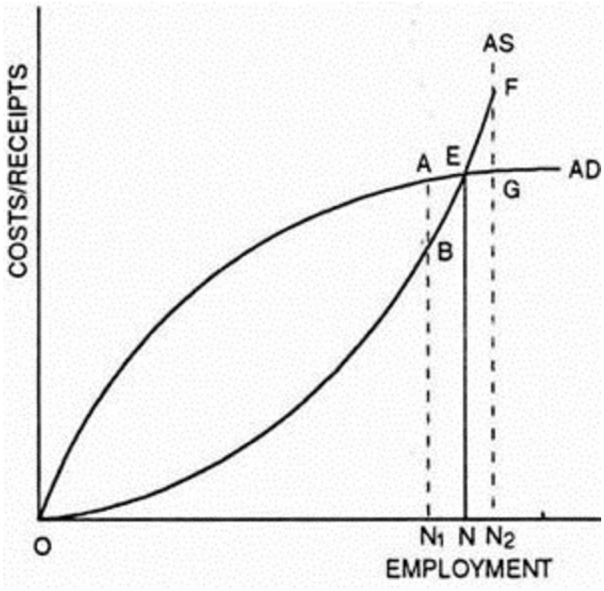
key arguments of Keynes's view is that the volume or the size of the employment in the country and the economy itself is specified by the respective size of the demand, including consumption and investment demand. At the same time, consumer demand depends on income. That is why Keynes negatively reflected the statements from neoclassical economics that the cuts in nominal wages have a positive effect on employment growth. On the opposite, he stated that the cuts in the nominal wages could not guarantee full employment in the market as well as economic growth or an increase in production volumes (Gruchelski, 2013, p. 97-80). The economist used to have another argument as the assumption of rigid nominal wages. It is important to mention that Keynes does not analyze the employment and unemployment data in the long-term observation. That is why his theory could be interpreted as the theory for the short period. On the other hand, it does not mean that the arguments and definitions in the Keynes's theory and the implementation of the policy cannot be recognized as impact on long-term economic growth and long-term unemployment. In opposite, as shown in the research it could be assumed that the impact of that theory in the long term will be visible. The Keynesian theory also argues that there is a correlation between the level of demand and the level of production in the economy. This was shown as the critical linkage between demand, production, output and employment rate. The increase in effective demand has a positive impact on the increase in production.

In such a situation, obviously, there is an increase in employment and a decrease in the unemployment rate respectively. While insufficient demand is happening then there is a decline in production and respectively decrease in the employment rate. This special case occurs when the sum of intended investments in the whole economy of the country is less than the sum of savings related to the income during full employment in the country (Milewski, Kwiatkowski et al., 2005, p. 544.). According to Keynes's theory, the special case of full employment is possible only when the tendency for investment and tendency for consumption are related to each other. This effect is called the optimum dependency.

The Keynesian employment theory could be indicated by the appropriate figure (Figure 1**)** where the aggregate supply (AS) function consists of different amounts of money that companies and entrepreneurs will receive by selling their goods with different levels of employment. In the other words, the aggregate supply in this figure shows the different levels

of income (including output and employment) that the firms will supply with the different expenses.

Figure 1: Equilibrium level of employment according to Keynes



Source: Das, 2022

As it is mentioned in Figure 1, the aggregate supply (AS) curve slopes upward to the right which means that in the case of a higher level of employment in common will lead to higher output and respectively an increase in sales. At the same time, when the full employment level is reached (as shown in Figure 1 at point F) the curve AS becomes perfectly inelastic. It can be described as the straight vertical line after point F. It means that employees cannot be increased anymore even if the expected sales increases.

According to Keynes's theory, the equilibrium of employment is the point of interaction between the curves AS (aggregated supply) and AD (aggregated demand) where the AD represents the expected receipts by the companies while the aggregate supply is mostly the costs. In that case, the logic is that employment will increase when the expected receipts are greater than the costs. On the other side, employment will increase until the point when the expected receipts will be equal to the costs. It means that the firms will not hire more employees and the employment rate will be stable. At point E in Figure 1, there is the equilibrium in employment according to Keynes's theory when the firms maximize their

profits and they are not intended to increase or decrease employment by hiring or dismissal of the employees. At this level of employment, the economy of the country will have its equilibrium as well. Accordingly, looking at this figure we can mention that at the employment level N1, the expected profits (AN1) are greater than the expected costs (BN1) and the firms will be intended to increase employment and respectively increase the output due to increased production. On the other hand, at the employment level N2, the expected profits (GN2) are less than the expected costs (FN2), so the firms will not be able to increase employment, as they would rather think about the cut staff or salary to reach the necessary equilibrium.

The famous Polish economist and diplomat in the mid of twentieth century Oskar R. Lange developed Keynes's theory of employment that can be summed up with some equational models (Lange, 1945):

- Liquidity Preference Function:

$$M = L (I, Y)$$

The amount of money (M) held by the population of the country is the function of two variables: rate of interest (i) and income (Y).

- Consumption Function:

$$C = F (Y, i)$$

The volume of consumption (C) is the function of income (Y) and the rate of interest (i) where the consumption and income increase and decrease together. It is important to mention that Keynes was not certain about the direct relationship between consumption and the rate of interest, so Oskar R. Lange elaborated on it already.

- Investment Function:

$$I = F (I, C)$$

The volume of investment (I) is the function of the rate of interest (i) and the consumption (C). According to the calculation, the efficiency of capital investments increases when the interest rates are going down. At the same time, the efficiency of the capital increases when the consumption increases and the opposite decreases when the consumption is falling down. In this regard, hereby the F is the investment function.

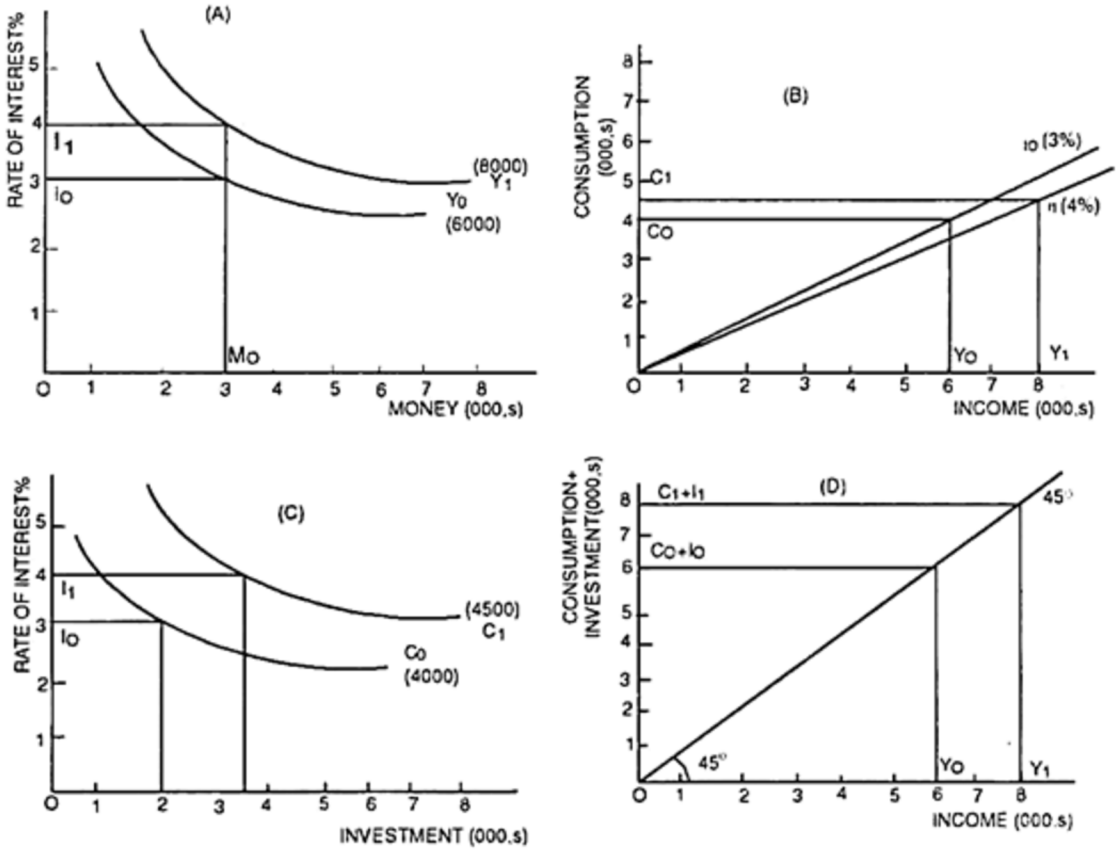
- Income-Expenditure Equality:

$$Y = C + I$$

Finally, in the other words, the income (Y) is equal to the sum of the consumption (C) and investment (I).

All functions explained above can be visualized in the figure (Figure 2).

Figure 2: Equational model of Keynes's theory of employment



Source: Lange,1945

There are some implications of Keynes's theory of employment that could be mentioned in some theses (Keynes, 1936):

I. Reform of Capitalism

Unemployment in Keynes's theory is the normal situation in the capitalist economy. At the same time, he does not want to replace capitalism with socialism.

II. Government Intervention

Keynes indicated that full employment is not what is automatically achieved, thus he advised the government to increase the intervention to raise the demand in order to increase the level of employment.

III. Taxation

Keynes argued that for an efficient increase in employment the volume of consumption and investment needs to be increased. In order to increase the tendency to consumption, he advised redistributing the income from the rich people to the poor people by the progressive taxation that is used now in many countries. It means that the people who get more income need to pay more taxes and the opposite.

IV. Monetary Policy and Reliable:

Employment can be manipulated by growing the quantity of money in the country. This can increase private investments, but Keynes did not suggest this methodology during the depression or unemployment periods.

V. Public Works Program:

Because of the unstable level of private investment, Keynes suggested the government open the public works and utilize the unemployed people there. Because of the multiplier function, this approach can increase employment many times.

VI. The objective of Full Employment:

Over the years, many countries accepted full employment as the main goal to achieve during economic development and policy. It means that in perspective almost every country wants to achieve the level where all people of the country who are able to work will have their jobs.

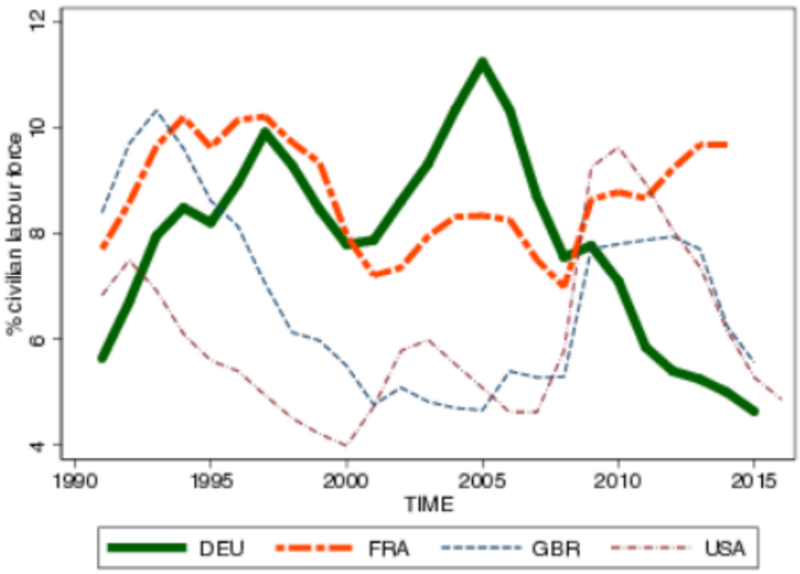
According to the elaborated research and analyses of the other authors related to the theory of employment, there are even possibilities to increase the employment level during recessions. For example, Gruchelski (2013, p. 82) mentioned that even during recessions or a high unemployment rate if the country has unused capital resources then the growth of the aggregate demand for goods and services produced by the local firms and companies is normally followed by an increase in employment and production, and consequently leads to the decrease of the unemployment rate. However, as mentioned by the author the experience

showed that during the last twenty years of the twentieth century the increasing governmental expenditure did not necessarily transform into a decrease in the unemployment rates. Moreover, the different pieces of literature of the number of authors declare the different approaches and interpretations of the Keynesian correlation between the unemployment rate and the economic growth of the country. As Gruchelski mentioned in his study, in the modern society and global economy the changes, and in particular, the increase of the unemployment rate can lead both to development as well as can slow down economic growth. For example, during the demand shocks a positive effect can influence economic growth and decrease the rate of unemployment. On the other side, the supply shocks in the market can have a significant impact on the growth of the country's economy as well as the rate of unemployment. That is why it is very important to understand whether the economy is struggling with Keynesian or classical unemployment and which critical tools are used for more effective results.

In that case, Okun's law is a very good example that describes the correlation between Keynesian unemployment and the economic growth of the country.

Carlos Carrillo-Tudela, Andrey Launov and Jean-Marc Robin prepared another research about the fall of the unemployment rates in Germany in 2018 (Carrillo-Tudela, Launov et al., 2018.). The authors of this paper investigated the recent fall in unemployment, the consequent rise in part-time work, the common labour market of the country and the changes there during the last years, the welfare and the terms and conditions for future development. The paper also describes the positive effect of the Hartz IV reform related to the labour market in Germany. There are interesting comparing of the different unemployment aspects between different countries (Germany, France, UK, and the USA) in this research – mainly the economies that are comparable with each other.

Figure 3: The unemployment rate in percentage of civilian labor

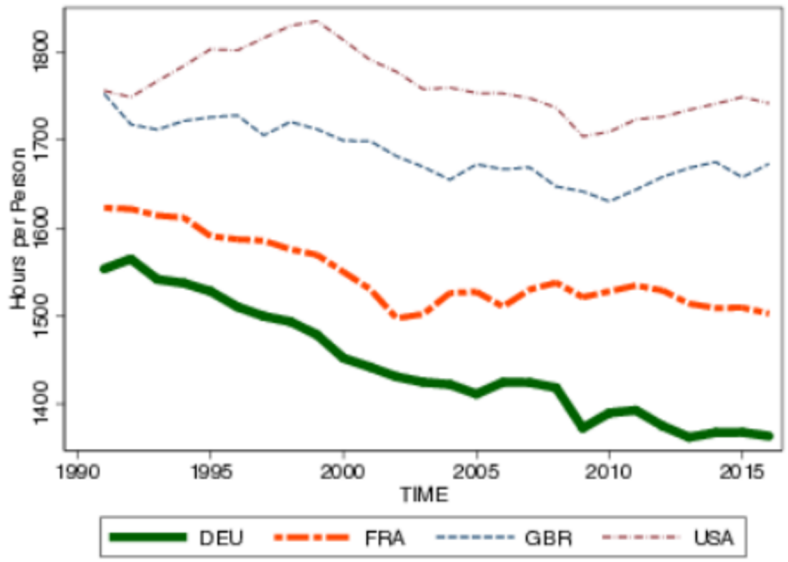


Source: Carrillo-Tudela, Launov et al., 2018

As mentioned in Figure 3 above the unemployment rate in Germany showed an extremely decline since the year 2005 mostly because of the state programs introduced by the government and aimed to reduce the unemployment rate, create new workplaces, adopt the rules and procedures for the refugees, part-time workers and other aspects.

The next Figure 4 shows the tendency the changes the working hours per person employed in different countries. It is also sharply visible that the average working hours per person in Germany decreased significantly during the last 25 years compared to the other countries.

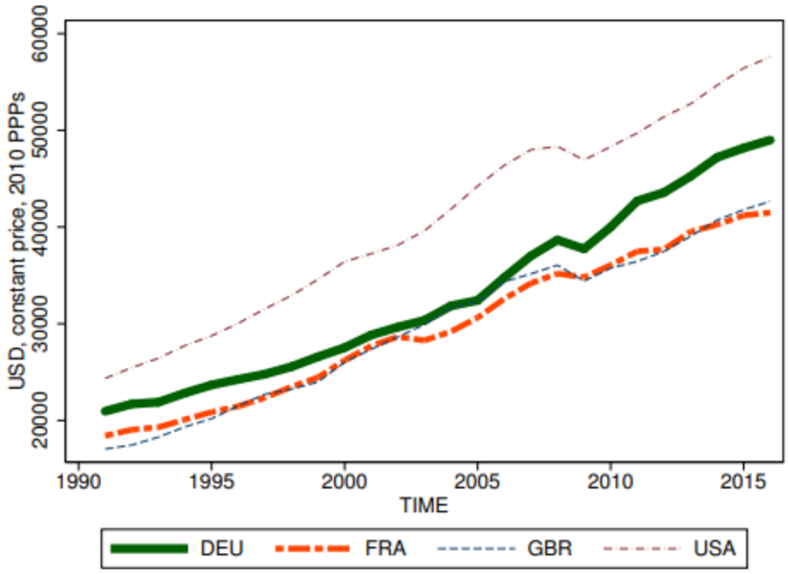
Figure 4: Average working hours per employed person



Source: Carrillo-Tudela, Launov et al., 2018

In that unemployment analysis, one of the most important figures for the evaluation was the level of growth of the local GDP and particularly GDP per capita.

Figure 5: GDP per capita

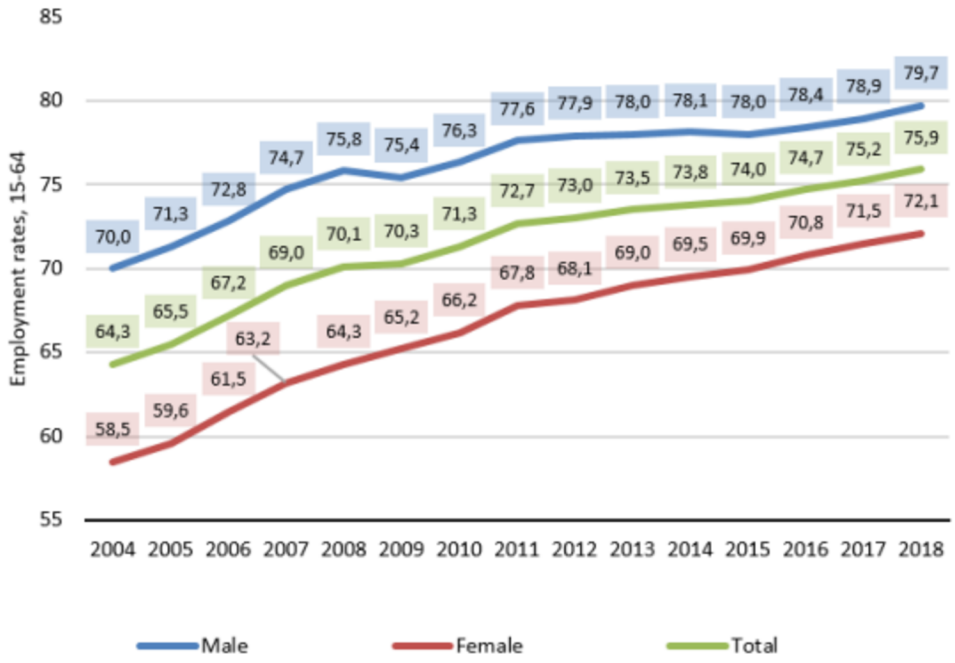


Source: Carrillo-Tudela, Launov et al., 2018

The study also found that the state development programs provided by the Federal Employment Agency helped to increase the quality of the labour force significantly during the last 25 years. Along with the decrease in the unemployment rate, people became more intelligent, qualified and trained.

There are a number of different researches and analyses of the unemployment rates in Germany during the last several years. This topic as well as the correlation between the unemployment rate and the changes in the gross domestic product was always interesting for the researchers as from the literature review the indicators are critical and usable for the different aspects of the economic growth of the country at its different levels of the development. As Germany is one of the most developed countries in the world, the analyses of the economic growth can be transformed to the other countries and regions and can be taken as the key tools for understanding the main economic processes.

Figure 6: Employment rates by gender in Germany (15-64)

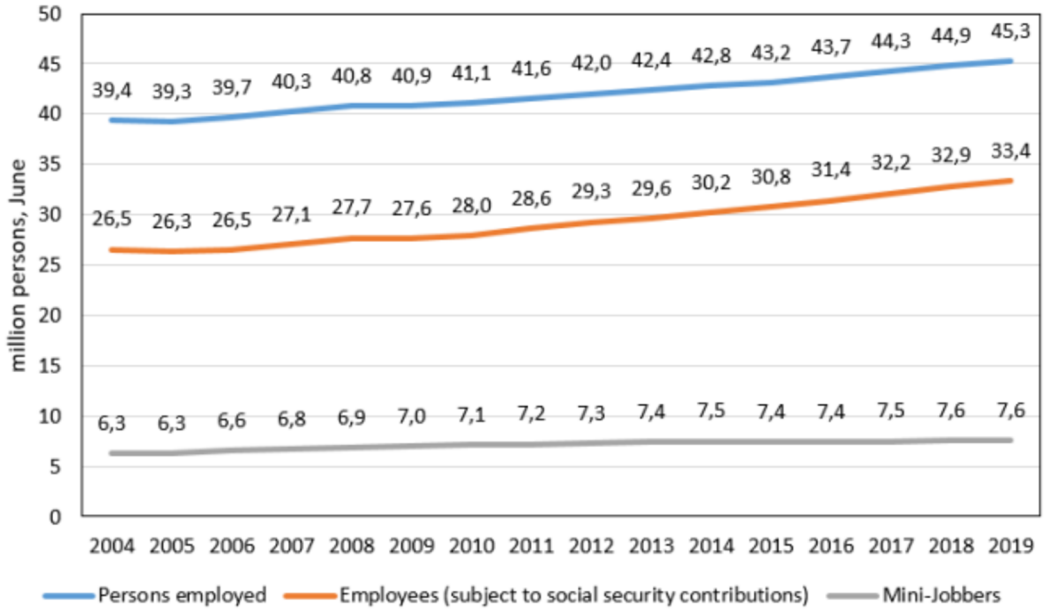


Source: Carrillo-Tudela, Launov et al., 2018

Nicola Duel and Tim Vetter (2020) in their research paid the attention to their analysis of the employment investigation in Germany after the global economic crisis in 2008. The researchers found that employment in Germany kept growing even after the global

economic crisis in 2008 which became the reason for the big changes in different markets across the continents. The key sources and the reasons for this growth in Germany were also the increased employment rates among women and the people who relate to the old ages. Part-time employment, especially among women became the catalyst of more than half of the total employment growth of the country starting from the year 2010. The other forms of non-standard forms of employment lost their relevance over the years because of the better employment conditions. It is interesting to mention that the authors found that 7.9 million people (sixth part of the total employed persons) were low-wage staff. Germany selected the active labour market programs as the key target for reducing the long-term unemployment rates. These active labour programs also covered the refugees assimilated into the country. The new challenges started during the coronavirus pandemic situation when the situation sometimes was out of control. In that conditions, the government made a decision about softening some requirements for the short-time work. The new challenges were also observed during the adaptation of the rules and procedures to the new forms of work.

Figure 7: Employment dynamics in Germany 2004-2019



Source: Carrillo-Tudela, Launov et al., 2018

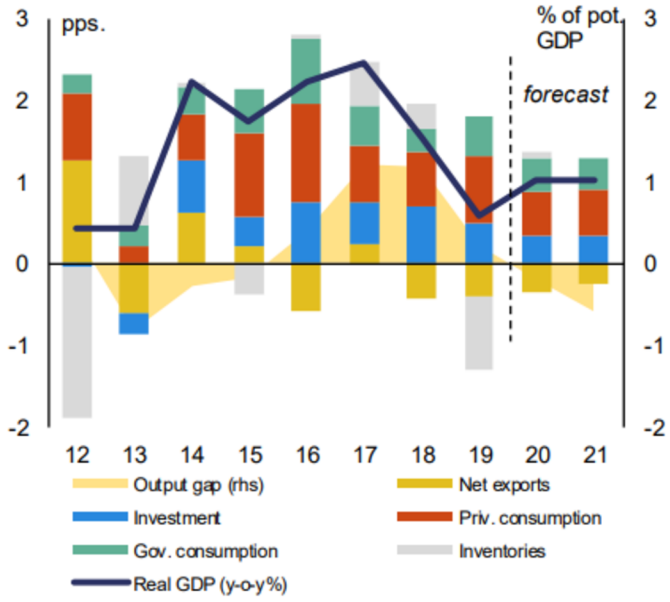
The authors of the research analyzed and collected information about employed persons in Germany since the year 2004 until the year 2019 (Figure 7).

3.2 Gross domestic product

There are many studies covering the analysis of the changes in GDP of Germany and according relationship with the main factors of these changes. That is why it was interesting to observe the Country Report Germany 2020 prepared by the Commission of the European Parliament. The document is valuable, especially because of the coronavirus pandemic situation and the significant impact on industrial development, GDP, unemployment rate and investment possibilities (European Commission, 2020).

As shown in the document, the economic expansion slowed extremely in the year 2019. The growth became unstable compared to 2018 taking into account that the country faced difficulties in manufacturing during the pandemic time. By the year, GDP increased only to 0.6 % and slowed down the average development by approximately 2.2 % per year in 2014-2017 years.

Figure 8: Demand components of GDP growth in Germany

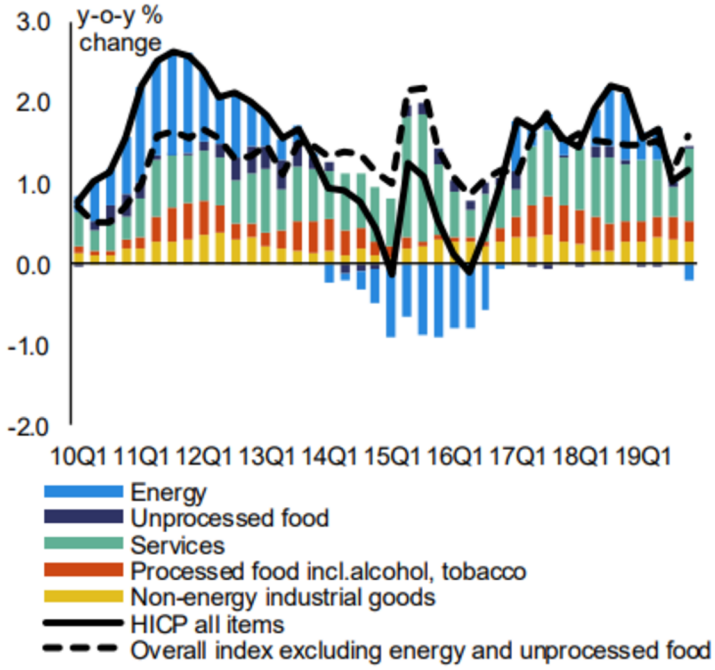


Source: Carrillo-Tudela, Launov et al., 2018

The attractive fact that was elaborated by the authors is that the domestic side of the German economy remained strong and the employment level reached a new high record. Despite the situation, overall market during the coronavirus pandemic situation and the

weakness in activity and more risky business atmosphere the labour market of the country remained strong as well. In such an unusual global pandemic situation with the many restrictions for consumers and service providers, job growth continued in the service sector of the economy. The dismissals or layoffs in the industrial sector including machinery remained contained as the companies and entrepreneurs tried not to lose the well-educated and high skilled employees and keep them for future development because nobody knew about the exact time of the prolongation of the pandemic situation. And also the interesting fact according to a study that despite the negative background of this situation the average salaries continued to grow that really helped to increase the market consumption on average at 0.4% on a quarterly basis. On the other hand, while the public and consumer services in Germany were showing stability the business-related services were demonstrating weakness in front of the common stable picture. Despite all these, the authors predict just a little growth in 2021 only around 1 % which would lead to an annual average increase of 1.4 % in the years starting from 2019 until 2021.

Figure 9: Contribution to inflation



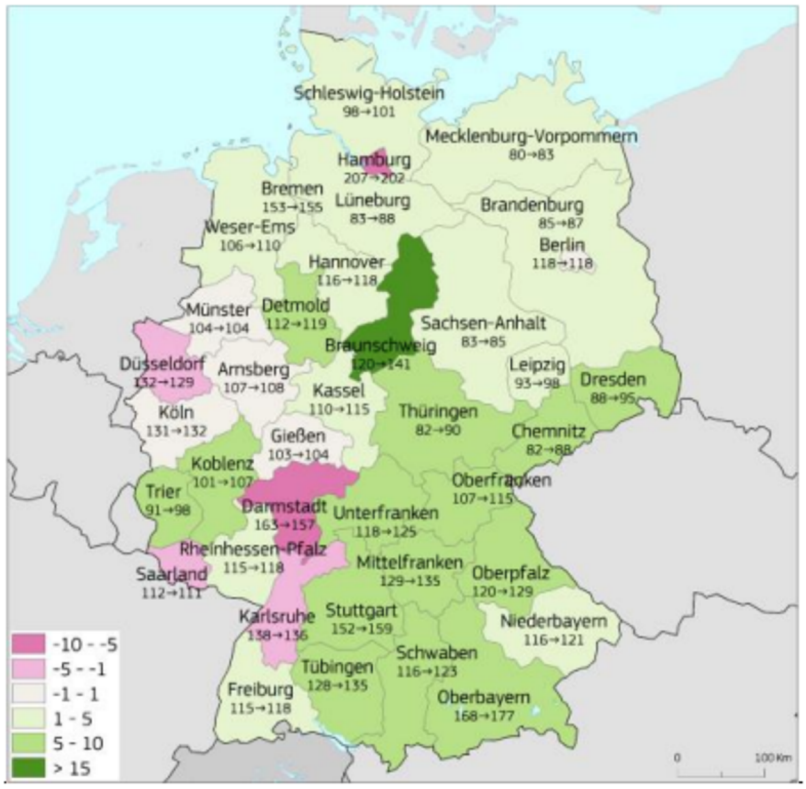
Source: Carrillo-Tudela, Launov et al., 2018

In accordance with the analysis and forecast of the authors, the inflation in Germany should remain moderate. The interesting fact is that the consumer inflation rate has been

shown below the average growth of the salaries (as shown before there was an average increase) that was accordingly supportive for the purchasing power of the population at the market during the pandemic time. Comparing the Harmonized Index of Consumer Prices around 2 % in the year 2018 and not taking into consideration the energy price and some unprocessed food prices the average index for the year 2019 is predicted just around 1.4 %. This picture shows that the inflation rate and the price index do not have a strengthening impact on the overall situation and the domestic aggregate demand projected by the government.

The authors of the research also gave detailed analyses of the GDP change per each structural unit of the country (land) in comparison to each other.

Figure 10: Change in GDP per head (2010–2017)



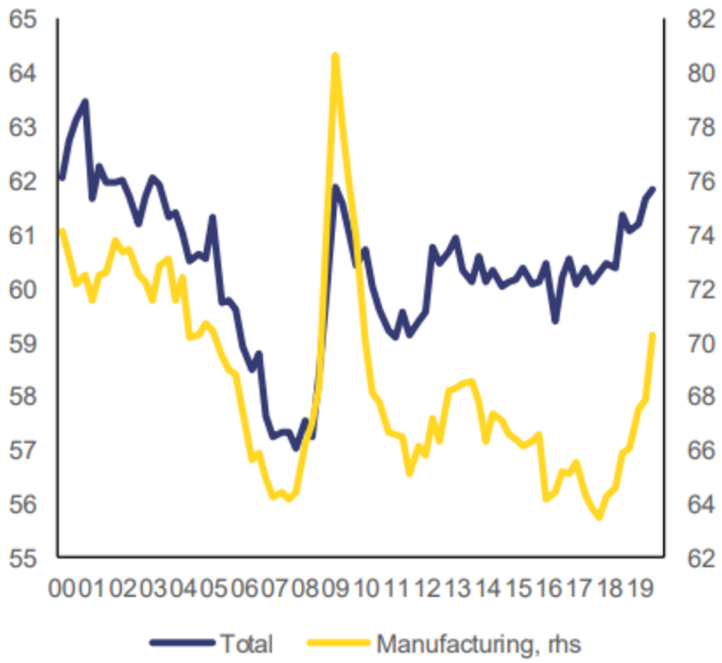
Source: Carrillo-Tudela, Launov et al., 2018

Looking at Figure 10, it can assume that the total change and development of GDP in Germany is unevenly distributed among the lands per head and in some regions, there are

some regional disparities, especially between the east and west parts of the country. According to findings and comparing the results at the beginning of the century, the mentioned disparities became smoother, but the gap is still big between some regions. Even though the German government tried to neutralize the difference between the regions during the last decades the least developed regions remain in the east of the country. For example, as shown in the finding data the GDP per head of the eastern regions of the country in the year 2018 represented just 74.7 % of the same figure of the western part. Nevertheless, in some eastern regions like Western Pomerana (1.0 %) or Berlin (1.1 %) the GDP growth per capita has been growing even lower than the average European Union economy (1.2 %).

Coming back to the labour market in Germany which is one of the parts of this study the authors of the research gave statistical analyses of the unemployment development and the common picture with the forecasts for the future.

Figure 11: Real Unite Labor Cost (ULC), labor share of GDP/GVA, %



Source: Carrillo-Tudela, Launov et al., 2018

As already mentioned in this study the labour market in Germany remained tangibly strong even during the coronavirus pandemic period despite the visible slow growth of the whole economy in the region. The unemployment rate continued its decline and was fixed

at 3.2 % in 2019. The employment rate for the age group between 20 years and 64 years old increased by approximately 1 % in 2019 compared to the previous year and stabilized at 80.5 % which is the highest figure among all European Union countries. The manufacturers and the companies started to rely on short-time-work agreements to avoid layoffs and the payments for compensation. Even in that situation, the employment growth was positive and the unemployment rate continued to show a decline. In addition, the analysis shows that the country does not use fully the potential of its labour market and, for example, in some sectors the female part-time work is still the highest in Europe.

3.3 Okun's law

Arthur Okun was an American economist who had several major works related to the analyses and economic research in different areas including the correlation between the unemployment rate and economic growth. He graduated with a PhD in 1956 in economics from Columbia University and taught at Yale University from 1961 until 1969. However, he became a better-known economist in the United States after started serving as the Chairman of the U.S. Council of Economic Advisors from 1968-1969, an agency within the Executive Office of the President of the United States Lyndon B. Johnson (Okun, 1980).

Being one of the supporters of the Keynesian economic theory, Okun strongly believed in the fiscal policy itself and argued that it was a much better economic tool to influence the stabilization of the economy than the federal monetary policy (Encyclopedia Britannica, 2022). That is why when the United States faced the recession in the middle of the 1960s, being the advisor of the Council of Economic Advisors agency, he advised the President of the United States to make an impact on the taxes burden and by reducing, the taxes stimulating the consumer spending. After leaving, the Council Okun became the senior fellow of the Brookings Institution and started research on the main trends of the economy and relationships with the different factors and tools of management. Some of his works are popular among economists and researchers until now and are describing the main steps to be done for the economic growth and stabilization of the economic situation of the country.

Okun was the founder of the theory well-known as the “Okun’s Law” which cited that for every 3 per cent increase in the economic growth rate above the long-term potential growth rate of the local economy the unemployment would decrease respectively by 1 per cent.

Okun is well known as one of the first modern economists who tried to analyze the correlation between any changes in GDP and the unemployment rate. The theoretical model of Okun's investigation and the dependence between economic growth and unemployment was built based on the study of the economy in the United States. Okun's law can be interpreted in other words. It says that each 1 per cent by which the actual unemployment rate is above the natural unemployment rate means that the real GDP is lower than the potential GDP for 3 per cent. Okun used to have the coefficient (then called Okun's coefficient) as the difference between the actual and the potential level of output which mostly fluctuated between 2 and 3 (Gruchelski, 2013, p. 14.).

Okun’s law can be shown in the following formula:

$$\mathbf{U - U^* = \beta\,(Y - Y^*)}$$

Where:

- Y – actual GDP (shown in per cent);
- Y* – potential GDP (shown in per cent);
- Y – Y* – the difference between the actual and the potential rate of growth indicated as the appropriate gap;
- U – actual unemployment rate (shown in per cent);
- U* – the natural unemployment rate (shown in per cent);
- U – U* – the difference between the actual unemployment rate and the natural unemployment rate indicated as the appropriate gap;
- β – Okun’s coefficient.

As shown in different kinds of literature the value of Okun's coefficient is the figure that is calculated on an approximation basis depending also on the difficulty of measuring the numbers of the different changes in the production, products and the number of unemployed people in the country. This index also could be different depending on the type of the economy and the country itself. Looking at the formula above it is obvious that in

order to prevent negative changes in unemployment rates there should be equality in the growth of the actual and potential GDPs. At the same time, reducing the level of real unemployment is always one of the key targets for the economy the real GDP has to grow faster than the potential GDP (Gruchelski, 2013, p. 84.).

From the different views of the other authors Khemraj, Madrick and Semmler (2006, p. 5) the increase in the employment rate can be realized when the GDP growth is above the potential product growth. By this referring in the mentioned formula to the gaps between the actual and potential figures the authors were trying to calculate and understand the utilization of potential production in the country and mention the number of unused labour resources which is indicated in the numeral figures of the unemployed people and respectively in the rate of the natural unemployment. On the basis of his research, Okun determined the thesis that the decline in the unemployment rate with the increase in production and output is, basically, the result of many described processes that affect this kind of change. Among the others, he concluded that the percentage decline in the unemployment rate is linked to the percentage of the changes in the working hours per employee or the respective changes in the weekly working hours. Moreover, in that situation, another interpretation of Okun's coefficient advises that the decline of the unemployment rate will be followed by according rise in income, whereby the income growth of the country will reach the growth of the population and productivity. As the summary of the above mentioned, under the interpretation of the Okun's law the labour market of the country or the restricted region of activity has its equilibrium when there is equality between the real unemployment and the natural unemployment rates as well as there is the equality between real GDP and the potential GDP.

Another interesting study was made by Sophie Dunsch (2016) who investigated Okun's Law and Young Unemployment in Germany and Poland by comparing the two countries from the key aspects. As the study reveals the unemployment, rates, especially taking into account the young generation, have increased in different countries of Europe over the last years. The author studied the connection between the employees of the young generation and vulnerable business cycles. In accordance with the literature review and similar studies in Germany and other countries, the author determined the Okun coefficients

for five different age groups. The results of the empirical analysis show that the youth in Poland is more sensitive to the changes in the business cycles and their fluctuations in comparison to the adults. While the analysis in Germany showed that, there are no significant differences between the selected age groups. As also mentioned in the different studies Dunsch found that in Germany the youth unemployment rate remained stable after the financial crisis in 2008 and even became slightly declined during the next couple of years. At the same time, the GDP of the country turned negative in 2009, but it did not damage the positive tendency of the unemployment rate in the country. The author used aggregated data for the European Union countries. The interesting finding of the study was the fact that in all studied countries the smallest Okun coefficient was observed for the age group between 55 and 64 years old. It could be the result of the governmental program protecting the elder people according to the employment laws.

In the conclusion of the research, Dunsch found the following results:

- The Okun coefficient in Germany for young people is larger than for the other age groups which means that youth is more sensitive and reactive to the fluctuations of the business cycles, but at the same time, the differences between the age groups are not significant according to the error and p-values.
- The Okun coefficient of the young people in Poland is higher than for the same age group in Germany which means that the youth in Poland will be more sensitive to macroeconomic shocks.

Different studies cover the research on the correlation between unemployment rates and the real GDP of the country. O'Higgins (1997) elaborated the Keynes's theory and approved once again that the correlation between the unemployment rate and the GDP of the country could be described by the demand curve when the increase in aggregated demand will lead respectively to an increase in production. Consequently, the increase in production will lead to additional working place, because the companies and entrepreneurs wish to expand production and increase the output. Thus, the unemployment rate will go down respectively. On the other side, the decline shock of the GDP in the country will create barriers for the company to hire more and more employees which will follow to rise in the unemployment rate.

The analysis of the youth unemployment rates has a special place in this topic as the question depends on the state government programs that include the adaptation and preparation of the specialists from school upward the graduation from the universities. Dietrich (2012) mentioned that despite all common well-known aspects the unemployment rates also depend on different country-specific factors like "skills" and most important the smooth transition from school to work which has a significant impact on the reduction of youth unemployment rate. On the other hand, young people are more sensitive to the changes in the economy and the fluctuations of the business cycles. It is because companies during the crisis and recessions will dismiss young employees rather than experienced staff. It means that the young generation is at a bigger risk during the crisis period that could be followed by a rise in the unemployment rate.

4 Practical Part

4.1 The economy of Germany

The economy of Germany developed undulant during the last 15-20 years as the world economy and society faced many difficulties and unpredictable crises or worldwide pandemic situations with COVID-19. Germany, being the European largest economy and the economic giant within the European Union played a significant role in the Euro-crisis. When Greece's economy faced huge economic problems in the middle of the 2010s in the current century, the German government interpreted it as its own "national problem" that needed the direct involvement of the Greek government (Kirst, 2021). Nevertheless, later when the “Grexit” became a visible and most convenient option and under the strengthening impact from the other member states of the European Union, the German government changed their position and declared that the problem should be solved by the general approach of all interested parties.

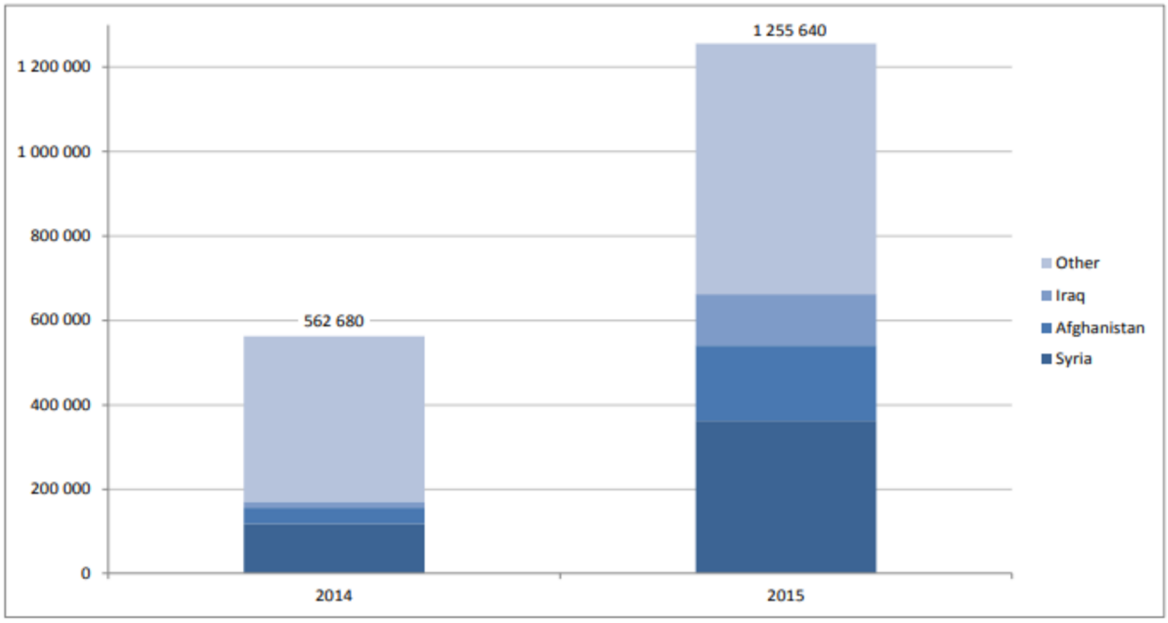
Taking responsibility after that Germany used their power to play a critical role in formulating financial support for the southern European members and elaborating the strict requirements under the different economic reforms there. Since then German government and official authorities continued to keep strong control under the financial austerity of the member countries that received financial support from the European Union. At that time Eurobonds, discussions became very popular, especially among the countries that had a financial deficit. Regarding the disputed Eurobonds, the German government along with the other leading member countries such as the Netherlands, put the veto vote in the Council to stop any attempts in this regard. Germany was against any debt mutuality between the countries in European Union.

Germany also used its power within the decision-making process in terms of the European Central Bank. While the President of the European Central Bank Mario Draghi announced the quantitative easing program in 2015, the German chancellor Angela Merkel openly supported the course and the target of the European Central Bank and, along with the French government announced the EUR currency as the key and irreplaceable for the

European Union (Czuczka, Kennedy, 2011). However, the program was met with mixed reaction in different parts of the European Union. This program lobbied by the European Central Bank became highly disputed in Germany among the leading economists that led to the number of dismissals of German economists from the management board of the European Central Bank.

Germany was one of the European member countries with the most significant numbers of registered migrants (890,000 in 2015) during the European migration crisis that affected the economic development in Europe as well. Compared to the previous year the number of registered migrants increased twice (Figure 12).

Figure 12: First-time asylum applicants registered in the EU in 2014-2015



Source: Eurostat, 2016

While the other countries in European Union were against taking the refugees in the civil war in Syria, Germany and especially chancellor Merkel accepted the critical decision in September 2015 to welcome the refugees as many as they can and, respectively, the country did not close the borders for them. German Chancellor Merkel made a famous statement where she proposed to take the migration crisis in European Union as a time for opportunity ("wir schaffen das"). At the same time, this statement and the completely

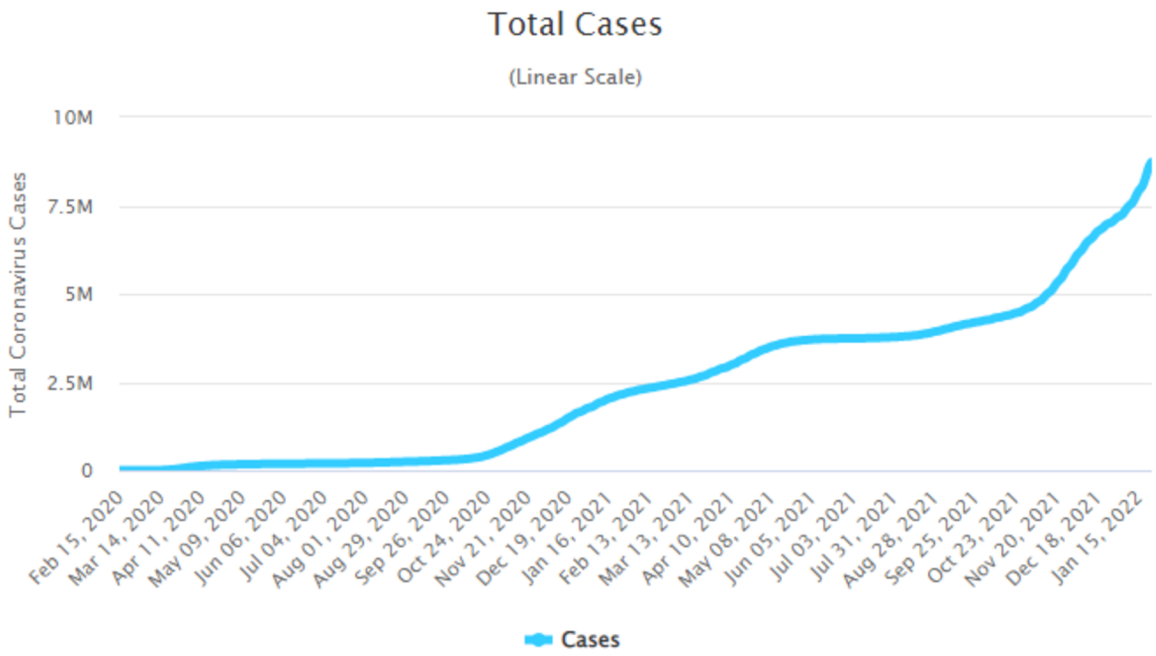
German migration policy that was promoted during that period faced huge criticism not only within the European Union but also outside of it. To avoid the increasing pressure from the migration crisis and the criticism from the other countries, the German chancellor together with the European Union came to the position of signing the famous European Union – Turkey deal (EU-Turkey Deal) (Consilium, 2016). In addition to that, the German Minister of Interior Horst Seehofer became one of the persons who supported the reform of the European Union's asylum with the modernization of the appropriate legislation in of Pact on Migration and Asylum.

The last 15 years of the economic development of the European Union also will be remembered as the Brexit negotiations and the crisis of that movement. Britain, initially, was thinking that the significant dependence on the German car industry would give them the opportunity to achieve some positive feedback and the right direction from the German government within the negotiation processes (Taylor, Schwartz, 2019). However, things went not according to the assumptions, and the German government fully supported the chief negotiator from the European Union side, Michel Barnier.

All of this described more or the less affected the total and common development of the country and, of course, was mirrored in the key figures like GDP and unemployment rate that will be described in the next chapter. Nevertheless, hereby it is also important to note the other figures that are also important for the country's development and some explanations of the current situation.

The coronavirus that was called as COVID-19 pandemic situation became one of the most influenced impacts on the modern economy all around the world. Coming as the pandemic situation forged the basic directions of the economy in almost all sectors. Germany was among the leaders in the number of COVID cases in Europe, including the deaths.

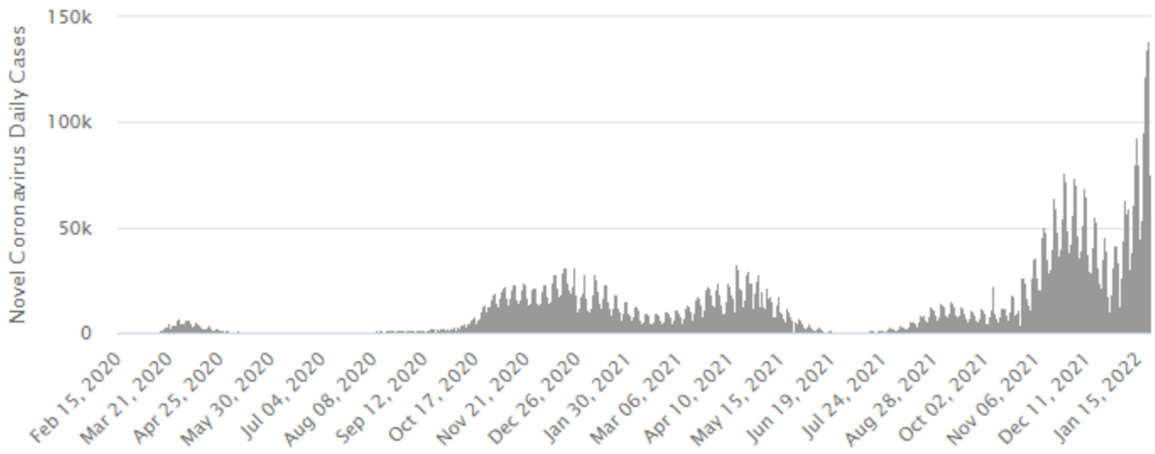
Figure 13: Total COVID cases in Germany



Source: Worldometer, 2022

The number of COVID cases is extremely high all around the world, especially during the seasons that are more comfortable for the disease to spread. The total number of closed coronavirus cases in Germany (Figure 13) exceeded 7.39 million in January 2022, while the number of deaths exceeded 117 thousand (2 %). The number of active cases is more than 1.3 million including people in critical situations 2,447 (0.2 %).

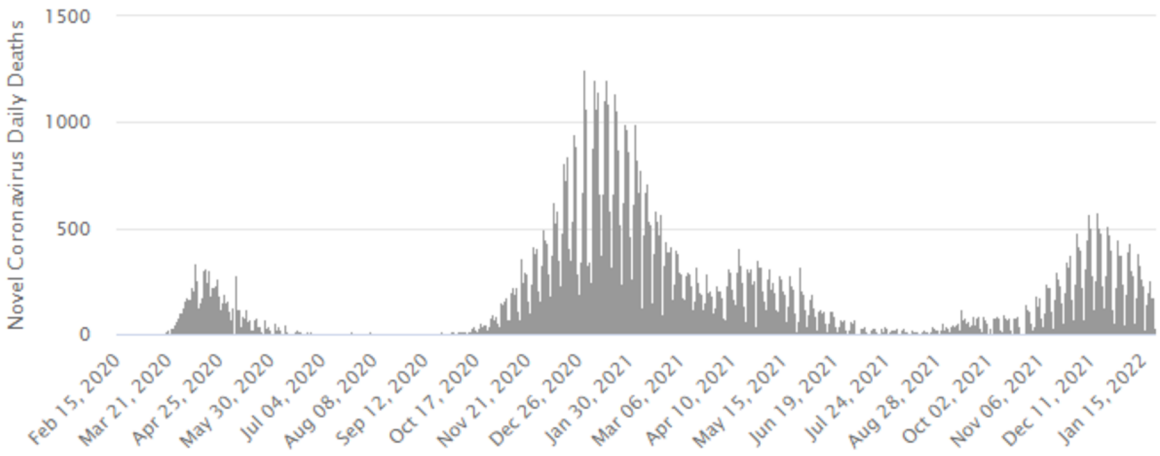
Figure 14: Daily new coronavirus cases in Germany



Source: Worldometer, 2022

As shown in Figure 14, the daily coronavirus cases also extremely increased recently as almost all countries around the world are living with the new stamp of coronavirus that is called "Omicron". Also revealing is the fact that the number of daily deaths is not proportional to the total number of coronavirus cases, because the German government as well as the other influential countries including the US, China, UK, Russian Federation, Turkey, etc. were actively involved in elaboration and promotion of the vaccination process against COVID-19 pandemic (Figure 15).

Figure 15: Daily deaths from COVID in Germany

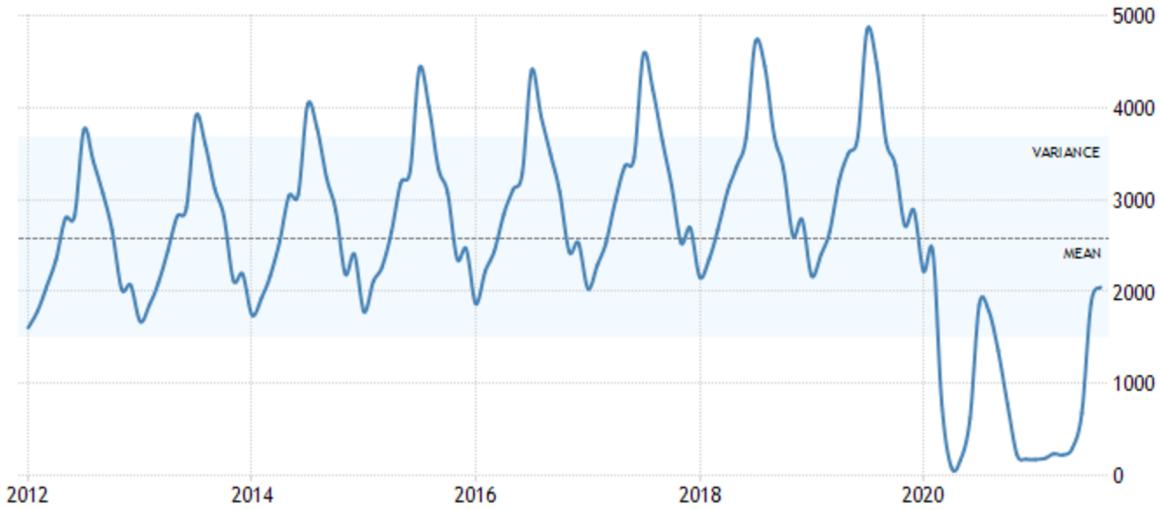


Source: Worldometer, 2022

As shown in Figure 15, the most number of deaths from the coronavirus was registered in the period from December 2020 until February 2021 when the world just was on the final stage of elaborating the vaccine. Now the death cases are much less, which can also tell about the efficiency of the vaccination process in the example of Germany, one of the biggest countries in the world from an economic perspective.

Tourism in Germany was one of the key elements for the country's GDP as the different lands were attractive for the tourists from neighbouring countries like Austria, France, Netherlands, Belgium, Czech Republic, Poland, Switzerland and even from the North. COVID-19 absolutely damaged the tourism area, because Germany obviously blocked its borders and highly limited the number of visitors to the country. After the required vaccination started almost in all European countries, Germany along with the other Member States opened the borders for the visitors with the necessary vaccine, but also by requiring PCR tests. Thus, the number of tourists in Germany dramatically decreased in 2020 being much lower than the mean level (Figure 16).

Figure 16: Tourists' arrival in Germany (thousands)



Source: Federal Statistical Office, 2022

The tourism sector is the part of the services sector that mainly was well developed in many German lands across the country as Germany has different natural resorts and places

for recreation. Berlin, Dresden, Stuttgart, Munich, Nuremberg and Frankfurt are among the cities that faced economic problems under the coronavirus restrictions.

Euro (EUR) is the national currency of Germany as well as of all other countries in the Eurozone. The currency has felt different situations during the last 15 years of its development. The German government was one of the critical parties that defended the national currency across the world even during the deep economic crises. US economy is always matched with the European economy as the key partner as well as the key indicator for further development. Germany, being one of the economic leaders in the European Union as well as in the Eurozone, also tries to strengthen the basis of the Euro currency and enforce necessary steps for the stable delivery of the currency exchange rates. Thus, one of the basic indicators in the case of the currency exchange is the rate across the US Dollar.

Figure 17: EUR-USD currency exchange rate for the last 25 years

Source: Trading Economics, 2022

At the beginning of the year 2022, the Euro rate came back to the position at the end of the previous century when the official currency just started its long way. The lowest level of the Euro currency rate across the US dollar was visible in 2001-2002 and the highest was in 2008 when it almost reached the level of 1.6 (Figure 17). Taking into account the strengthening position of the German economy along with the other Member States the forecast of the Euro currency is good from the perspective of its further development in the

region and across different markets. The Eurozone, the area where the Euro currency is used officially consists of 19 countries and looks like a stable strong community for economic development in the future: Germany, Belgium, Ireland, Spain, France, Italy, Luxembourg, the Netherlands, Austria, Portugal, Finland, Greece, Slovenia, Cyprus, Malta, Slovakia, Estonia, Latvia and Lithuania.

Another indicator of the strengthening European economic policy is the figure about the accumulated European Central Bank assets for the Euro area (Figure 18).

Figure 18: European Central Bank assets in Euro area (millions of Euro)

Source: Federal Reserve Bank of St. Louis, 2022

The total assets of the European Central Bank reached more than 8.5 billion EUR in the year 2022.

Another key indicator that describes the development of the local economy, especially concerning the developed countries, is the stock market indicator. Germany of the most developed countries at least in the European Union for the basis and constructed behaviour of the stock market with the constitution and representation of the key stock players from the different areas of the economy. Germany Stock Market Index is called DE40 in the official stock markets and indicates the key changes of the global market players. DE40 faced some falls during the global economic crises, especially in 2008, but it has stable growing tendency during the last 15-20 years (Figure 19).

Figure 19: Changing in Germany Stock Market Index (DE40)

Source: Trading Economics, 2022

DE40 reached the maximum level at the end of the year 2021 (Figure 19), but a bit fell at the beginning of 2022. In any case, the latest figures showed the growth in the private sector rates in the Eurozone and particularly in Germany. At the same time, many investors are monitoring the tendencies of the negotiations between Ukraine and Russia and how the communication can affect the stock market. On the other hand, some countries in Eurozone as well as the US Federal Reserve announced the changes in interest-rate policies for the first time after the long break. One of the giants of the German technology market Philips announces a fall in sales and consequently in net income at the end of the year 2021 because of the problems with the supply chain mechanism and the coronavirus pandemic situation. All these factors more or less affect the stock market distribution and the market responses accordingly. Nevertheless, the forecast of the German stock market is favourable and conducive to development in the nearest future.

One of the key figures that describe the local economic stability of the country is the inflation rates that affect the common prices and price indexes of the country. The inflation rate in Germany was confirmed at the end of the year 2021 at the level of 5.3% (Figure 20), which became the highest rate in the last 30 years. It looks like despite the fact that some of

the key figures are still stable and even getting better the government cannot stop the rising prices and consequently the inflation rate of the country.

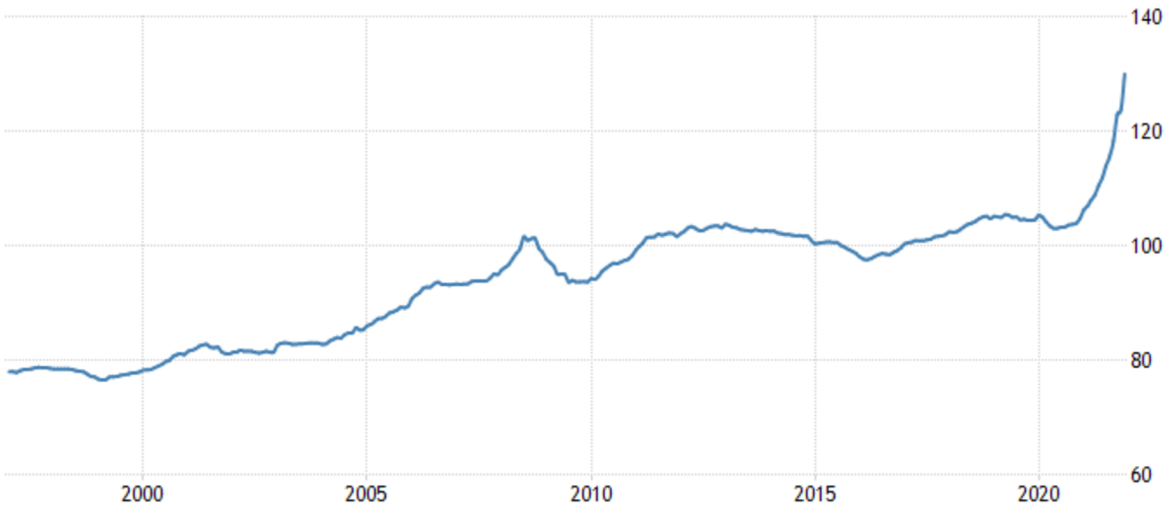
Figure 20: Inflation rate in Germany

Source: Trading Economics, 2022

As shown in Figure 20, the European largest economy faces inflationary pressure because of some problems and difficulties in supply chain management of the biggest companies and corporations as well as the temporary objective and subjective effects like VAT reduction and the decrease in oil products prices in the year 2021. Then the prices in Germany also increased respectively.

Also, the key factor that affects the increase of the price index, as well as the inflation process and the parameters related to that, is the producer price index. Comparing the previous years of the producer price index in Germany an extremely big jump was observed in the year 2021 by reaching the maximum level of 130 points in December from 123.8 points in November of the same year (Figure 21). For a better understanding of the index, it is important to note that the Producer Price Index in Germany is composed of the average prices changing of goods and services that were provided by the different types of manufacturers and producers in the wholesale market during the indicated period. This indicator also measures the effect of the following inflation process. Thus after the smooth increase of this Index during the years it rapidly increased in the year 2021.

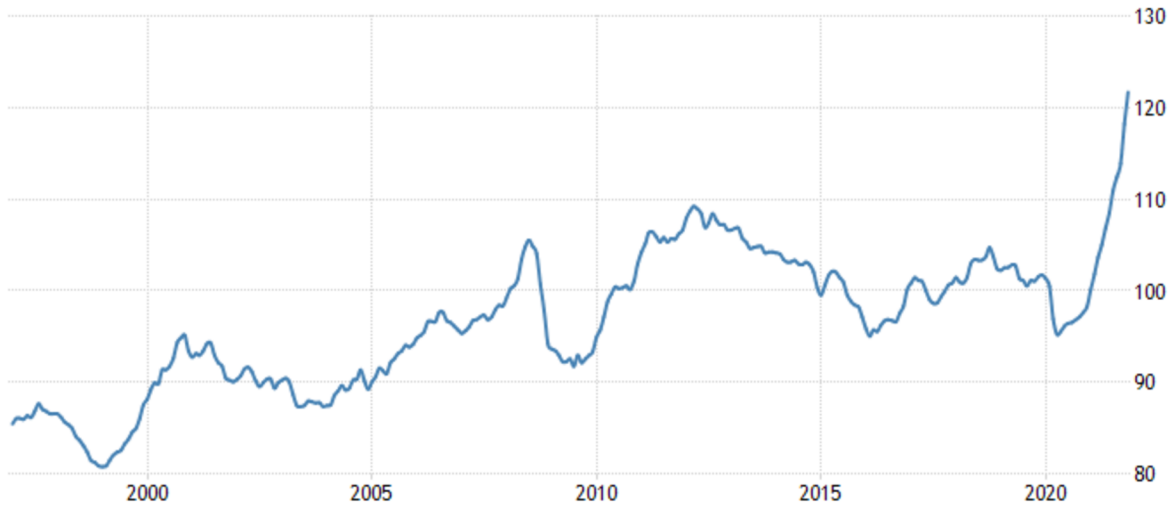
Figure 21: Producer price index in Germany



Source: Trading Economics, 2022

Recent respective changes in the prices for imported goods and services, especially in the energy field, also affected the European economy, including Germany. Thus, it is interesting to note the Import prices index in Germany during the last 10-15 years (Figure 22).

Figure 22: Import Prices Index in Germany



Source: Trading Economics, 2022

Import Prices Index with some exclusions has been growing for decades. According to the local definitions in Germany, the Import Prices are connected to the rate of the prices

changing of different goods and services that were purchased by the residents and consequently supplied by the foreign sellers. As may be noted from the definition, Import Prices are affected by exchange rates very much. In 2021, Germany faced the largest annual increase in import prices since the year 1974 (Statistisches Bundesamt, 2021). The main impact came from the price jumping for energy (159.5 %) because of the higher prices for natural gas (270.9 %), oil (100.4 %) and other mineral products (90.5 %). Intermediate goods also rose by 23 % because of the higher prices for the different products that have a huge impact on the economy in common: fertilizers and nitrogen (144 %), aluminium (64.2 %), iron and steel (60.2 %) and the basic plastic forms (44.7 %). The increase in import prices affected the population not only in Germany but also in the other Member States.

As already shown in this document, Germany as well as the other Member States faced some difficulties from an economic point of view. Despite the fact, that in common the figures of the completely German economy are still potentially positive there are some negative effects as was shown above. However, taking the account the current situation with the energy resources and the coronavirus pandemic the common forecasts for the German economy for the next two years are favourable (Figure 23).

Figure 23: Forecast of some indicators in Germany

Currency	1.13	1.13	1.12	1.12	1.12	1.11
Stock Market (points)	15101.89	15099	14736	14380	14033	13365
Government Bond 10Y (%)	-0.09	0.01	0.01	0.02	0.03	0.04
GDP Growth Rate (%)	1.70	1.1	0.8	0.7	0.5	0.4
GDP Annual Growth Rate (%)	2.50	4	2.5	2.6	1.7	2
Unemployment Rate (%)	5.20	5.7	5.9	5.6	5.2	4.9
Inflation Rate (%)	5.30	4.5	3.7	2.9	1.7	1.8
Inflation Rate Mom (%)	0.50	0.4	0.3	-0.2	0.7	0.7
Interest Rate (%)	0.00	0	0	0.1	0.25	0.5
Balance of Trade (EUR Million)	12000.00	19500	14700	15800	9200	7400

Source: Trading Economics, 2022

As shown in Figure 23, the Euro currency exchange rate is forecasted to remain more or less at the same level as to US dollar, the GDP growth rate should be stable and the

unemployment rate should decrease. At the same time, the inflation rate should also be fixed with the appropriate policies of the European Central Bank and the German government. In any case, it seems that the next several years also will be a challenge not only for the German economy but also for all countries around the world, including the leading developed economies.

4.2 Unemployment and GDP development in Germany

The initial information about the unemployment and GDP development in Germany compared to the other Member States was already given in the Chapter of Literature Review with the connection to the key literature in this regard. Hereby the more wide and detailed information will be given as the common understanding of the current situation in Germany from the perspectives of GDP and unemployment tendencies, especially in the framework of the movements that were observed in the country during recent years. The situation with migration problems and the global coronavirus pandemic situation also affected the key figures as shown above. That is why it is important to note the key tendencies and some forecasts in this regard.

Figure 24: Number of employed persons in Germany (thousands)

Source: Trading Economics, 2022

The number of employed persons in Germany had the tendency to grow during the last 15-20 years with some exclusions during the global economic crisis at the beginning of

the century (Figure 24). At the end of the year 2020, this number reached its maximum of 45.3 million people. That figure was increasing also because of migrants who actively tried to find at least any job in European Union, including Germany, as the country was open enough for the migrants according to the local migration policy. The global pandemic situation affected the German labour market as well, so there is a small decline in the number of employees at the beginning of the year 2021, but then a smooth increase. At the end of the year 2021, the actual number of employed persons was 45 million people.

If one checks the changes in the number of employed people in percentage, it can observe the cutting decline in number because of the COVID-19 global pandemic situation (Figure 25). It was the highest decline (-1.4%) in many decades.

Figure 25: Germany Employment Change

Source: Eurostat, 2022

Nevertheless, the employment rate in Germany is still high for the pandemic crisis that the country faced during the last couple of years. At the end of the year 2021, the total employment rate in Germany was equal to 76.7 % (Figure 26) which is very close to the highest (77 %) figure that was shown at the end of the year 2019. The German government had issued many proposals at the beginning of the current century about the stabilization of the employment rate and increasing the basic figures by some reforms in legislation and attracting more people to part-time jobs all around the country. Germany also paid critical attention to the migration and social problems trying to solve them in parallel with proper employment. All of this helped to increase the employment rate from the average of 66 % at

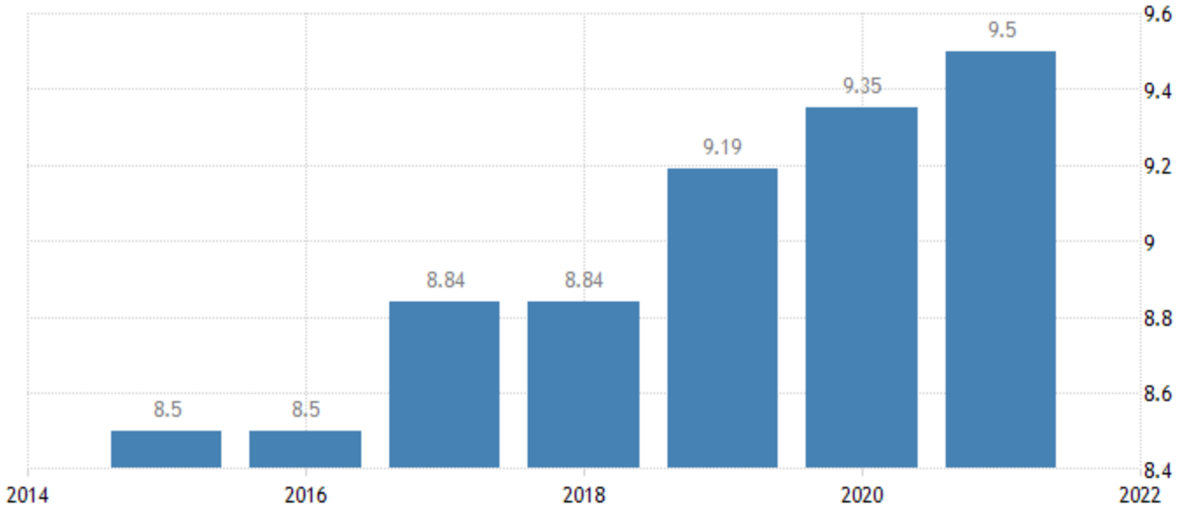
the beginning of the century up to 76-77 % at the end of the second decade. The employment rate, basically, measures the number of people with the appropriate jobs to the total number of working age people in percentage.

Figure 26: Employment rate in Germany

Source: Trading Economics, 2022

It is also interesting to note that the gross country minimum wages in Germany are also constantly increasing (Figure 27) and reached their maximum (9.50 EUR/hour) in the year 2021.

Figure 27: Germany Gross Minimum Wages (EUR/hour)



Source: Trading Economics, 2022

Coming back to the unemployment rate, Germany can proud of its management during the last decades as the seasonally adjusted unemployment rate fell to 5.2 % (Figure 28) at the end of the year 2021 compared to 6.1 % the same period in 2020. The number of unemployed people decreased to 2.4 million people with the lowest number since March 2020 which could be valued as one of the key positive elements during the coronavirus pandemic time (Statistisches Bundesamt, 2021). At the same time, different lands in Germany have different effects of the crisis. Thus, the highest unemployment rate was recorded in Bremen (10.2 %) and Berlin (9.1 %) while the lowest rates were recorded in Bayern (3.1 %) and Baden-Württem-berg (3.5 %).

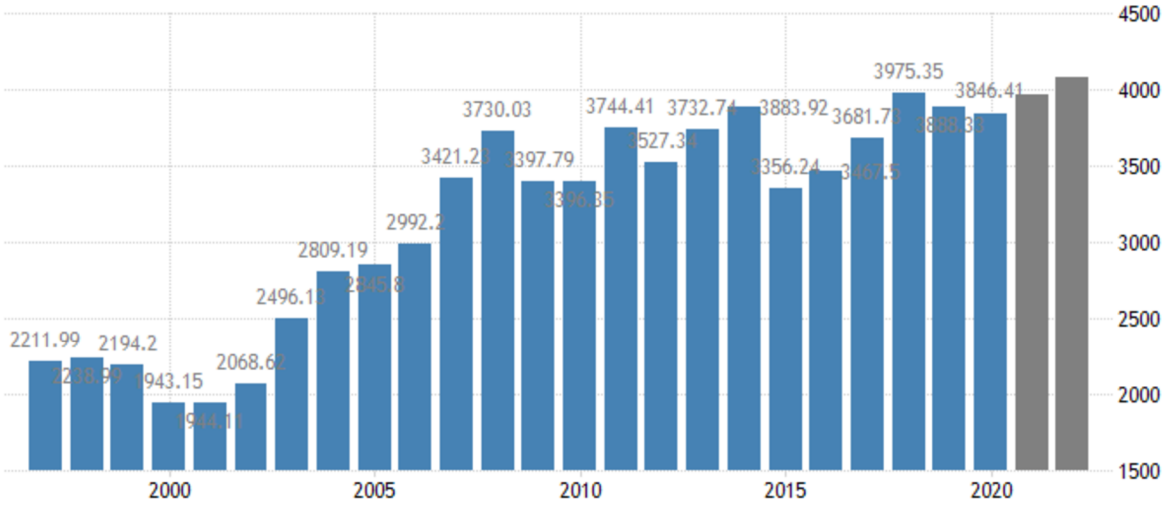
Figure 28: Germany's Unemployment Rate

Source: Trading Economics, 2022

The German economy is the fifth largest economy in the world and the biggest economy on the European continent. Germany is the leading country in many different directions of the industries, including such areas as the machinery being the biggest exporter of car and vehicles industry; chemicals and household equipment that is distributed all around the world. Mercedes-Benz, BMW, SAP, Volkswagen, Audi, Siemens, Allianz, Porsche, Deutsche Bahn, Deutsche Bank, Bosch and many other well-known companies from Germany are among the world leaders in business activity and have their representatives in many countries across the world (Statistisches Bundesamt, 2021). The common activity of all these companies along with the other different factors compose the GDP figures of the country. According to the latest figures, household consumption (55 %)

is the biggest part of German GDP. Gross capital formation takes the share of 20 % of GDP (of which 10 % is in construction, 6 % in machinery and 4 % in other products). The government expenditure covers 18 % of the GDP composition. Exports of goods and services (46 %) minus the imports account (39 %) bring 7 % to the total GDP.

Figure 29: Germany's GDP (billion US dollars)



Source: Trading Economics, 2022

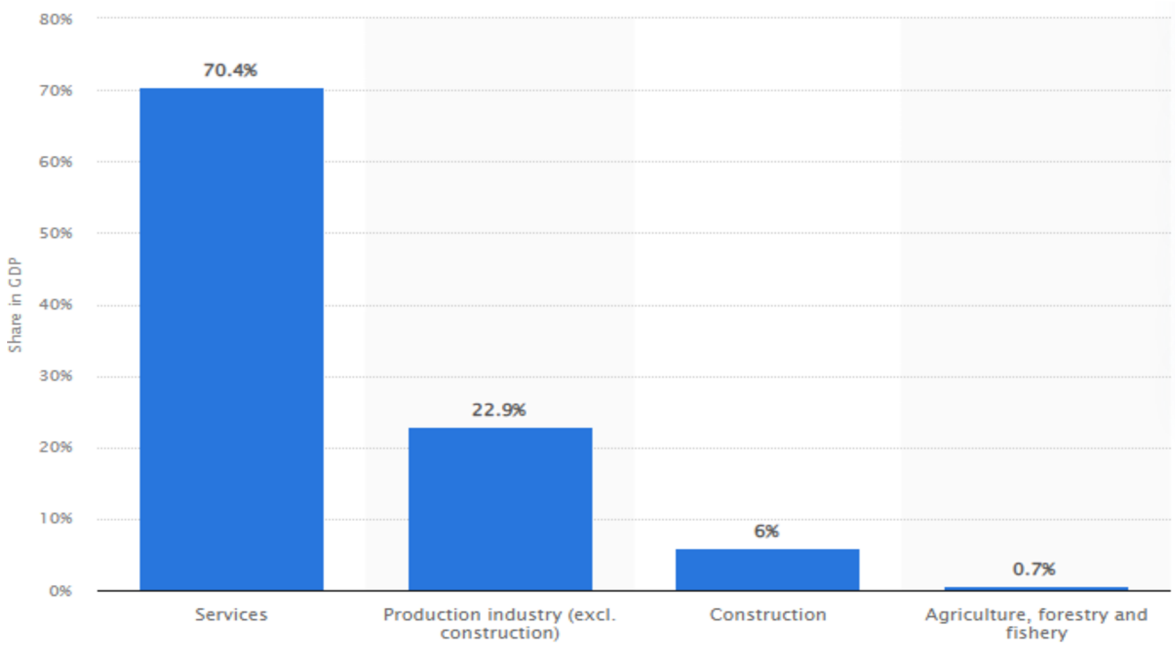
The GDP in Germany was equal to 3846.41 billion US dollars (Figure 29) at the end of the year 2020 in accordance with the official data from the World Bank (Worldbank, 2022). German GDP represents 3.4 % of the world economy. According to the forecasts, in 2022 the value of GDP in Germany should exceed the level of 4000 billion US dollars for the first time in its history (Figure 29).

Figure 30: GDP growth (annual %) in Germany

Source: Trading Economics, 2022

During the worldwide pandemic and economic crisis at the end of 2020 and the beginning of 2021, Germany faced a record negative GDP growth rate (-11.3 %) since the 70th of the previous century (Figure 30). Germany had undulating development of the GDP growth, especially after the II World War, but the world crisis in 2008 and the global pandemic situation of COVID-19 in 2020 was indicated in the negative growth of the GDP of the country that affected also the common situation in European Union. Nevertheless, according to the forecasts, in the nearest year, the rate should be increased up to 10 % (Figure 30).

Figure 31: Share of economic sectors in GDP in Germany (2020)



Source: Statista, 2020

At the same time, the interesting fact is that in spite of this the service sector in Germany remains the dominant position in the total GDP contribution (Figure 31). In 2020 services sector had a 70.4 % share of GDP while the production industry had 22.9 % and construction 6 %. Agriculture, forestry and fishery had only 0.7 % of German GDP.

Although the services sector went down in 2020 and decreased to the minimum level for the last 3-4 years, (Figure 32) the businesses adopted the new circumstances and started to offer new products and services online or that can be delivered remotely. It was especially needed during the global quarantine and COVID restrictions when the delivery companies increased their opportunities to gain additional funds and income from this kind of service.

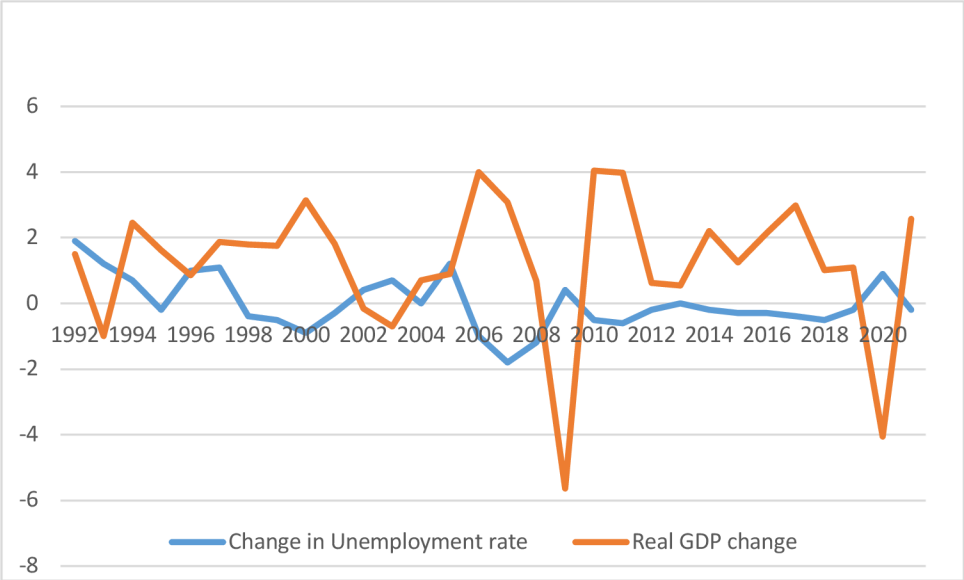
Figure 32: GDP from services in Germany (2012-2021), EUR Billion

Source: Trading Economics, 2022

The services (retail, trade, transportation, accommodation, and food as included in Figure 31) in Germany are still the main options with the highest impact on the local GDP structure. It can be observed from Figure 31 that services faced a tangible impact from the world pandemic crisis in 2020, but then recovered and even became better at the end of 2021. As seen from the graph, GDP from services increased to 136.23 EUR Billion in the third quarter of 2021 compared to the 125.79 EUR Billion one quarter before in 2021 (Statistisches Bundesamt, 2021).

4.3 Regression Analysis

Figure 33: change in real GDP and change in the unemployment rate in Germany, percentage



Source: own processing based on Trading Economics, 2022

As it can be seen in the figure above, there is definitely a negative relationship between the change in unemployment and the change in the real GDP. However, the strength of this relationship and the numeric values behind it will be assessed in the regression analysis.

In order to ultimately answer the question of the dependency between the change in the unemployment rate and the change in the real GDP following the pattern described by Okun in his law, it is also sensible to create a linear regression that will predict the change in the real GDP based on the change in the unemployment.

Thus, the following model will be created:

$Y = ß_0 + ß_1X_1 + U_e$, where:

Y = Change in Real GDP in Germany expressed in percentual change compared to the previous year

X_1 = Change in the unemployment rate in Germany expressed in percentual change compared to the previous year

U_e = error term

Since it is an econometric model, an error term is included in the model. In addition to this, after creating the model, the author will verify if the model is BLUE (best linear unbiased estimate) and also assess the quality of the model. The linear model will be created based on the ordinary least squares method in the application called Gretl.

In the figure below, the original dataset used for the creation of a linear model is shown.

Figure 34, the original dataset

Year	Change in Unemployment rate	Real GDP change
t	X	Y
1992	1,9	1,49893
1993	1,2	-0,99122
1994	0,7	2,46228
1995	-0,2	1,61088
1996	1	0,85115
1997	1,1	1,8651
1998	-0,4	1,79299
1999	-0,5	1,74589
2000	-0,9	3,13874
2001	-0,3	1,81468
2002	0,4	-0,16574
2003	0,7	-0,71062
2004	0	0,70104
2005	1,2	0,903
2006	-1,0	3,995
2007	-1,8	3,090
2008	-1,2	0,687
2009	0,4	-5,640
2010	-0,5	4,044
2011	-0,6	3,988
2012	-0,2	0,616
2013	0,0	0,552
2014	-0,2	2,209
2015	-0,3	1,239
2016	-0,3	2,144
2017	-0,4	2,979
2018	-0,5	1,009
2019	-0,2	1,088
2020	0,9	-4,063
2021	-0,2	2,581

Source: Trading economics, 2022

Figure 35, Gretl model output

The author got the following output from Gretl:

```
Model 1: OLS, using observations 1992-2021 (T = 30)
Dependent variable: RealGDPchange

                      coefficient   std. error   t-ratio   p-value
  ---------------------------------------------------------------------
  const                 1.22649      0.345360     3.551    0.0014  ***
  ChangeinUnemploy~    -1.19527      0.431700    -2.769    0.0099  ***

Mean dependent var   1.234460   S.D. dependent var   2.097711
Sum squared resid    100.1827   S.E. of regression   1.891548
R-squared            0.214939   Adjusted R-squared   0.186901
F(1, 28)             7.666001   P-value(F)           0.009869
Log-likelihood      -60.65513   Akaike criterion     125.3103
Schwarz criterion    128.1127   Hannan-Quinn         126.2068
rho                 -0.009370   Durbin-Watson        1.941504
```

Source: own processing

Following the output from Gretl, the author is able to create the following econometric model:

$$Y = 1.22649 - 1.19527x1 + Ue$$

With the given relationship between variables:

For every 1% increase in the unemployment rate in Germany, the value of real GDP decreases by 1.19%.

Then, it is essential to assess the quality of the model and test if residuals are autocorrelated or not, if they are distributed normally and if they are homoscedastic.

The first aspect that is needed to be taken into consideration is the coefficient of determination (R^2). In this case, this coefficient is equal to 0.21, which basically means that 21% of the variation in the change in the real GDP in Germany is explained by the variation in the change in the unemployment rate in Germany.

Frankly speaking, this is not a good result, but this does not necessarily mean that the created model is bad. The most logical explanation would be that the change in

unemployment is not the only predictor influencing the change in the real GDP, and the model has to include more predictors, such as the inflation rate, for instance.

Then, it is essential to test if the whole model is significant. Given the fact that there is just one predictor, once the null hypothesis of the F-test gets rejected, it would mean that the change in the unemployment rate significantly contributes to the change in the real GDP in Germany. The testing procedure is as follows:

Ho: $\beta_0 = 0$ (the model is not significant)

Ha: $\beta_0 \neq 0$ (the model is significant)

A = 0.05

F = 7.66

P = 0.009

0.009 < 0.05 => Ho rejected, and Ha is assumed => the whole model is significant.

If the author wished to expand the testing procedure and also do a t-test, the result will be the same – the null hypothesis about the absence of a relationship between the predictor and the predicted variable would be rejected at 0.009 < 0.05 (t-test).

Then, it is essential to prove the existence of the other aspects of econometric models – the absence of autocorrelation, homoscedasticity and normality of residuals.

For this purpose, Gretl will be used once more, and the output is available in the figure below.

Figure 36, testing output

```
LM test for autocorrelation up to order 1 -
  Null hypothesis: no autocorrelation
  Test statistic: LMF = 0.00234799
  with p-value = P(F(1, 27) > 0.00234799) = 0.961709

White's test for heteroskedasticity -
  Null hypothesis: heteroskedasticity not present
  Test statistic: LM = 1.55977
  with p-value = P(Chi-square(2) > 1.55977) = 0.458458

Test for normality of residual -
  Null hypothesis: error is normally distributed
  Test statistic: Chi-square(2) = 11.1585
  with p-value = 0.00377539
```

Source: own processing

Firstly, the author will test if there is autocorrelation of residuals present in the model:

Ho: no autocorrelation

Ha: there is an autocorrelation

A = 0.05

P = 0.96

0.96 > 0.05 => Ho is not rejected (no autocorrelation)

Then, the author will check if residuals are homoscedastic or not:

Ho: heteroscedasticity is not present

Ha: heteroscedasticity is present

A = 0.05

P = 0.45

0.45 > 0.05 => Ho is not rejected (residuals are homoscedastic)

Finally, the author is testing if residuals are normally distributed or not:

Ho: residuals are normally distributed

Ha: residuals are not distributed normally

A = 0.05

0.003 < 0.05 => Ho is rejected, Ha is assumed (residuals are not distributed normally)

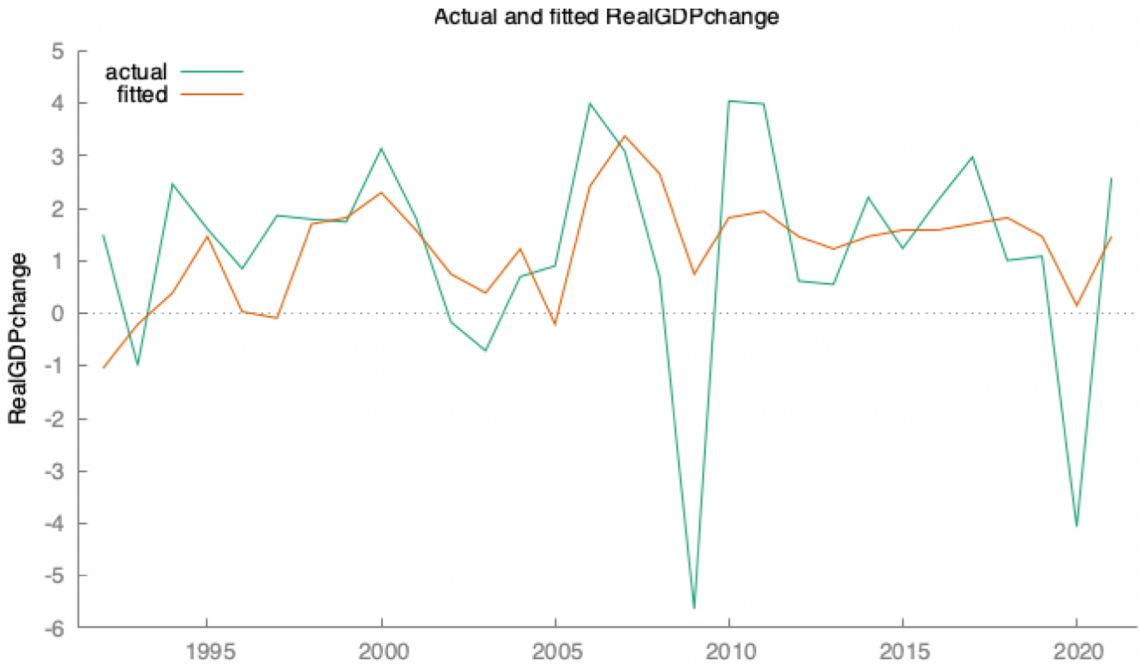
Overall, the model looks solid apart from the minor problem with the normality of residuals. Yet, this problem can be avoided if the original dataset will be expanded to a greater number of observations.

Nevertheless, the author's main objective for creating the model was not to create an impeccable model but to explain the relationship between two variables. Yet, as it turned out, the projected effect on the change in the real GDP is 0.8% lower than in Okun's law (2% compared to 1.2%). This is another piece of crucial evidence that supports the assumption that Okun's law, despite correctly categorizing the direction of the relationship between the change in the unemployment rate and the change in the real GDP, does not always get the percentage right. Undoubtedly, in the case of Germany over the course of 30 years – from 1992 to 2021, it cannot be said that Okun's law perfectly works as described.

As the author sees it, the main reason behind it lies on the surface – the only one variable - change in unemployment is not a sufficient force to describe the fluctuations in the real GDP. There are much more variables related that additionally help to explain the variation in the change in the real GDP. However, despite a portion of inaccuracy, the law itself correctly describes the nature of the relationship between the variables.

In addition to everything said above, the following figure shows the difference between the actual and fitted values.

Figure 37, actual vs fitted values



Source: own processing

As it can be seen above, the model does its job of predicting the direction of changes somewhat correctly – almost in every case when there is a surge in the actual value, the fitted value repeats the pattern but less accurately. This is another piece of evidence for the fact that it is not possible to blame only the change in the unemployment rate for any changes in the real GDP – there are much more variables responsible for triggering changes in the real GDP.

5 Results and Discussion

The German economy is the fifth largest economy in the world and the biggest economy on the European continent. Germany is the leading country in many different directions of the industries, including such areas as the machinery being the biggest exporter of car and vehicles industry; chemicals and household equipment that is distributed all around the world.

Germany faced the highest GDP growth of 10 % in 2021 while the lowest rate was shown at the end of 2020-beginning of 2021. This paradox is linked to the COVID-19 global pandemic situation and the reaction to that of the German government. Germany also lived the global employment crisis in 2005 when the unemployment rate reached 12 %. After that, this figure started extremely decreasing and reached 5 % in 2021.

As was mentioned in the objectives of the thesis, the main goal of the author was to find out if Okun's law does really depict the strength of the dependency between the change in the real GDP and the change in the unemployment rate. Thus, when answering the question of whether it does so or not, the author believes that it might be sensible to split the question into two parts: "Did Okun's law predict the nature of the relationship between the change in the real GDP and the unemployment correctly for Germany over the time span of 30 years from 1992 to 2021?" and "Can it be said that the following percentual dependency between the change in the real GDP and the change in the unemployment rate, i.e., whenever the unemployment increases by 1%, the real GDP falls by 2% can be applied to Germany over the time span of 30 years from 1992 to 2021?".

The author, as it was described above, used the regression analysis to answer two questions. As a consequence, the following dependency between the change in the real GDP and the change in the unemployment rate was found:

For every 1% increase in the unemployment rate in Germany, the value of real GDP decreases by 1.19%.

Hence, it is possible to say that Okun's law does its job of predicting the nature of the relationship between the two negatively correlated variables well indeed, but the percentual effect on the real GDP in Germany is far from being equal to 2%. Hence, the development of the unemployment rate and the real GDP in Germany only partially confirms Okun's law since the change in the unemployment rate is only responsible for a 1.19% change in the real GDP.

However, as the author discovers upon creating the model, the change in the unemployment rate is not sufficient to precisely describe the development of the real GDP and predict it, as the R^2 of the model created was equal to 0.21, meaning that only 21% of the variation in the change of the real GDP was explained.

It boils down to the assumption that there are more variables that are needed to be included in the model – inflation and domestic consumption, for instance.

6 Conclusion

Germany is one of the most developed countries in the European Union and one of the top economies in the world and is a significant indicator of the development of other countries. The German economy and the main figures can be taken for the key analyses of the development of modern countries.

When during different research the economists discuss some deviations from the perspectives of Okun's Law, many of them take Germany as a very interesting example, especially during the recent examples. As shown in several figures here in this work, Germany is one of the rare countries where the unemployment rate fell during the time of recession, especially after 2008. This effect was called by some economists a "miracle" in Germany (Burda, Hunt, 2011). It is mostly explained by some experience in work-sharing that became popular in Germany and followed by the decrease in hours per worker. One of the main sources for that was the different subsidies to the employers who kept the staff and did not let them go.

As shown in the Practical part, Results and Discussions of this work, according to the calculations and the presented analyses of the figures Okun's law has been explained as it can definitely be observed a negative correlation between the change in the rate of unemployment and the change of the real GDP in Germany. However, Okun's law only partially applies to the case of Germany, as the increase in the unemployment rate only triggers a 1.2% change in the real GDP of Germany.

After World War II Germany faced critical decisions about how to develop in the future, because the administrative system, industries and technologies changed a lot. The country transformed its politics, economic system and relations with its neighbours. Because of the correct political and economic decisions, Germany was able to develop to the size of one of the world economic leaders with huge visible development in almost all figures, including the growth of GDP and decreasing in the unemployment rate (Figure 33).

According to the objectives of this work, the aim of the analysis was to find out if the development of two indicators (the change in the unemployment rate and the real GDP) confirms Okun's law.

As it can observed from the Results and Discussions as well as from the Practical part of this thesis, there was a relationship between the figures and that is why it is possible to partially confirm the observation of Okun's Law in Germany. At the same time, it is important to note that Okun's Law does not fully explain the situation of unemployment behaviour, because there are also many other factors that affect the changes in the unemployment rate as well as in the key development figures like GDP and etc. Coming back to the German "miracle' during the recession, the effect was also possible because of some governmental decisions targeting the decrease in the unemployment rate. In that situation even when the GDP was more or less stable for the country, the unemployment rate continued its reducing tendency.

The Government put the primary targets to expand the social contribution and reduce the unemployment rate by using some options like subsidies and state support of employers. Nevertheless, it is also important to note that according to the literature the residual in Okun's Law in Germany is a bit modest in comparison with unemployment changes in several neighbouring countries.

Different methods and tools were used to assist the employees and unemployed people during recessions and social migration crises. As was mentioned earlier in this thesis, Germany became one of the main countries in the European Union that accepted a big number of migrants and social refugees. That is why the employment question became a critical target for the government to avoid the consequences of the migration crisis.

The study was based on figures that were obtained from official sources and the methods that were found in the literature review. The analysis covered at least 15 years of economic development in Germany by taking into account key figures such as the unemployment rate and the GDP growth. In parallel, other figures were mentioned to present

a more wide picture of the economic development of the country as they also affect the changes in the certain relationship and also for a better understanding of the model.

The author believes that further researchers can go more deeply in comparative analysis of the cross-countries to understand the differences in the results among the several countries. It will be also interesting to follow the further effect of the COVID-19 global pandemic on the economic development in different countries and the relationship among key figures, including the analysis of Okun's Law in such circumstances.

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