

**Czech University of Life Sciences Prague**

**Faculty of Economics and Management**

**Department of Trade and Finance**



**Bachelor Thesis**

**The Relationship between GDP Growth and  
Unemployment. Testing the Okun's Law in Kazakhstan**

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# **BACHELOR THESIS ASSIGNMENT**

Sultan Nagmetov

Business Administration

Thesis title

**The Relationship between GDP Growth and Unemployment. Testing the Okun's Law in Kazakhstan**

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## **Objectives of thesis**

The author's main goal lies in testing if the Okun's law is still a relevant economic phenomenon and if the general law developed by one of the most prominent economists of the 20th century is still relevant based on the example of a selected country – Kazakhstan.

## **Methodology**

The author bases his analysis on the quantitative method, where he focuses on creating a linear regression model based on annual time series data on the selected time interval – from 2000 to 2021. The author uses Gretl for the analysis and the main kind of data used is secondary data obtained from The World Bank. After estimating the model, the author focuses on the interpretation of his results and on verification of the model.

In economics, Okun's law is an empirically observed relationship between unemployment and change in GDP per capita. It was empirically tested, that every 1% increase in unemployment will result in approximately 2% decrease in GDP, meaning that the linear coefficient between GDP growth and change in unemployment is approximately equal to 2 (for the USA). However, this relationship (and the coefficient) is heavily contingent on technological, political, financial, social and other events, that influence the decision to be employed, productivity of labor and overall production in a country. The aim of this paper is to describe

- 1) the prerequisites and assumptions of Okun's law
- 2) the economic development of country A over last 20-30 years (upon the availability of the data) related to the Okun's law
- 3) the empirical literature on testing the Okun's law
- 4) to test the Okun's law in Country A over the period of last 20 years on available data on GDP per capita and unemployment and to find the relevant coefficient.
- 5) Based on the first two chapters to explain why the coefficient is different from 2.

Methodologically the paper relies on time series regression analysis. The advisor expects the students to be able to perform it in whatever software they are taught (EXCELL, SPSS, STATA, SAS etc.)

## The proposed extent of the thesis

40-50 stran

## Keywords

Kazakhstan, Okun's Law, GDP growth, unemployment, transition economy, emerging economy, structural change

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## Recommended information sources

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## Expected date of thesis defence

2023/24 WS – PEF

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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 Kazakhstan" 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 16.03.2024

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## **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 Kazakhstan**

## **Abstract**

The author's main goal lies in testing if the Okun's law is still a relevant economic phenomenon and if the general law developed by one of the most prominent economists of the 20th century is still relevant based on the example of a selected country – Kazakhstan. This objective has a specific sub-goal, which is strongly associated with the creation of an econometric model that will precisely identify the quantitative effect of the change in real GDP of Kazakhstan on the change in the unemployment rate of the same country.

It was identified that the nature of the relationship is the same as the Okun's law described it, but the magnitude is absolutely different – to achieve a 1 percentage point drop in the unemployment rate in Kazakhstan, it is essential to reach 11.76 increase in the real GDP, which suggests that the Okun's law is not fully applicable to the cases of emerging economies.

**Keywords:** Kazakhstan, Okun's Law, GDP Growth, unemployment, transition economy, emerging economy, structural change

# Vztah mezi růstem HDP a nezaměstnaností. Testování Okunova zákona v Kazachstánu

## Abstrakt

Hlavním cílem autora spočívá v testování, zda je Okunův zákon stále relevantním ekonomickým fenoménem a zda je obecný zákon vyvinutý jedním z nejvýznamnějších ekonomů 20. století stále relevantní na základě příkladu vybrané země – Kazachstánu. Tento cíl má specifický dílčí cíl, který je silně spojen s vytvořením ekonometrického modelu, který přesně identifikuje kvantitativní vliv změny reálného HDP Kazachstánu na změnu míry nezaměstnanosti ve stejné zemi.

Bylo zjištěno, že povaha vztahu je stejná, jak ji popsal Okunův zákon, ale velikost je naprosto odlišná – k dosažení 1% poklesu míry nezaměstnanosti v Kazachstánu je nezbytné dosáhnout pouze 11.76% zvýšení reálného HDP, což naznačuje, že Okunův zákon není plně použitelný pro případy rozvíjejících se ekonomik.

**Klíčová slova:** Kazachstán, Okunův zákon, růst HDP, nezaměstnanost, přechodná ekonomika, rozvíjející se ekonomika, strukturální změny

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## List of abbreviations

<b>BLUE</b>	Best Linear Unbiased Estimator
<b>OLS</b>	Ordinary Least Squares
<b>GDP</b>	Gross Domestic Product
<b>USD</b>	United States Dollar
<b>FDI</b>	Foreign Direct Investment
<b>ILO</b>	International Labor Organization
<b>USA</b>	United States of America
<b>USSR</b>	Union of Soviet Socialist Republics

# 1 Introduction

It is essential to start the bachelor thesis by saying that the birth of modern economics happened largely thanks to the contribution that Adam Smith and David Ricardo made, thus creating the Classical Economics. However, as it usually happens with any science, further contributions made by more modern scientists significantly changed the perception of the discipline, thus creating something that today is called the Neo-Classical Economic theory. The illustration is used for the reason – the Okun's law, which was one of the very first findings made thanks to the newly emerged discipline of econometrics, is often criticized by modern scientists for being unapplicable and not precise in the context of modern economies. It is believed that there are infinitely many reasons for that, but there are still suggestions that the law is still applicable.

Due to the active ongoing debate in the world of economics about the applicability of the Okun's Law, the author, who comes from one of the biggest Central Asian economies, is interested of whether the law holds for Kazakhstan. Kazakhstan is classified as either an emerging or transition economy, which made a huge effort of liberalizing its economic system after the fall of the Soviet Union (Macerinskiene & Sakharova, 2011). In the light of the aforementioned circumstances, the author believes that testing the applicability of the Okun's law for such an interesting case can prove itself influential for the modern economic theory and the study of processes in emerging and transition economies. Ultimately, the study can contribute to both phenomena at once – the study of the Okun's law and also the study of processes in emerging and transition economies.

In addition to the objective of identifying the applicability of the law and the significance of the finding for the academic world, the findings of the study can also help policymakers in Kazakhstan to properly target the unemployment rate of the country. This will be achieved with the help of including additional factors into the linear regression model, thus creating a multiple linear regression, where quantitative effects of other macroeconomic indicators will be analyzed alongside the change in real GDP variable, which presents the central leitmotif of the study. Those goals and objectives are achieved with the help of the econometric estimation, which is done with the help of one of the most useful and sophisticated tools used in modern econometric studies – Eviews, where graphs are presented, and models are created and verified.

## **2 Objectives and Methodology**

### **2.1 Objectives**

The author's main goal lies in testing if the Okun's law is still a relevant economic phenomenon and if the general law developed by one of the most prominent economists of the 20th century is still relevant based on the example of a selected country – Kazakhstan. This objective has a specific sub-goal, which is strongly associated with the creation of an econometric model that will precisely identify the quantitative effect of the change in real GDP of Kazakhstan on the change in the unemployment rate of the same country.

In addition to the two objectives mentioned in the previous chapter, the author additionally seeks to identify other factors that can be used for the prediction of the change in the unemployment rate for the biggest Central Asian economy. Alternatively, it is possible to summarize the bachelor thesis with the help of the following five research questions:

- 1) What are prerequisites and assumptions of the Okun's law?*
- 2) What is the economic development of Kazakhstan over the course of the analyzed time period?*
- 3) What is the most frequent criticism of the Okun's law?*
- 4) Does the Okun's law hold for Kazakhstan on the selected time period?*
- 5) In case of potential deviations from the relationship described by Okun, what could be the reasons behind them?*

### **2.2 Methodology**

The bachelor thesis is exclusively concerned with the utilization of quantitative techniques, where a large emphasis is put on the econometric estimation. The econometric estimation used by the author is heavily based on the Gauss-Markov Theorem and the utilization of the OLS technique. The OLS technique is used for the estimation of parameters

of the multiple linear regression used in the empirical part of the work, and this technique is done with the help of the Eviews application. Eviews computes parameters for the model with the help of linear algebra, where parameters are computed in the following manner:

$$(X^T X)^{-1} X^T Y \quad (1)$$

In addition to the estimation of parameters, the author does not stop there. Since the model that will be implemented is of linear structure – both parameters and variables are linear, the parameters show slopes or unitary change in the dependent variable. Because of this, there is an additional need to calculate elasticities, which will help to compare the effect of different variables on the dependent variable. Elasticities in the context of the linear estimation are calculated in the following manner:

$$E (\%) = \beta_{it} * \frac{x_{it}}{\hat{y}} \quad (2)$$

As it could already be possible to notice thanks to the notation “t”, the author mainly focuses on the estimation based on the time series data, which is obtained with the help of two public databases – FRED and The World Bank. Due to the fact that the country emerged in 1991 as an independent state, following the collapse of the Soviet Union, the data for the majority of indicators is available only from 1991. However, due to the “shock therapy” arising from the first wave of liberalization, which led to the situation when some of indicators had astonishingly high values resulting in outliers, which are harmful for the linear estimation, it was decided to start the analysis from 1997, when the economy managed to stabilize. The final year in the time series dataset is 2022, thus making it to 26 observations.

For the description of data, descriptive statistics is implemented, as well as different graphs and scatterplots for describing the development of selected macroeconomic indicators. Also, after estimating the linear regression model, a subsequent verification is used, which is concerned with the implementation of F-test, t-tests, the Jarque-Bera test, i.e., normality test, the Breusch-Pagan test, i.e., heteroscedasticity test and the Breusch-Godfrey test, i.e., autocorrelation test. In case of good results for the aforementioned series of tests, the decision of whether the estimated model can be considered to be BLUE or not will be made by the

author. In case of good statistical and econometric results of the model, the further utilization of the model will be recommended for further studies.

## **3 Literature Review**

### **3.1 Okun's Law**

#### **3.1.1 Essence**

The law that bears the name of its creator – Arthur Okun, who was at the time a Yale professor and an economic advisor of the American president in the office, was created in 1962. Okun, who was by trade an economist and also a follower of Keynesian economist, managed to come up with the empirical evidence for his law thanks to the econometric estimation. However, it is first essential to focus on the principle and logic behind the relationship, as well as on the implications that it had for policymakers and the government in the office (Okun, 1983).

Keynesian economist is a special school of economics, which is often regarded as the main driving force behind all economic policies until approximately the mid 60s, when the paradigm was slowly changed towards the liberal kind of economic thought. Keynesian economics is explicitly concerned with the policy of interventionism, where the government regularly makes corrections and interventions, primarily with the use of fiscal policy, which involves two main tools – tax policy and expenditure. As a result of expansionary type of fiscal policy, the amount of disposable income of consumers rises and they are spending more, which in turn triggers an economic growth. According to the founding father of this school of economics, the expenditure is everything, so the government has to prompt people to spend at all costs. On the other hand, there are quite common situations when the economic growth is not achieved since either reducing tax is not effective because of unnecessary and unusual spending, or because of the crowding-out effect that leads to lower capital investment done by private sector. In the light of those circumstances and difficulties with the economic growth experienced by the majority of developed countries, such as the United States, Okun was concerned with the identification of additional empirical relationships that will help to boost the economy of the USA. As a matter of the fact, Okun was not the only economist concerned with the study of economic output during the early 60s since it was the time when the USSR actively started to close the gap between the two countries' output (Maes, 2008).

Nevertheless, after profound empirical studies and analysis, Okun managed to come up to something that is perfectly justified by the recent receiver of the Nobel Prize for economics – Ben Bernanke: *“That rule of thumb describes the observed relationship between changes in the unemployment rate and the growth rate of real gross domestic product (GDP). Okun noted that because of ongoing increases in the size of the labor force and in the level of productivity, real GDP growth close to the rate of growth of its potential is normally required, just to hold the unemployment rate steady. To reduce the unemployment rate, therefore, the economy must grow at a pace above its potential.”* (Hooper, 2017)

Consequently, Okun formulated the following empirical relationship:

$$\frac{\hat{Y}-Y}{\hat{Y}} = c(u - \bar{u}), \text{ where:}$$

- $Y$  summarizes the actual output or the real GDP of a country.
- $\hat{Y}$  summarizes the potential output of a country.
- $u$  summarizes the actual unemployment rate.
- $\bar{u}$  summarizes the natural rate of unemployment.
- $c$  is the factor relating changes in unemployment to changes in output.

Ultimately, after performing a series of mathematical derivations, it is possible to create the following equation for the identification of the real growth rate for a country using the Okun's law:

$$\frac{\Delta Y}{Y} = k - c\Delta, \text{ where:}$$

- The left part of the equation  $\frac{\Delta Y}{Y}$  describes the economic growth.
- $k$  describes the growth rate of full-employment output, also called the Okun's coefficient. (White & Chu, 2013)

Based on empirical evidence and the law formulated by Okun, it is suggested that the coefficient representing the slope of the function is expected to be equal to 2, thus leading to the following relationship: *for every 1 per cent increase in the unemployment rate, the real*

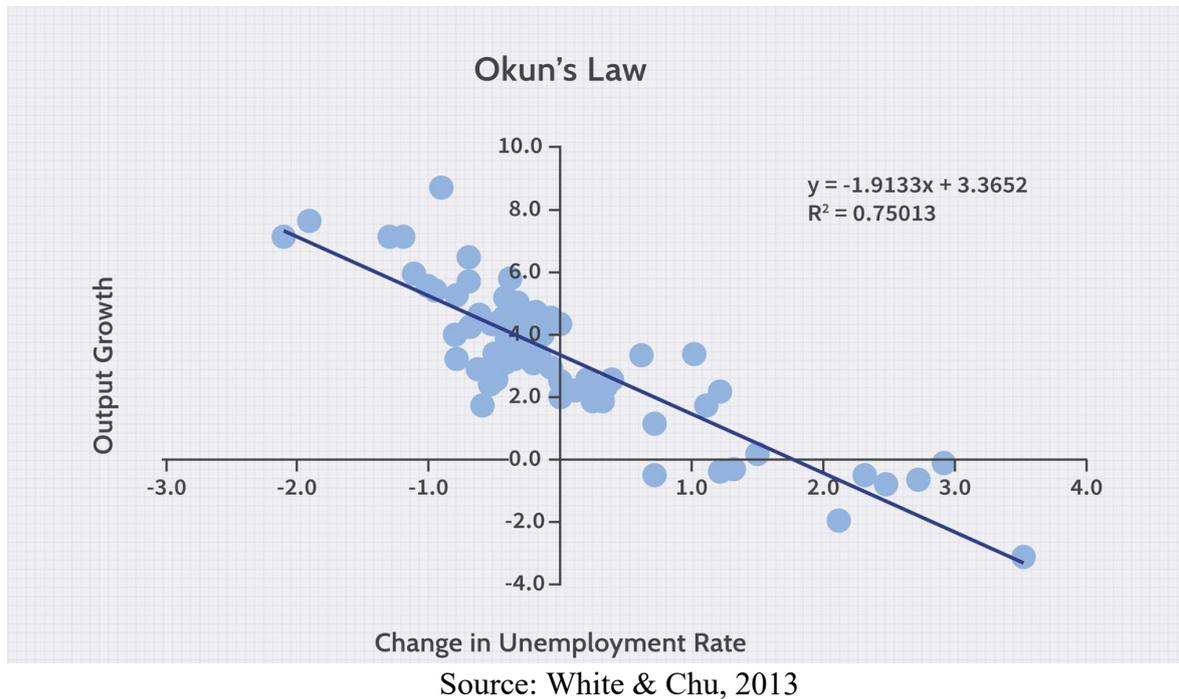
*GDP falls by 2 per cent, or for every 4% increase in the real GDP, the unemployment rate falls by 1%.* However, this is still debatable since many scholars claim that the finding is not fully accurate (Freeman, 2000).

As it was mentioned earlier, the Okun's law provides a series of essential insights for the operations of labour market and the state of the economy as a whole, Okun's law carries with it significant repercussions for those in charge of formulating public policy and helps them to better evaluate their decisions when considering the potential effect on the economy. If policymakers are able to get a grasp of the link between shifts in GDP and unemployment rates, they will be better equipped to make educated choices about fiscal and monetary policies that will help stabilise the economy (Prachowny, 1993).

One important way in which Okun's rule may be put to use is in the process of determining the output gap, which can be defined as the difference between the current GDP and the potential GDP. According to the legislation, the unemployment rate will most likely be greater than its natural rate if the economy is performing at a level that is lower than its potential level, which is demonstrated by a gap in production that is negative. In contrast, the unemployment rate is likely to be lower than its natural rate when the economy is running over its capacity, which is indicated by a positive output gap. This is because the economy is producing more than it is capable of producing. When it comes to designing proper economic policies, policymakers really need this knowledge in order to successfully shrink the production gap and attain full employment (Izyumov & Vahaly, 2002).

In addition, Okun's rule offers a helpful instrument for estimating unemployment rates based on anticipated shifts in GDP. This may be done by using the law. Economists are able to estimate the influence that a number of different economic situations will have on the labour market by evaluating the value of Okun's coefficient. These estimates can serve as a guide for policymakers as they make timely changes to monetary and fiscal policies to offset the negative effects that economic fluctuations have on unemployment (Fouquau, 2008). Visual representation of the Okun's law is presented in Figure 1.

**Figure 1, the Okun's law in practice**



### 3.1.2 Criticism

Despite the fact that the law is formulated on the empirical basis rather than on the theoretical and underpinned by estimations made by Arthur Okun himself, there are still many different reasons for active criticism of the Okun's law and its relatively rare application to modern-day economics. Individual reasons for criticism are described in the following paragraphs.

- **Limited scope of applicability**

Okun's Law is potentially flawed since it is predicated on a number of assumptions. At first, it ignores the impact of structural shifts in the labour market and technological developments by supposing a constant link between the production gap and the unemployment rate. The supposed stability of the connection is called into question by the fact that economic conditions and labour market dynamics might change over time. Second, Okun's Law presupposes a linear connection between the two variables, which could not hold during times of considerable structural change or when the economy is under severe circumstances. Potential non-linearities and asymmetries in the connection are ignored by the linearity assumption.

Finally, Okun's Law overlooks additional factors including labour force participation rates, demographic shifts, and changes in labour market institutions when assuming that changes in the unemployment rate are primarily driven by changes in the production gap (Silvapulle et al., 2004).

- **Lack of empirical evidence and practical challenges**

Challenges in empirically testing and implementing Okun's Law have been found. The difficulty of quantifying the production gap is one such issue. Estimates of the production gap can vary widely due to differences in methodology and data sources, making it challenging to establish a reliable correlation with the unemployment rate. Furthermore, official unemployment rate figures have been criticised for their potential inaccuracy in capturing underemployment, discouraged employees, and people who have stopped looking for work completely. Okun's Law's applicability in the real world may be compromised by such measurement uncertainties (Ismihan, 2010).

- **Non-linearity of the described relationship**

Opponents of Okun's Law point out that it assumes too much linearity between the output gap and the unemployment rate. Non-linear patterns of economic downturns and recoveries are common, with some industries and skill sets being hit more than others. Asymmetrical impacts of economic shocks, sectoral inequalities, and the rigidity of the labour market are all examples of conditions that might give birth to non-linear connections. Therefore, forecasts and policy suggestions based on Okun's Law may be off because of its too basic assumptions (Lee, 2000).

- **Contextual factors**

The correlation between the output gap and the unemployment rate is complicated, but Okun's Law ignores these complexities. The sensitivity of the unemployment rate to changes in the production gap can be greatly influenced by differences in labour market institutions, social security systems, and government policies between nations. Further complicating the link between the two is the fact that Okun's Law ignores the impact of inflation expectations, the dynamics of financial markets, and global economic interdependencies (Freeman, 2001).

- **Hysteresis and long-term unemployment**

Okun's Law has also been criticised for its failure to account for hysteresis, the phenomenon wherein high unemployment rates remain even after they have decreased. Okun's Law states that unemployment rate changes are transitory and tend to level out at their natural rate. However, there is evidence that long-term unemployment can result from skill erosion, worker discouragement, and limited access to the labour market. Therefore, the negative effects of economic downturns on labour markets may be understated by Okun's Law (Schorderet, 2001).

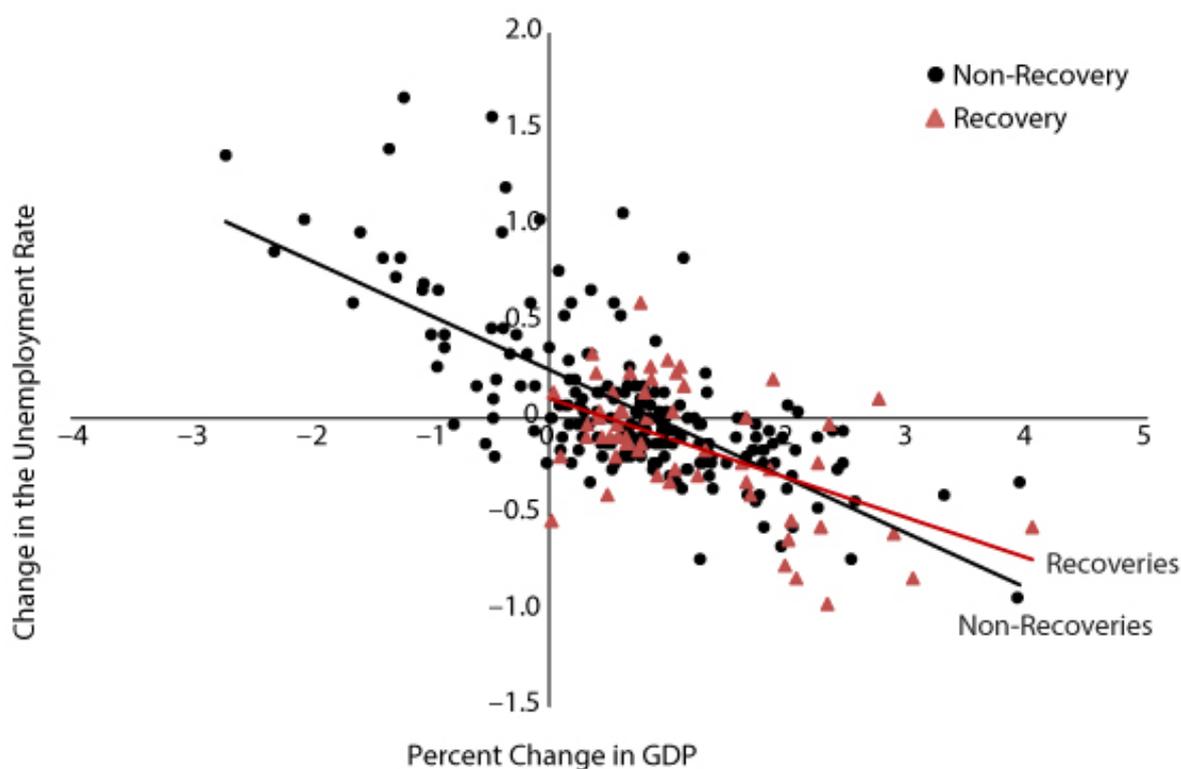
- **Alternative measures**

Okun's Law has its drawbacks and problems; thus, scholars have offered several ways to quantify the connection between the output gap and the unemployment rate. Alternatives include expanding the scope of analysis by factoring in new labour market variables like underemployment and labour force participation rates. The asymmetry and complexity of the link between output and unemployment may also be captured by non-linear modelling approaches and regime-switching models (Sögner & Stiassny, 2002).

- **Inaccurate magnitude during business cycles**

Over the time, recent economic studies concluded on the subject of the Okun's law applicability is more adequate during the recessionary periods since the law does not hold during the period of recovery, for which there is a plenty of empirical evidence, such as the one described in Figure 2 where the inaccuracy is pretty visible (Owyang & Vermann, 2013).

Figure 2, the law during the recovery and non-recovery periods



Source: Owyang & Vermann, 2013

### 3.2 Kazakhstan's Economic Specialization

Kazakhstan, which may be found in Central Asia, is well-known for its extensive natural riches as well as its key location geopolitically. Since its independence from the Soviet Union in 1991, Kazakhstan has achieved tremendous success in changing its economy and attracting foreign investment. This achievement may be attributed to Kazakhstan's ability to host international sporting events. This article is a comprehensive study of the economy of Kazakhstan, focusing on its most important sectors, most significant difficulties, policies of the government, and future possibilities (Nurlanova et al., 2017).

The economy of Kazakhstan is exceptionally robust in comparison to that of its neighbors. It is projected to have a Gross Domestic Product (GDP) of roughly 180 billion dollars in 2021, making it the most powerful economy in Central Asia. Kazakhstan has had tremendous economic growth over the course of the past three decades, which can be attributed in large part to the country's rich deposits of oil, gas, and minerals. Agriculture, manufacturing, and service industries are among those that have been prioritized in the nation's efforts to effectively

diversify its economy and minimize its reliance on companies that exploit natural resources (Raihan & Tuspekova, 2022).

**Figure 3, Kazakhstan's economic infographics**



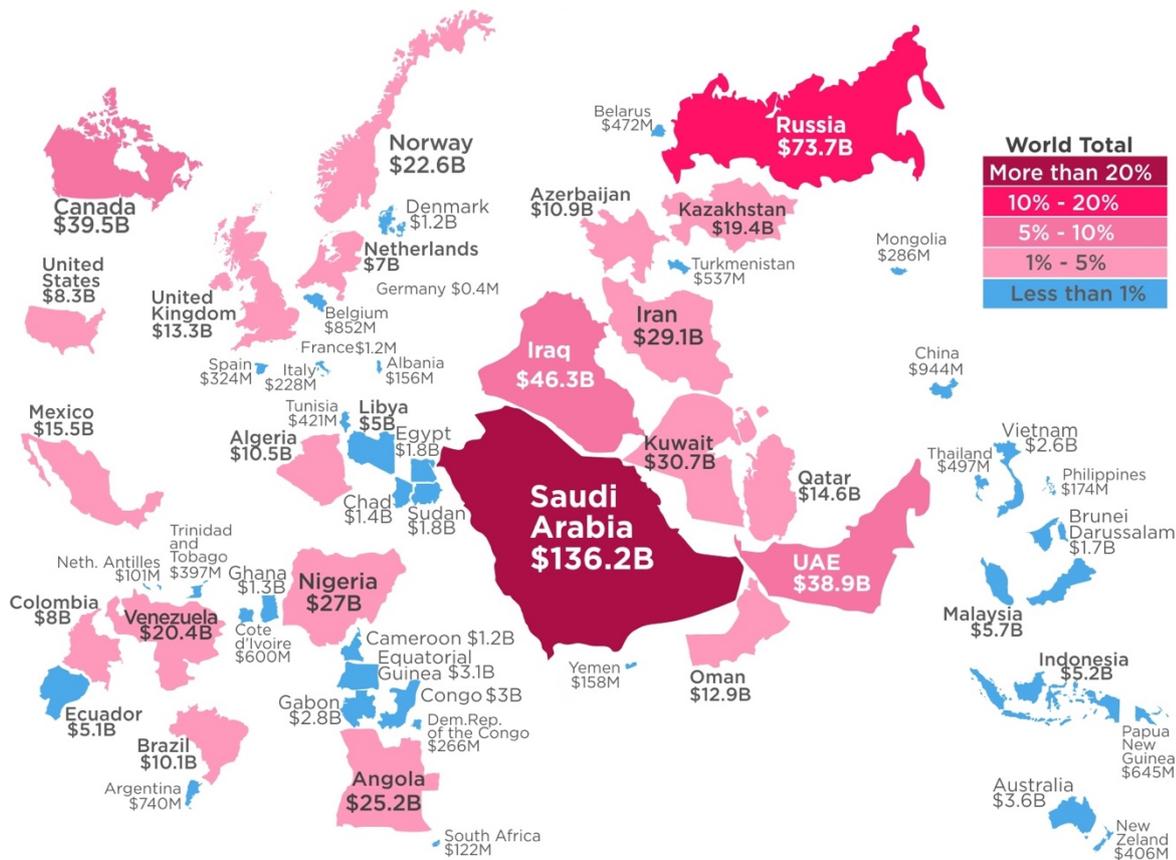
Source: Freepik, 2023

Kazakhstan is home to significant natural gas deposits and ranks ninth on the list of countries that generate the majority of oil reserves around the globe. The energy industry is extremely important to the overall economy of the country and makes a sizeable contribution to both the revenue from exports and the general fund of the government. In addition, the mining industry, which encompasses the extraction of minerals like as uranium, copper, and gold, contributes to the expansion of the economy as well as the inflow of foreign direct investment. On the other hand, Kazakhstan's large fertile territory has allowed it to develop a prosperous agriculture industry. Potatoes, wheat, barley and maize are among the most important agricultural products produced in the nation. In addition, the livestock business, which encompasses the raising of animals like as cattle, sheep, and horses, is a substantial contribution to the agricultural sector. The government has enacted policies with the goals of modernizing agriculture, increasing overall productivity, and promoting output that is export oriented. The country of Kazakhstan has come a long way in terms of its efforts to strengthen its manufacturing and industrial sectors. The nation has a primary emphasis on high value-

added sectors such the manufacturing of equipment and chemicals, as well as textiles and food processing. To encourage innovative technical development in the industrial sector and to entice foreign direct investment, the government has developed special economic zones and offered financial inducements (Kaiser & Pulsipher, 2007).

However, despite relatively robust primary and secondary sectors, services continue to be the country's core area of specialization. This is because services account for about half of the country's yearly value added. The contribution that Kazakhstan's economy receives from the service industry, which includes the financial sector, telecommunications, transportation, and tourism, is on the rise. The nation's goal is to develop into a regional center for finance and logistics, with the intention of luring international financial institutions and investors. The tourist industry is also picking up steam, and it is doing so because to Kazakhstan's rich cultural legacy, its beautiful natural attractions, and the progress that has been made in the country's infrastructure (Zhumussova & Dulambayeva, 2019).

**Figure 4, the world map of crude oil exports in 2016**



Source: Business Insider, 2023

Kazakhstan has seen economic success, but the country still confronts a number of obstacles that must be overcome in order to maintain its current level of growth and development. Although Kazakhstan has achieved some headway in the direction of diversifying its economy, there is still a significant need to lessen the country's reliance on businesses that are involved in extractive activities. To achieve economic diversification, additional investment must be made in non-resource industries; innovation must be encouraged; and the business climate must be improved in order to attract both local and international investment. The vastness of Kazakhstan's terrain calls for significant expenditures to be made in its infrastructure, which includes transportation, logistics, and energy production, among other areas. Trade will be facilitated, competitiveness will be increased, and foreign investment will be attracted as a result of the modernization of infrastructure and the development of a transport network with strong connections. The development of human capital is essential for ensuring continued economic growth as well as competitiveness in today's global marketplace. In order to stimulate creativity and productivity, Kazakhstan has to place a priority on raising the quality of education, expanding opportunities for vocational training, and strengthening its research and development capabilities. Increasing transparency, improving governance, and successfully battling corruption continue to be significant difficulties. In order to guarantee a consistent rate of economic expansion, it is vital to fortify existing institutions, put in place efficient anti-corruption safeguards, and work to advance the rule of law (Janenova, 2010).

The economy of Kazakhstan possesses a tremendous amount of untapped potential for further growth and development in the years to come. Its allure to international business is enhanced by the fact that it possesses a strategic position, an abundance of natural resources, and continuing government changes. Nevertheless, in order to realise the full potential of the nation, persistent efforts must be made to diversify the economy, develop the infrastructure, strengthen the institutions, and increase human capital (Shahbaz et al., 2017).

### **3.3 Transition Economies**

Countries in transition are those making the transition from a socialist, centrally planned economy to a freer, more market-based one. The fall of the Soviet Union and the following breakup of the Eastern Bloc in the 1980s and 1990s are commonly seen as the catalysts for

these changes. Reforms such as privatisation, liberalisation, and institutional reorganisation are necessary for a successful transition from a centrally planned to a market-based economy. This article offers an in-depth look at economies in transition, analysing the obstacles they encounter and the methods they use to expand economically sustainably (Svejnar, 2002).

The transition from command economies to market-based ones gave rise to transition economies. Former communist republics in Central and Eastern Europe, as well as certain countries in Asia and Africa, have had to undergo economic restructuring in the wake of the Soviet Union's fall and the end of the Cold War. Weak institutions, obsolete infrastructure, and a lack of familiarity with market methods were just some of the hurdles these nations had to overcome throughout their transition (Garibaldi et al., 2001).

The practise of privatisation is a hallmark of economies in transition. Most businesses and industries in centrally planned economies belonged to the government. In order to make the change to a market economy, many formerly state-owned assets were sold off to private investors. The goals of privatisation were efficiency, productivity, and competitive enhancement. There were variations in equity, transparency, and economic effectiveness as a result of privatisation programmes because of how they were implemented in different nations (Peng, 2000).

The liberalisation of markets is another notable feature of transition economies. For this reason, restrictions on trade, pricing, and other rules that hampered business development and access to markets had to be lifted. Transition economies aimed to attract foreign money, introduce new technology, and integrate with the global economy by opening up to international commerce and investment. However, indigenous sectors frequently struggled to compete with foreign rivals and adapt to market pressures as a result of the liberalisation process (Fischer et al., 1996).

Many obstacles stood in the way of transition economies achieving long-term economic progress. Significant social and economic dislocations resulted from the sudden transition from a planned economy to a market-oriented society. Three primary areas—macroeconomic stability, institutional development, and social welfare—are where problems manifest (Estrin et al., 2009).

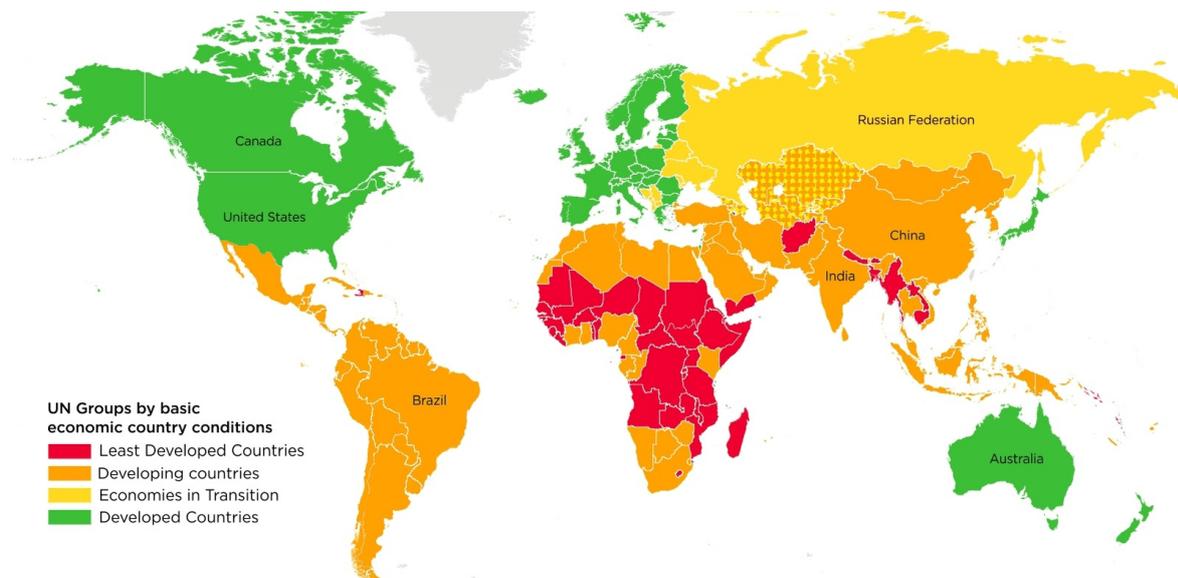
Transition economies were especially concerned with maintaining macroeconomic stability. High inflation, budget deficits, and swings in the currency rate were common once countries made the transition to a market economy. These macroeconomic difficulties hampered investment and economic development while also posing serious threats to the stability of the economy as a whole. In order to solve these problems and reestablish macroeconomic stability, economies in transition required to develop effective monetary and fiscal policies (Beck & Laeven, 2006).

Transition economies also had to deal with the difficulty of developing their institutions. New legal structures, regulatory organisations, and enforcement mechanisms were developed to back up market-oriented systems as part of the transition process. The economy faced serious challenges due to weak institutional capability, corruption, and a lack of openness. Investment in institution-building, governance reform, and the rule of law promotion were all necessary for transition economies to attract foreign direct investment. Throughout the transformation, social welfare was also an important focus. In many cases, massive unemployment and wealth gaps resulted when states dismantled social safety nets and restructured sectors. There was a lot of social unrest and a general drop in living standards throughout the shift. Social policies were implemented in transition economies to cushion the blow of changes and distribute prosperity more equitably (Nellis, 1999).

The economies in transition used a wide range of methods to overcome obstacles and achieve long-term economic growth. The goals of these plans were to achieve macroeconomic stability, implement structural changes, and become more globally integrated. The immediate problems of inflation, fiscal imbalances, and currency volatility were the focus of macroeconomic stabilisation efforts. This was achieved by the introduction of stringent monetary policies, fiscal austerity initiatives, and changes to the currency exchange rate. Price stability, deficit reduction, and a reliable exchange rate system were all goals of transition economies (De Melo et al., 2001).

To make transition economies more productive and competitive, structural adjustments were necessary. Market liberalisation, deregulation, and privatisation were all part of these changes. Deregulation and liberalisation attempted to lower obstacles to entry and increase competition, while privatisation aimed to transfer state-owned assets to private hands. Improvements in infrastructure, a friendlier atmosphere for doing business, and a push for creative problem solving were also part of the structural reforms. Transition economies benefited much from joining the global market. These governments hoped to attract foreign investment and gain access to new markets by liberalising their trade and investment policies. For integration to occur, it was necessary to open up markets to foreign trade and investment and to join regional and international trade pacts. Attracting FDI from abroad also helped boost economic growth and facilitate the spread of new technologies (Dunning, 2004). The classification of countries on the globe is presented in Figure 5.

**Figure 5, classification of countries**



Source: UNCTAD, 2021

Notably, it is essential to mention in the end that one of the biggest differences between transition economics and developing ones is the fact that transition economies tend to have a more developed and better stock of human capital, as well as infrastructure that is in a desperate need of renewal and replacement. On the contrary, developing countries are suffering from problems with infrastructure and low levels of education that they are constantly trying to address (Yeager, 2018). Nevertheless, the author will continue with his analyzed with the empirical testing of the Okun's law model presented in the analytical part of the work.



## 4 Practical Part

### 4.1 Preparation for Estimation

#### 4.1.1 Hypothesis and Assumptions

Before proceeding to the estimation, it is first essential to formulate the main hypothesis of the empirical part of the bachelor thesis. Based on the scientific framework that has been reviews in the previous part of the bachelor thesis, it is possible to formulate the following hypothesis: *The relationship between the change in the unemployment rate and the change in the real GDP has the negative nature – as one increases, the other decreases. When it comes to the magnitude, the slope of the change in the real GDP is equal to -4%. In other words, for Kazakhstan to reach 1% decrease in the unemployment rate, the country has to achieve an increase of 4% in the real GDP.*

In addition to describing the relationship between the two variables, the author includes additional variables from the macroeconomic domain, which are also expected to contribute in a significant way to the change in the unemployment rate in Kazakhstan. Henceforth, the economic model used in the estimation process can be formulated in the following way:

$\Delta UNEMP = f(\Delta RGDP, INFL, LFORCE, FDI)$ , where:

- UNEMP stands for the unemployment with the sign delta explaining the change.
- RGDP stands for the real GDP with the sign delta explaining the change.
- INFL stands for the inflation rate.
- LFORCE stands for the labor force.
- FDI stands for the foreign direct investments.

It is expected that the sign of the RGDP will be negative, the sign of the INFL will be negative, the sign of the LFORCE will be negative and the sign of the FDI will also be negative. Additionally, it is assumed that the estimate will be consistent, linear and unbiased, which can be ensured by assuming that there will be no multicollinearity, no serial correlation of residuals, no heteroscedasticity and that residuals will follow the normal distribution. Deviation from one of the aforementioned assumptions will result in distorted standard errors, for the majority of

cases, and the absence of normality will result in inability to use statistical inference, notably F and t-tests that require the presence of the normal distribution in small samples.

#### 4.1.2 Economic Model and Data

Now, after specifying the hypothesis and also additional assumptions, it is possible to continue to the data collection that is done with the help of two resources – FRED and the World Bank. It was possible to collect the dataset that is presented below in Table 1.

**Table 1, the dataset for the empirical analysis**

Year	d_Unemployment, p.p.	Real GDP growth, p.p.	Inflation, %	FDI, billion USD	Labor Force, millions
1997	6.43	2%	17.41	1.32	7.67
1998	3.44	-2%	7.15	1.15	7.62
1999	1.98	3%	8.30	1.59	7.60
2000	0.05	10%	13.18	1.37	7.60
2001	0.12	13%	8.35	2.82	7.61
2002	0.33	10%	5.84	2.59	7.66
2003	-0.71	9%	6.44	2.48	7.75
2004	-2.32	10%	6.88	5.62	7.85
2005	-1.1	10%	7.58	2.55	7.93
2006	-0.55	11%	8.72	7.61	8.07
2007	-0.38	9%	10.85	11.97	8.26
2008	-0.27	3%	17.14	16.82	8.50
2009	-0.34	1%	7.32	14.28	8.64
2010	-0.53	7%	7.40	7.46	8.73
2011	-0.63	7%	8.42	13.76	8.80
2012	-0.08	5%	5.10	13.65	8.86
2013	-0.78	6%	5.85	10.01	8.91
2014	-0.38	4%	6.71	7.31	8.97
2015	-0.1	1%	6.67	6.58	9.02
2016	-0.09	1%	14.55	17.22	9.07
2017	-0.14	4%	7.44	4.76	9.11
2018	-0.13	4%	6.02	0.35	9.16
2019	0.03	5%	5.25	3.73	9.23
2020	-0.06	-3%	6.77	7.21	9.18
2021	-0.05	4%	8.04	4.55	9.29
2022	-0.05	3%	17.40	4.91	9.63

Source: The World Bank, 2023 and FRED, 2023

Before finally formulating the econometric model, it would be wise to follow the development of the selected macroeconomic indicators since it will help the author to answer one of the research questions, notably the one about the recent economic performance of Kazakhstan. For this purpose, it is downright crucial to start with the analysis of descriptive statistics, which will be presented in Table 2 containing the output from Eviews.

**Table 2, descriptive statistics**

	D_UNEMPL...	FDI__BILLIO...	INFLATION__	LABOR_FO...	REAL_GDP...
Mean	-0.305846	6.678790	8.875141	8.489457	0.053077
Median	-0.135000	5.261364	7.420234	8.684320	0.044000
Maximum	0.330000	17.22379	17.40804	9.632385	0.135000
Minimum	-2.320000	0.353292	5.097915	7.596246	-0.025000
Std. Dev.	0.530378	5.109317	3.790284	0.667272	0.040529
Skewness	-2.225823	0.720989	1.365972	-0.121530	0.016488
Kurtosis	9.111789	2.325861	3.506843	1.526720	2.295410
Jarque-Bera	61.93538	2.744908	8.363772	2.415435	0.538995
Probability	0.000000	0.253484	0.015270	0.298879	0.763763
Sum	-7.952000	173.6485	230.7537	220.7259	1.380000
Sum Sq. Dev.	7.032511	652.6281	359.1564	11.13130	0.041066
Observations	26	26	26	26	26

Source: own analysis based on FRED, 2023 and The World Bank, 2023

An entirety of 26 observations was analyzed. Based on the average value of the variable of the first difference in the unemployment rate in Kazakhstan, it is identified that unemployment was decreasing on average. The magnitude of the average decrease for the studied time period is equal to 0.30 percentage points, which is not an outstanding figure, but definitely suggests that there is a downward-sloping trend in the development of the unemployment rate in the country. The biggest increase in the unemployment was equal to 0.33 percentage points, which is not fairly a lot for one year. The minimum change of unemployment is 2.32 percentage points. Therefore, it is possible to say that the country's unemployment rate was under control. The variable is not distributed normally, according to Jarque-Bera test.

For the FDI variable, the situation is definitely different, as the average value of the FDI net inflow to the country was 6.67 billion USD in current terms. Of course, this is not a big value in the context of other major developing economies, such as the neighboring China, or India, but this is still a good result for Kazakhstan. The highest amount of investments is equal

to 17.22 billion USD, which is an outstanding result, while the lowest value presumably identified at the beginning of the studied time period is equal to just 0.35 billion USD. The variable is normally distributed and the sum of all FDI inflows over the course of 26 years is equal to 173 billion USD, almost making up for the country's total GDP.

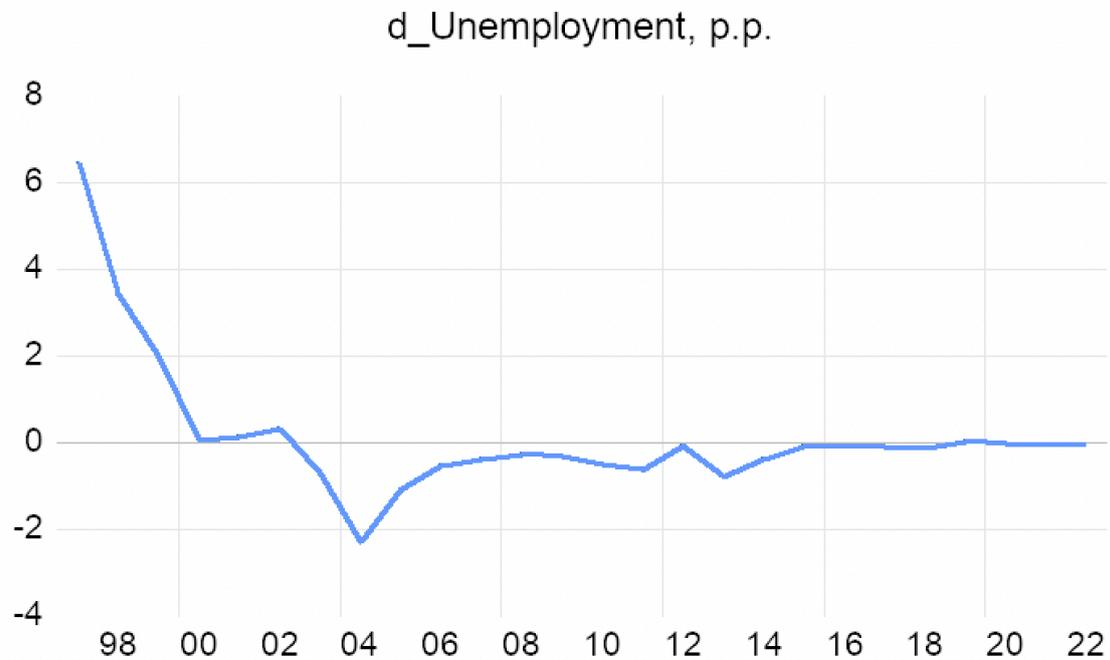
The situation with the inflation rate in Kazakhstan is not so favorable as the average value of the inflation rate for the country is 8.87 percentage points. Given the traditional target level of inflation of around 2-3 per cent, this is definitely something that needs corrections by the Central Bank of the country. The highest inflation was equal to 17.4 per cent spotted either during the early years of the country's independence or during the last years of the studied time period arising due to the instability of the world economy. The lowest level of inflation of Kazakhstan was 5.09 per cent, which is still a lot when bearing in mind the fact that the target is at around 2-3 per cent. The variable is not distributed normally.

The average number of labor force in Kazakhstan in millions is 8.48, which is not much when considering that the current population of Kazakhstan is approaching the figure of 20 million. The maximum labor force is identified on the level of almost 10 million – 9.63 million people being able to work, according to the methodology of the ILO. The lowest number of people being legally able to work in Kazakhstan was equal to 7.59 million people. The variable is distributed normally.

About the final and the most important variable out of the list of regressors – the change in the real GDP it is possible to spot many different aspects of its development. For sure, the average value of 5 per cent is a stunning result that prompts the author to conclude that the country's economic performance during almost 3 analyzed decades was rather outstanding, and the country was quite effective in terms of performing the transition from centrally planned economy to a market-based one. The absolute maximum economic growth that is identified for the time period is equal to 13.5 per cent, which is a very good result. In turn, the absolute minimum of 2.5 per cent does not seem to concerning as the economy did not really suffer a serious shock but rather a normal recession, which is pretty common given the nature of endlessly changing and repeating business cycles. The variable is normally distributed.

Now, it is essential to proceed to the time series analysis of every variable with the help of scatterplot graphs from Eviews. The first studied variable is the change in the unemployment rate in Kazakhstan, which can be found in Figure 6.

**Figure 6, the scatterplot of the d\_unemployment**



Source: own analysis based on FRED, 2023 and The World Bank, 2023

It is important to note that during the early years after gaining the independence, the country faced an upward-sloping trend or, to put it simpler, a growth in the unemployment rate until approximately the year 2000, when the growth of unemployment stopped. Consequently, the country managed to proceed to a steady decrease of the unemployment, which became relatively stationary after the start of the Great Recession. In fact, the pattern seems downright strange as during the world financial crisis, countries traditionally faced an increase in the unemployment, while Kazakhstan seems to have not been fully touched by the problem. Nevertheless, the next variable to be discussed in the same light is the change in the real GDP presented in Figure 7.

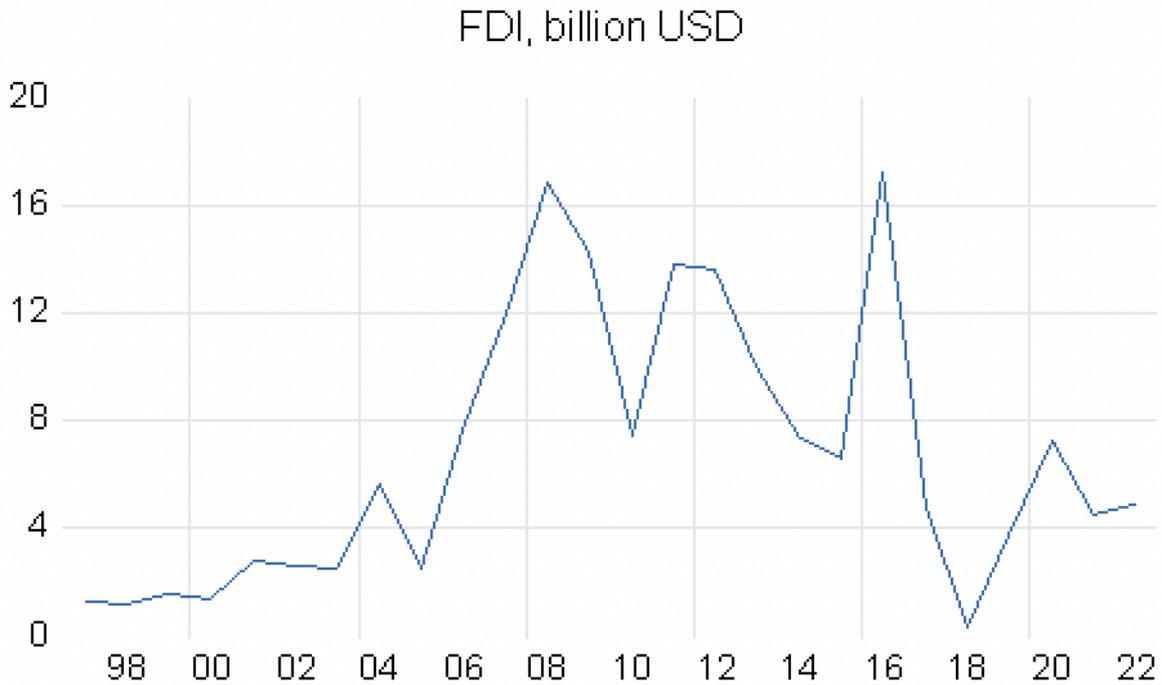
**Figure 7, the scatterplot of the real GDP growth**



Source: own analysis based on FRED, 2023 and The World Bank, 2023

When looking at the development of the real GDP change, it is possible that the growth was a far more frequent occurrence rather than a decrease. The country experienced the recession in just two years – in 1998 and 2020, when the indicator dropped below zero. Interestingly enough, the country's real GDP was not really hit by the Great Recession in a horrific way since it still experienced a small growth. The explanation behind this might lie on the surface – the country did not really have a strong financial sector back then, so the world economic crisis did not hit the country as bad as states that were far more integrated into the globalization processes. However, the fact that the country experienced a recession in 2020 might mean two things – either the crisis of 2020 was so devastating that it hit literally all countries in the world without any exception, or Kazakhstan managed to become more integrated into the world economy, so it had to also bear the consequences of the Great Recession. The next variable that will be analyzed is the FDI, whose development in time can be found in Figure 8.

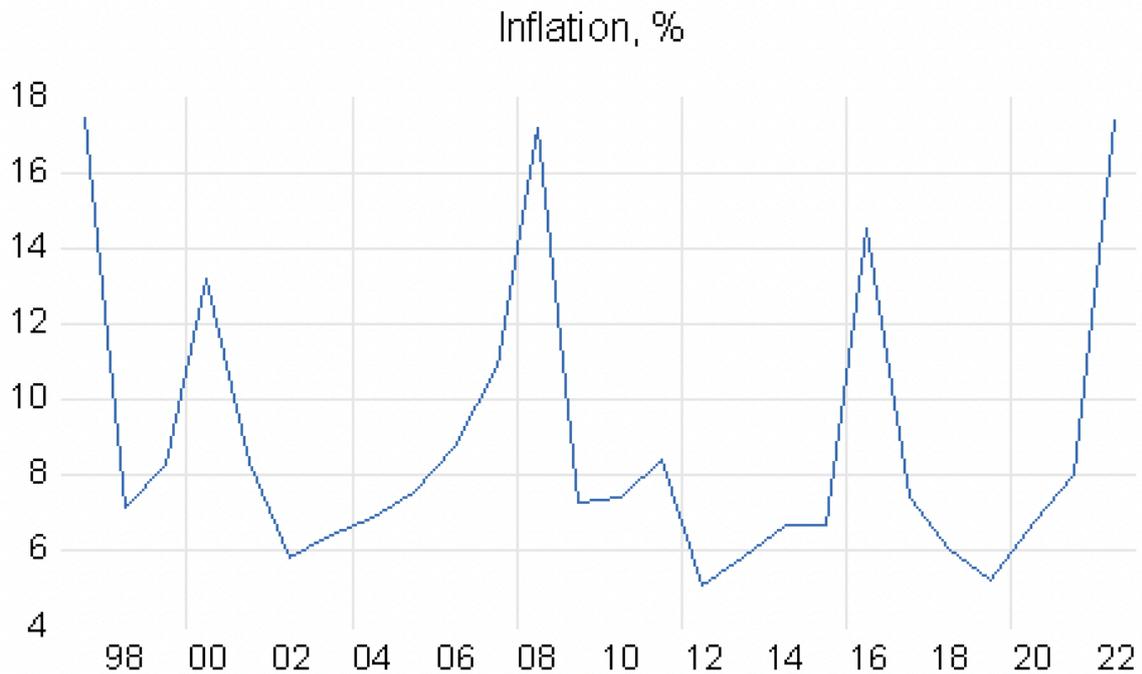
**Figure 8, the scatterplot of FDI**



Source: own analysis based on FRED, 2023 and The World Bank, 2023

In fact, the situation with the FDI is rather optimistic rather than pessimistic since the country's volume of received investments from foreign partners has never dropped below 0, which is a sign of an attractive and prosperous economy. What is quite interesting to note is that the highest volume of investments is spotted during the middle of the previous decade and this is presumably linked to the change in the exchange rate regime, when the country shifted from the government-controlled fixed exchange rate to a free-floating one that resulted in a huge depreciation of the domestic currency and potentially higher volume of investments into the country. The next variable is the inflation rate, which can be found in Figure 9.

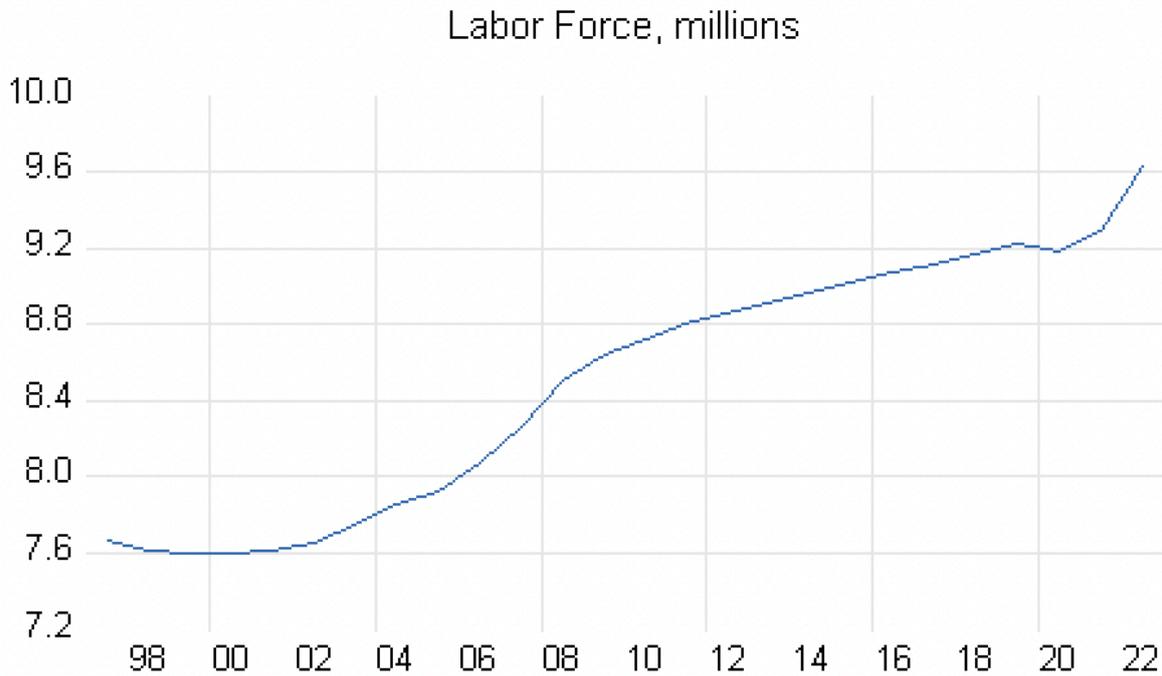
**Figure 9, the scatterplot of the inflation rate**



Source: own analysis based on FRED, 2023 and The World Bank, 2023

It is possible to say with a certain degree of confidence that the Central Bank of the country did not really manage to keep the situation with the inflation rate under control since its level has never ever dropped below 4 per cent and neither it had reached the target of 2-3 per cent. What is more, frequent fluctuations seem to resemble some kind of seasonality, where inflation surges once in 8 years up to the level of approximately 18 per cent. Inflation targeting seems to be the most troubled aspect of Kazakhstan's economic governance. Finally, the last variable shows the situation with the labor force, and it can be found in Figure 10.

**Figure 10, the scatterplot of labor force**



Source: own analysis based on FRED, 2023 and The World Bank, 2023

As for the labor force of the country, it is definitely possible to say that it was rising not linearly but rather exponentially, which is pretty traditional for all variables related to demographics and population. However, the recent surge in 2020-2022 is explained by the demographic boom of early 2000s, resulting in higher number of people joining the labor force when they entered the legal age for working in the country. All in all, the situation with this aspect seems to be pretty good. Before proceeding to the formulation of the econometric model for the studied case, it is essential to check one of the assumptions stated earlier, and notably the one about no multicollinearity. For this purpose, a correlation matrix is generated in Eviews, which is presented in Table 3.

**Table 3, the correlation matrix**

Correlation					
	D_UNEMPL...	FDI_BILLIO...	INFLATION__	LABOR_FO...	REAL_GDP...
D_UNE...	1.000000	0.067786	-0.013758	0.416979	-0.715977
FDI_B...	0.067786	1.000000	0.192750	0.384311	-0.161900
INFLAT...	-0.013758	0.192750	1.000000	-0.039948	-0.136251
LABOR...	0.416979	0.384311	-0.039948	1.000000	-0.443250
REAL_...	-0.715977	-0.161900	-0.136251	-0.443250	1.000000

Source: own analysis based on FRED, 2023 and The World Bank, 2023

Quite certainly, there are no cases of perfect collinearity that will prevent the author from estimating parameters at all. Alternatively, neither there is any case of high collinearity since all absolute values of correlation coefficients of independent variables are lower than 0.8. Now, it is finally possible to formulate an econometric model that will be estimated in the next chapter of the diploma thesis.

$$\Delta UNEMP = \gamma_0 + \gamma_1 \Delta RGDP + \gamma_2 INFL + \gamma_3 LFORCE + \gamma_4 FDI + U_e$$

Gammas will exactly be something that is estimated with the help of the first formula from the methodology of the diploma thesis. In addition to that, it is also essential to briefly comment the presence of the error term in the end of the econometric model. Given the fact that the author estimates an economic process, where variables are traditionally influenced by countless many different events and factors, the error term indicates all variables and economic factors that have not been included into the model. The next chapter of the bachelor thesis is dedicated to the estimation of the model with the help of the OLS.

## 4.2 Estimation

The estimation and further interpretation of parameters will be solely based on the output from Eviews that can be found in Table 4.

**Table 4, OLS output from Eviews**

Dependent Variable: D\_UNEMPLOYMENT\_\_P\_P\_  
Method: Least Squares  
Date: 07/10/23 Time: 08:56  
Sample: 1997 2022  
Included observations: 26

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI__BILLION_USD	-0.008425	0.017097	-0.492754	0.6273
INFLATION__	-0.011821	0.021615	-0.546893	0.5902
LABOR_FORCE__MILLIONS	0.115252	0.142818	0.806982	0.4287
REAL_GDP_GROWTH__P_P_ C	-0.088510	0.021952	-4.031868	0.0006
	-0.653309	1.281506	-0.509798	0.6155
R-squared	0.540378	Mean dependent var		-0.305846
Adjusted R-squared	0.452831	S.D. dependent var		0.530378
S.E. of regression	0.392325	Akaike info criterion		1.137589
Sum squared resid	3.232299	Schwarz criterion		1.379531
Log likelihood	-9.788662	Hannan-Quinn criter.		1.207260
F-statistic	6.172424	Durbin-Watson stat		1.655693
Prob(F-statistic)	0.001904			

Source: own analysis based on FRED, 2023 and The World Bank, 2023

It is possible to create the following model:

$$\Delta UNEMP = -0.65 - 8.85\Delta RGDP - 0.011INFL - 0.11LFORCE - 0.008FDI + U_e$$

- In case if the real change GDP goes up by 1 percentage point, the unemployment falls by 0.0885 percentage points relatively to the previous year, *ceteris paribus*.
- In case if the inflation rate goes up by 1 percentage point, the unemployment falls by 0.011 percentage points relatively to the previous year.
- In case if the labor force increases by 1 million people, the unemployment falls by 0.115 percentage points relatively to the previous year.
- In case if the FDI increases by 1 billion USD, the unemployment falls by 0.008 percentage points relatively to the previous year.

It can be concluded that signs of all variables are estimated correctly, apart from the labor force, where the original assumption was that the sign will be negative. However, it is wise to say that it strongly depends on the economy, as the original assumption of the author was that younger generations have a better education, so with the increase in the labor force as they would join the number of people working in the country, they will not have difficulties with finding the work. However, the situation seems to be rather different as it increases the competitiveness inside of the economy thus leading to higher unemployment, which is also pretty logical. In addition to that, it is definitely possible to say that it became already pretty apparent that the Okun's law is not applicable to Kazakhstan, since in order to achieve a 1 percent reduction in the unemployment rate, it is needed to increase the real GDP by 11.76 percent (one divided by the slope of the real GDP change variable).

### **4.3 Verification**

The first part of the verification is concerned with the verification of statistical properties of the estimated model. For this purpose, the very first indicator that is taken into consideration is the value of the adjusted R square, which is equal to 0.45 or 45%. This can be interpreted as: *45 per cent of the variation in the change in unemployment in Kazakhstan is explained by the change in the real GDP, FDI, labor force and inflation*. The value is definitely not big enough for the author to consider the model for forecasting, but it can still be useful in case if there will be any significant parameters. Before verifying the statistical significance of individual

parameters, it is first essential to perform the F-test, where the null hypothesis about insignificance is rejected, so the whole model is significant.

Alternatively, the situation with individual parts is not so optimistic as there is just one variable that is significant – the real GDP growth. On one hand, this is a good result considering that the ultimate goal of the bachelor thesis was to test the applicability of the Okun’s law in Kazakhstan. However, on the other hand, this is not so good since other parts of the model do not really provide any meaningful interpretation due to their insignificance. Presumably, by switching to the original variable of the unemployment rate, this problem could be eliminated, but the main purpose of the bachelor thesis remains to test the applicability of the Okun’s law, so the author moves forward. Another important element of regression diagnostics is the utilization of three information criteria – Akaike, Schwarz and Hannan-Quinn, where low values are preferred. Given that the author created just one model and there is no other reference model to compare the values of those criteria with, it is possible to conclude that their figures are favorable as they are quite close to negative figures.

The next step involves the diagnostics of residual, which forms the part of the econometric verification. The first type of test that will be implemented is the Breusch-Pagan test for the verification of heteroscedasticity. Reflections are based on the results from Figure 11.

Source: own analysis based on FRED, 2023 and The World Bank, 2023

**Figure 11, the Breusch-Pagan test**

Heteroskedasticity Test: Breusch-Pagan-Godfrey  
Null hypothesis: Homoskedasticity

F-statistic	1.600973	Prob. F(4,21)	0.2111
Obs*R-squared	6.075823	Prob. Chi-Square(4)	0.1936
Scaled explained SS	10.43507	Prob. Chi-Square(4)	0.0337

When judging by the probability of the F-value, it is possible to suggest that the null hypothesis for the test was not rejected. The original null hypothesis for this type of testing is that there is no heteroscedasticity, which is a good result fully complying with one of the

assumptions for the econometric estimation. The next test is the Breusch-Godfrey test used for the identification of serial correlation presented in Figure 12.

Source: own analysis based on FRED, 2023 and The World Bank, 2023

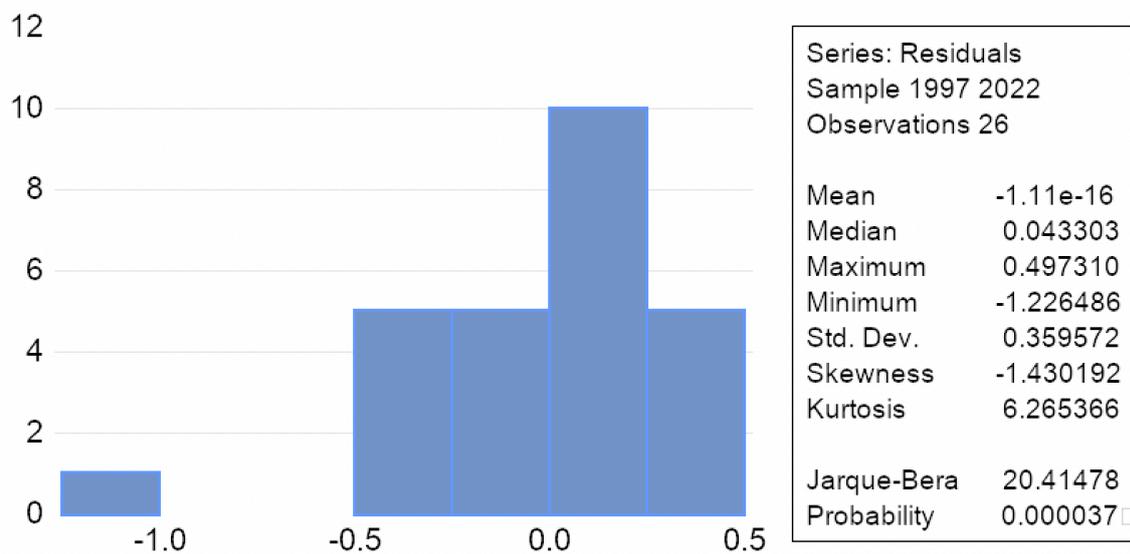
**Figure 12, the Breusch-Godfrey test**

Breusch-Godfrey Serial Correlation LM Test:  
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	0.628286	Prob. F(1,20)	0.4373
Obs*R-squared	0.791895	Prob. Chi-Square(1)	0.3735

According to the probability associated with the F-statistics, it is possible to conclude that the null hypothesis is not rejected. The null hypothesis for this kind of test is that there is no serial correlation, where the lag of the first order was selected. Therefore, there is no serial correlation in this case, which is a good result fully complying with one of the assumptions of the linear estimation. The final test is the test for normality – Jarque-Bera test, which is presented in Figure 13.

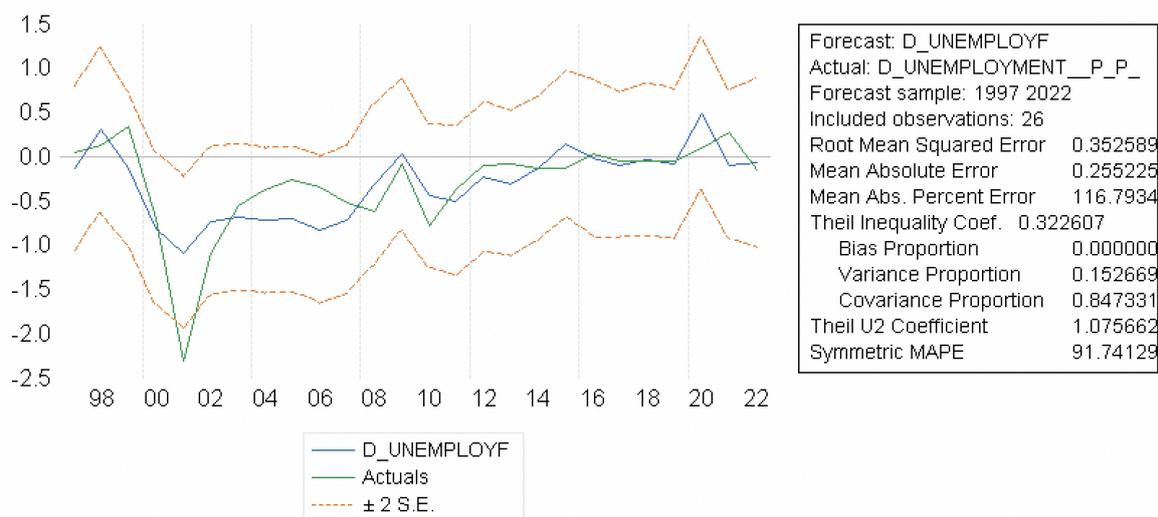
**Figure 13, the Jarque-Bera test**



Source: own analysis based on FRED, 2023 and The World Bank, 2023

Unfortunately, it is pretty apparent that the null hypothesis is rejected due to a really low value for the probability – below 0.01. The null hypothesis for the test is that the residuals are distributed normally, which is not the case and in violates one of assumptions from the beginning. However, the author believes that this problem can be overlooked for the case since it does not prevent nor anyhow distort the value of the parameter – the only implication of this problem is inability to properly use statistical inference. For future studies, it is recommended to increase the sample size and potentially use panel data, which can help to get rid of the problem. It is suggested that the model is still BLUE even despite the aforementioned problem. All in all, it is essential to proceed to the comparison of the fitted value and observed ones. This is presented in Figure 14.

**Figure 14, fitted vs. observed**



Source: own analysis based on FRED, 2023 and The World Bank, 2023

Of course, the spread of the confidence interval confirms that the utilization of the model for forecasting purposes is not the best idea because of relatively low precision. On the other hand, when comparing fitted and actual values, it is apparent that the regression line does to some extent fit in a good way and predict the direction of change in a correct way, while the magnitude is not correct – the model seems to underestimate changes in the unemployment rate. Finally, the author also calculates elasticities for all variables, which is shown in Table 5 with averages located in the final row below the last observation.

**Table 5, elasticities for regressors**

<b>Year</b>	<b>Real GDP change</b>	<b>Inflation</b>	<b>FDI</b>	<b>Labor Force</b>
1997	-0.12	-16.70	-0.90	71.76
1998	0.01	-0.64	-0.07	6.64
1999	-0.02	-0.90	-0.12	8.07
2000	-0.19	-3.38	-0.25	18.97
2001	-0.13	-1.10	-0.27	9.81
2002	-0.07	-0.53	-0.17	6.79
2003	-0.06	-0.56	-0.16	6.63
2004	-0.07	-0.71	-0.41	7.90
2005	-0.06	-0.64	-0.15	6.50
2006	-0.09	-1.03	-0.64	9.28
2007	-0.13	-2.07	-1.63	15.35
2008	0.14	9.83	6.88	-47.56
2009	-0.01	-0.64	-0.89	7.38
2010	-0.03	-0.45	-0.32	5.14
2011	-0.05	-0.72	-0.84	7.31
2012	-0.02	-0.32	-0.61	5.43
2013	-0.02	-0.32	-0.39	4.77
2014	-0.02	-0.34	-0.26	4.38
2015	0.00	-0.31	-0.22	4.14
2016	-0.01	-2.34	-1.97	14.19
2017	-0.01	-0.33	-0.15	3.96
2018	-0.01	-0.22	-0.01	3.25
2019	-0.01	-0.20	-0.10	3.40
2020	0.01	-0.30	-0.23	3.97
2021	-0.01	-0.34	-0.14	3.82
2022	-0.01	-0.99	-0.20	5.36
<b>Average</b>	<b>-0.04</b>	<b>-1.01</b>	<b>-0.16</b>	<b>7.56</b>

Source: own analysis based on FRED, 2023 and The World Bank, 2023

According to the calculation done with the help of the second formula, it is possible to conclude the following:

- Whenever the real GDP changes by 1%, unemployment change falls by 0.04%.
- Whenever inflation changes by 1%, unemployment falls by 1.01%.

- Whenever FDI changes by 1%, unemployment falls by 0.16%.
- Whenever labor force changes by 1%, unemployment increases by 7.56%.

Based on the results, it is possible to say that the biggest contributor to changes in the unemployment rate was the labor force variable. Finally, after performing all calculations and estimations, it is possible to continue to the interpretation of the results and provide additional recommendations for further estimations and studies in the same domain.

## 5 Results and Discussion

### 5.1 Empirical Evidence for Okun's Law

To begin the results and discussion chapter, it is essential to start by reminding that the central leitmotif of the bachelor thesis was the identification if one of the biggest discoveries of econometrics from the 20<sup>th</sup> century – the Okun's law, can be applied to the case of Kazakhstan, and by checking the compatibility of the concept, it could be possible to provide essential feedback on the current applicability of the law in the 21<sup>st</sup> century after many structural changes, and also to the case of a transition economy. The author believes that the performed analysis in fact allows him to provide a series of answers to the main dilemma of the thesis.

Undeniably, it is essential to start with specifying imperfections of the model that has been created. Thus, the biggest problem of the model lies in the absence of normality, which does not fully allow the author to actively refer to the results of t-tests and F tests which both require the assumption of normality. On the other hand, it is still possible to interpret the estimated parameters, where the most valuable regressor is the change in the real GDP. The change in the real GDP is surely significant with the contribution of a negative 8.85 percentage points to the change in the unemployment rate arising from one percentage point change in the real GDP growth. Alternatively, when bearing in mind that according to the Okun's law, for a country to decrease its unemployment rate by 1%, it is needed to achieve a growth in the real GDP that would equal 4%, it is possible to say that it is not the case for Kazakhstan based on the time series analyzed (from 1997 to 2022). Thus, with the usage of simple mathematics and thanks to the estimated parameter, it is possible to conclude that for the case of Kazakhstan, for policymakers to achieve a one per cent drop in the unemployment rate, it is needed to reach a 11.76 per cent increase in the real GDP, which is almost 2.5 times higher than what has been stated in the Okun's law. Therefore, the answer to the main hypothesis about the applicability of the Okun's law to Kazakhstan is that the nature of the relationship remains the same, but the magnitude is absolutely different, where almost as twice effort as in the original suggestion is needed from policymakers to ensure that the unemployment rate will drop. Similar findings about the inaccuracy of the Okun's law are made by Owyang & Vermann (2013), Jardin & Gaétan (2011) and Kaufman (1998).

However, just identifying that the Okun's law is not fully accurate is not enough since one should also seek for reasons explaining the observed phenomenon. The author believes that there are in essence two explanations for this, which are pretty straightforward and quite logical. The first explanation behind the observed situation is that the Okun's law is outdated, and this is especially stated by many modern econometricians, such as Zanin & Marra (2012) and Louail & Riache (2019). In essence, they justify their suggestion in a pretty logical way, which is also shared by the author of this bachelor thesis. Undeniably, economies, despite still working based on some fundamental principles, change and so do ordinary processes in economics change under the force of structural changes – people became significantly wealthier than in the past, government employment programs and methodologies for computing unemployment, as well as labor codes change around the globe thus distorting something that has been working in the past. In the eyes of the author, this criticism is pretty logical since the law was first discovered in 1962 – nearly 61 years ago. During those 61 years, the whole economic paradigm changed and changed not only because of changes in economic processes, but also because of high rates of globalization and liberalization of trade that increased the number of opportunities that people have in economies. Therefore, the first explanation behind inaccurate magnitude for Kazakhstan is the fact that the law is outdated mainly because of the structural change from the year 1962.

The other reason is nonetheless significant as the first one and to the author, this seems to be the main driver setting apart two results of the estimation – the one performed by Okun and the one performed by the author for Kazakhstan. Undeniably, deriving an economic theory and applying it universally to every state might not at all be so easy. Whereas one theories can, in fact, be applied to different economies and countries, such as theories of economic growth and notably the Solow's one, other theories did not really put any large emphasis on disparities between economies. Of course, in countries where economic processes are working smoothly due to the level of development and maturity of an economic system, the effect that economic policies and generally changes in macroeconomic variables have can be systematized, while the same cannot anyhow be said about countries that are on their stage of the catching-up growth with not fully mature institutions, a higher number of market failures and imperfections and longer lag from economic policies. Therefore, the author's main suggestion about why there is a difference in the estimated parameter between the Okun's law and the case of Kazakhstan

lies in the inapplicability of the law for countries in transition. Countries in transition, as it has briefly been specified, are slightly different from the developing ones because of their relatively good stock of human capital, so it is believed that the general theory underlying the Okun's law is not applicable since those countries experience a hybrid type of growth, where they possess traits of developed countries (good human capital and infrastructure) and developing (poor institutions and corruption) at once. The author of the bachelor thesis is not the only one thinking in the same way – Izyumov & Vahaly (2002) also finds the law inapplicable for the case of countries in transition.

## **5.2 Recommendations**

For the series of recommendations, the author would like to address two particular matters – the first one is the econometric estimation and the second one is potential adaptation of the Okun's law for modern-day economies. When addressing the first matter, notably the one about the econometric estimation performed by the author, it is possible to suggest that the estimation process might indeed be full of imperfections, where the two biggest ones are majority of insignificant regressors and absence of normality. The author believes that the first problem can easily be eliminated by expanding the framework and adding additional variables, such as the amount of disposable income or minimum wage, as well as the primary enrollment rate. When it comes to the second issue about the absence of normality, the most logical solution would be increasing the size of the dataset, which can be done with the help of panel data. Apart from potentially eliminating the problem with the absence of normality, presumably arising from the presence of outliers, such a study could provide another overview of the question and answer the question about the applicability of the Okun's law from another perspective.

When it comes to another recommendation, notably the one about the potential adaptation of the Okun's law for modern-day economies, it is essential to say that it would be wise not to just develop a universal rule of thumb for all economies at once, which might seem too ambitious resulting in potential imperfections and inaccurate magnitudes for specific groups of countries, but to develop an individual framework for a specific group of countries, such as developing, developed and least developed. Alternatively, it could be possible to do so for different income categories, such as for

low-income countries, lower-middle income countries, etc. By doing so, the framework of the Okun's law can become more accurate and more sophisticated prompting to a fewer number of logical questions being posed about the applicability of the law.

## 6 Conclusion

The goal of the bachelor thesis was to test the applicability of the Okun's law for the case of Kazakhstan, where the main objective of the thesis was formulated with the help of 5 individual research questions. The author used the technique of the econometric estimation to reach the goal and answer all individual research questions. The answers for research questions from the goals and objectives chapter are provided in individual chapters below.

The first question was dedicated to the study of assumptions behind the Okun's law. The Okun's law is a law coined by Arthur Okun, where he expressed that for every 1 per cent drop in employment there is an associated degrowth of the real GDP approximately equal to 2%. Alternatively, the law can be reversed claiming that for the country to achieve a 1 per cent drop in the unemployment rate, it would be essential to achieve a growth in the real output with the magnitude of approximately 4 per cent. The law is not based on any theoretical background, which arises a lot of controversy and attract criticism to the empirical finding. Okun described the law solely based on the empirical research conducted by him in the 60s.

The second question, where the main question was about the recent economic development of Kazakhstan, is without any hint of a doubt can be answered by the author with the help of the analysis of time series data. According to the author, it is possible to suggest that Kazakhstan was going through a very favorable period of economic expansion, where the country was able to increase its output by significant figures and Kazakhstan experienced an economic recession only twice during the analyzed time period between 1997 and 2022 – in 1998, following the first wave of liberalization and the “shock therapy” and in 2020, following the pandemic of coronavirus. The most troubled aspect of Kazakh economy seems to be inflation rate – inflation targeting does not seem to be very effective as the average inflation rate for the period was on the level of approximately 8 per cent.

The third question was dedicated to the criticism associated with the Okun's law. The biggest piece of criticism for the empirical relationship identified by Okun is absence of any theoretical background or solid foundation for the assumption, as well as potential inapplicability of the concept as a result of the structural change in the 70s and 80s. Yet, the nature of the relationship is off criticism, while the actual magnitude tends to differ from one country to another.

For the fourth question about the actual applicability of the Okun's law for the case of Kazakhstan, it is definitely possible to conclude that the law partially holds, but just the nature and direction of the relationship between two variables. In fact, for Kazakhstan to reach a 1 per cent drop in the unemployment rate compared to the previous year, it would be essential to achieve an economic growth with the magnitude of approximately 11.76 per cent, which is almost 2.5 times bigger than the figure suggested by Okun.

When it comes to the reasons for the potential deviation from the Okun's law, the author believes that there are two main explanations. It is either the law that is not fully accurate anymore as a result of the structural change in the 70s and 80s, or the law is not at all universally applicable, especially to the case of rather complex types of economies, such as countries in transition. In the end, it is recommended to expand the framework by focusing on each specific group of states individually thus potentially having better results in terms of the accuracy and precision.

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