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"Okun's Law: The effect of Economic Growth on Unemployment in EU-Candidate Countries and Ukraine"

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Abstract

Okun's Law is an inverse relationship between unemployment rate and economic growth. The idea of this thesis is to provide an econometric analysis of Okun's Law for five EU-Candidate countries and Ukraine (potential candidate country). The study is based on new annual data set from 1999 to 2018. For the analysis we use the first difference method and gap method originally stated by Okun (1962). We apply Hodrick-Prescott filter to extract cyclical unemployment and cyclical output needed for the analysis using gap method. We also attempt to examine whether including additional lags to the models can stabilize the coefficients of the static models. The obtained results could explain the institutional differences in selected countries that determine the rigidity or flexibility of labor market.

Zusammenfassung

Das Okunsche Gesetz ist ein negatives Verhältnis zwischen Arbeitslosigkeit und Wirtschaftswachstum. Diese Arbeit beschäftigt sich mit der ökonometrischen Analyse des Okunsches Gesetzes für fünf EU-Kandidatenländer und die Ukraine. Die Studie basiert auf einem neuen jährlichen Datensatz von 1999 bis 2018. Für die Analyse wird die von Okun (1962) ursprünglich vorgeschlagene Differenz-Methode und Gap-Methode verwendet. Mit Hilfe des Hodrick-Prescott-Filter wird die zyklische Komponente von der Arbeitslosigkeit und dem Output extrahiert, die für die Analyse mithilfe der Gap-Methode benötigt wird. Untersucht wird auch, ob das Einbeziehen zusätzlicher Verzögerungen in die Modelle, die Koeffizienten der statischen Modelle stabilisieren kann. Die erzielten Ergebnisse könnten die institutionellen Unterschiede in ausgewählten Ländern erklären, die die Starrheit oder Flexibilität des Arbeitsmarktes bestimmen.

Contents

Abbreviations

AIC	Akaike Information Criterion
AICC	corrected Akaike Information Criterion
CIS	Commonwealth of Independent States
DOLS	Dynamic OLS
EU	European Union
GDP	Gross Domestic Product
G7	Group of Seven (Canada, France, Germany, Italy, Japan, United Kingdom, United States)
HP	Hodrick-Prescott filter
IV	Instrumental Variable
ILO	International Labor Organization
OLS	Ordinary Least Squire
OC	Okun's Coefficient
OECD	Organization for Economic Cooperation and Development
PCA	Partnership and Cooperation Agreement
SOLS	Static OLS
SUR	Seemingly Unrelated Regressions
US	United States
WDI	World Development Indicators
i.e.	that is
e.g.	for example
et al.	and others

1 Introduction

This thesis aims to provide an econometric analysis of Okun's Law when applied to the following EU-Candidate countries: Albania, North Macedonia, Montenegro, Serbia, Turkey, and Ukraine, which is one of the potential candidate countries.

In its simplest form, Okun's law examines the statistical relationship between unemployment rate and the economic growth. This relationship has an important meaning for policymakers and economists in determining the optimal growth rate and assessing the labor market conditions.

Okun's Law can be estimated using different methods. Okun (1962) used three alternative model specifications, two of which can be shown to be mathematically equivalent (*Moosa, 1997*). A first method is so called "difference version", that describes the contemporaneous relationship between changes in unemployment rate and output growth rate in a country. In this approach, economic growth is considered to be an exogenous variable. Okun's Coefficient may be interpreted as follows: on average, a 1 percentage-point increase in the output growth rate is associated with a decrease in the unemployment rate by 0.3% points compared to the previous period. A second method is so called "gap version", which considers the relationship between unemployment gap and output gap. The unemployment gap is the difference between the actual unemployment rate and the natural unemployment rate, and output gap is the difference between actual output and potential output. If the gap method is used, then the important and controversial question, how to measure the natural unemployment rate and the potential output, arises. In empirical studies several alternative procedures have been considered, which produce different estimates of the trend and cycles. One of the easiest ways used by researchers is smoothing the output and unemployment applying time-series filters, inter alia, Hodrick-Prescott filter, Kalman filter, Beveridge-Nelson filter (*Silvapulle et al., 2004*). A third version is the "fitted trend and elasticity method". This method obtains the unemployment-output coefficient from the level data without including a trend to the model.

Many economists (researchers) suggest different variations of Okun's Law. Although they differ from the original equations, these relationships are also called Okun's Law. One of the modified versions of it can be found in many studies as the dynamic version of Okun's Law, where the past changes in the unemployment rate and the output growth rate are included as regressors. However, this relationship does not capture the contemporaneous relationship between unemployment rate and output growth, as Okun suggested (*Knotek, 2007*).

As in any law in economics, science or any discipline, it is important to determine whether the law holds in different conditions and over time. For Okun's law, it seems that there are conditions in which it holds well, and others where it does not. Many studies have explored several problems with Okun's Law. First, Okun's Coefficient (OC) has not always been stable as suggested and varies across countries and time. Second, the output growth rate is affected by other labour market variables, such as participation rate, changes in working hours, productivity, technological factors, transaction costs, acquired skills, moral factors etc. (*Ibragimov et al., 2017*).

Many studies agree on the inverse relationship between changes in the unemployment rate and economic growth and indicate presence of a relatively stable statistical relationship between them. In this study, in case of North Macedonia and Serbia the negative relationship is not observed whereas Albania, Montenegro, Turkey and Ukraine show this relationship clearly.

Most of the studies of Okun's law in the literature and those by regulatory agencies like IMF are based on estimates obtained using Ordinary Least Squares (OLS). The obtained results are often used for the analysis of labour market developments over time, cross-country comparisons of labour markets as well as for unemployment or economic growth forecasting (*Ibragimov et al., 2017*).

In this thesis, we are willing to test the original Okun's statement using first difference method and compare the size of Okun's coefficient with those from gap method and modified dynamic versions of these two methods. Furthermore, we are willing to examine whether the economic development of these countries have the same pattern as EU-countries or not and how it differs across countries. The inclusion of additional lags may be reasonable on several grounds. For example, if firms invest in the training of their staff they will be reluctant to lay the trained

workers off during impermanent shortfalls of demand. They also may be hesitant about recruitment of new personal and its training them if it is felt that the increase in demand is for a short time. Job security regulations also make it more difficult to lay off or to employ the workers (*Kaufman, 1988*).

The remainder of this thesis is constructed in the following way: In Section 2, the Literature is reviewed, Section 3 formulates the methodology and lays out the econometric model used. Section 4 gives a precise data description, Section 5 demonstrates the empirical results for the selected countries and possible economic explanations for them. Section 6 concludes the thesis.

2 Literature Review

Applying different methods, Okun (1962) empirically determined the negative correlation between changes in unemployment rate and the output growth. To determine this relationship Okun used the first difference method, the trial gaps method and the fitted trend and elasticity method. The first difference method is built on changes in unemployment and output. The gaps method used levels assuming the trend of output growth at constant rates. The fitted trend and elasticity method showed the possibility to derive the coefficient without assuming a trend even if the variables are trending. Using quarterly dataset from 1947 to 1960 Okun reached the conclusion that a 3%-point increase in output leads to 1%-point decrease in the unemployment rate. In other words, to perform a 1%-point reduction in the unemployment rate, real GDP must be approximately 3% points higher than its potential GDP.

After the relationship between unemployment and output was first proposed by Okun (1962), many studies were performed to test this relationship for US economy, and also for economies of other developed countries. In particular, this relationship was examined by Kaufman (1988), Prachowny (1993), Weber (1995), Moosa (1997), Lee (2000), Knotek (2007) among many others.

Kaufman (1988) estimated Okun's Law for several industrialized countries and detected significant differences in the cyclical responses of unemployment rates

among these countries. Kaufman explained the increased value of Okun's coefficient following the two oil shocks in the 1970s by arguing it with willingness of the firms to sustain the costs of layoffs and termination because they believed that post oil shock recessions would be more serious than previous downturns. Another reasonable explanation is labor market reforms, which have intensified in recent years.

Prachowny (1993) considered Okun's law from a theoretical point of view and tested it for the US economy using two different quarterly data sets: from 1947:1-1986:2 and from 1965:1-1988:4. He applied a specific production function approach with factors such as capital input, capital utilization rate, number of workers and the number of hours worked. He found much smaller coefficient than Okun.

Weber (1995) applied four different methods to estimate Okun's Coefficient: static OLS, dynamic OLS with two and four lags, VAR model with two and four lags and Cointegrating regression method. He used the cyclical unemployment and log of cyclical output to estimate Okun's coefficient for the US economy using quarterly data from 1948:1-1988:4. He found that the coefficients vary between -0.22 and -0.34 and that, while the static estimates support Okun's coefficient at a value close to the original law, the other dynamic methods all suggest smaller coefficients. He also pointed out that Okun's coefficients are sensitive to the methods used to extract cyclical output and unemployment and they also may depend on different estimation methods.

Moosa (1997) tested Okun's Law for the United States, Canada, France, Germany, Great Britain, Italy and Japan. He used annual data from 1960 to 1995 and Harvey's structural time series model to extract cyclical components of output and unemployment. The estimation methods used in this study were OLS, rolling OLS and Seemingly Unrelated Regressions (SUR) technique to capture cross-country correlations. The empirical results showed that employment is more responsive to economic growth in North America and less responsive in Europe and Japan.

Lee (2000) estimated Okun relationship for 16 OECD countries using annual data from 1955 to 1996. Lee compared results from first-difference and gap approaches. For the gap version three different methods to extract cyclical output and unemployment are used, namely the Hodrick-Prescott filter, the Kalman filter and the Beveridge-Nelson method. Lee pointed out that the relationship is not stable

over time and differs across countries, but he confirmed the validity of Okun's relationship. According to Lee (2000) Okun's coefficient estimates are qualitatively similar across models and quantitatively different across countries.

Sögner (2001) examined whether Okun's relationship in Austria exhibits structural changes applying Markov-Chain Monte Carlo methods and using quarterly data from 1976 to 1995. Sögner noted that there are neither structural breaks nor outliers and that the GDP-unemployment relationship is stable. Compared to the outcomes for the G7 countries in Moosa (1997) he found that Okun's coefficient (-0.28) for the Austrian economy is relatively small, i.e. changes in output growth have smaller effects on unemployment for the Austrian economy. Thus, he demonstrates the low flexibility of the Austrian labor market.

Crespo-Cuaresma (2003) suggested that the relationship between output and unemployment gaps may take a nonlinear form and he provided a regime-dependent specification of Okun's Law for the US economy, so that the effect of output growth on unemployment is allowed to vary depending on whether the cyclical output is higher (expansion) or lower (recession) than the threshold parameter. This specification is a basic generalization of the linear estimation method proposed by Moosa (1997). He applied the Hodrick-Prescott filter and a bivariate structural time series model to extract cyclical components from output and unemployment rate. The study indicates the existence of an asymmetric Okun's relationship, so that cyclical unemployment is more responsive to contemporaneous economic growth in recession than in expansion. In the light of the findings Cuaresma argued that the use of a purely linear model to estimate the degree of responsiveness of unemployment to output could lead to misleading results.

Knotek (2007) tried to answer the following two questions: First, Is Okun's Law a reliable, stable relationship and second, is the Law a useful forecasting tool applying different estimation methods, namely the "difference version" originally used by Okun, dynamic version, the "gap version", and production function approach. This study based on US data from 1948 to 2007. Based on rolling OLS estimation results, he claims that Okun's Law is not a tight and stable relationship, because its coefficients have varied considerably over time and there are many exceptions where output slowdowns have not coincided with rising unemployment.

Ball et al. (2013) examined the relationship between unemployment and economic growth for US economy and 20 other developed countries applying the first-difference and gap methods. They also run regressions with additional lags in order to check whether this adjustment improves the fit of Okun's coefficient and conclude that dynamic versions of the relationship provide higher coefficients. They claim that Okun underestimated the effects of output on unemployment because of the contemporaneous assumption and interpret absence of lags in Okun's equation as a modest misspecification. Although they found evidence of instability over time for 7 of the 20 countries, based on entire study, they concluded that Okun's relationship is strong and stable (contrary to Knotek (2007)) by the macroeconomic standards and that Okun's Law earns its name.

Ibragimov et al. (2017) suggest that the traditional estimation methods using OLS regressions do not account for possible endogeneity of the regressors leading to the inconsistency of the estimates and they provide Okun's relationship for several CIS countries using instrumental variable (IV) regression methods. They pointed out very low Okun's coefficients $(0.0057 - 0.075)$, i.e. to reduce unemployment rate by 1% point, GDP must grow at least 13% points faster, and they explained the large differences from the coefficients of developed countries by inflexibility, persistence and stickiness of the labour market.

3 Methodology

This thesis examines the effect of economic growth on unemployment in EU-Candidate countries and Ukraine. For this analysis, we use the first difference method and gap method reported by Okun (1962) and confirmed by many other studies and textbooks (Kaufman (1988), Blanchard (1989), Knotek (2007)). For the gap version of Okun's Law there is no unique approach to determine the natural unemployment rate and potential economic growth. There are different approaches to decompose variables into trend and cyclical components. One of the easiest ways used by researchers is smoothing the output and unemployment applying time-series filters, inter alia, Hodrick-Prescott filter, Kalman filter, Beveridge-Nelson filter.

3.1 First Difference Method

The first difference method illustrates how changes in unemployment rate from one period to the next moved with output growth rate. It takes the form:

$$\Delta u_t = \alpha + \beta y_t + \varepsilon_t \qquad (1)$$

where $\Delta u_t = u_t - u_{t-1}$ is a change in unemployment rate from one period to the next and $y_t = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$ is a real output growth rate, α is a constant term and β is called Okun's coefficient. This equation captures the contemporaneous relationship between output growth and movement in unemployment. Usually, Okun's coefficient is negative; an increase in output is associated with a falling unemployment rate and decrease in output is associated with a rising unemployment rate.

Furthermore, in order to stabilize the original static version of Okun's equation the additional lags of the change in unemployment rate can be included in the equation. The inclusion of lags is also sufficient to remove serial correlation from the residuals, which often arises in static version. After adding the lags, the model takes the following form:

$$\Delta u_t = \alpha + \beta y_t + \sum_{j=1}^{k} \gamma_j \Delta u_{t-j} + \varepsilon_t \qquad (2)$$

where Δu_{t-j} are lags of the change in the unemployment rate. The lags account for the dynamics in the Okun's relationship. A dynamic version of Okun's equation can be found in many empirical studies (e.g. Knotek 2007). For annual data a two-period lag is rather common (Ball et al., 2013).

3.2 Gap Method

To estimate Okun's coefficient using the gap method we follow the generalised model specification proposed by Weber (1995) and Moosa (1997). This model takes the following form:

$$u_t^c = \alpha + \beta y_t^c + \varepsilon_t \qquad (3)$$

where $u_t^c = u_t - u^*$ is cyclical unemployment (the gap between actual and natural unemployment rate), $y_t^c = y_t - y^*$ log of cyclical output (the gap between actual output and potential output) and ε_t is an error term. The model can be modified by including lags of the cyclical unemployment in order to check whether additional lags can change Okun's coefficient *(Moosa, 1997)*. The dynamic version has the following form:

$$u_t^c = \alpha + \beta y_t^c + \sum_{j=1}^{k} \gamma_j u_{t-j}^c + \varepsilon_t \qquad (4)$$

where u_{t-j}^c are lags of the cyclical unemployment rate.

We use the Hodrick-Prescott (1997) filter to extract cyclical components of the unemployment and output variables. The trend components can be considered as natural unemployment rate and potential output.

We determine the lag length of the dynamic model based on the corrected Akaike Information criterion (AICC) proposed by Hurvich and Tsai (1989), due to the limited sample size. The final number of lags for each country is chosen in order to minimize the value of the AICC.

In the next section we present the data set which we are going to use in our model estimation for selected countries.

4 Data

This study considers Okun's Law for five EU-Candidate countries: Albania, North Macedonia, Montenegro, Serbia and Turkey. We also consider Ukraine as one of the potential candidate countries. For this analysis we use raw annual unemployment rate and real GDP (in constant 2010 US$) data from World Bank database (WDI, https://databank.world bank.org/home.aspx). The data covers the time period from 1999 to 2018.

Unemployment rate is a share of total labour force without work but available for and seeking employment modelled by International Labour Office estimate (ILO, https://www.ilo.org/ilostat-files/Documents/description_UR_EN.pdf).

Real GDP data are in constant 2010 US dollars converted from domestic currencies of given countries using 2010 official exchange rates (https://databank.worldbank.org/home.aspx).

To be able to compute Okun's coefficient using the first difference method the GDP growth rate variable is required. We generate this variable using real GDP data. For the gap method we use cyclical unemployment and logarithm of cyclical output extracted from unemployment rate and logarithm of real GDP using Hodrick-Prescott filter.

For comparability we use the same sample size of 20 observations for all countries.

5 Empirical Results

5.1 Albania

Albania submitted the application for EU membership in April 2009 and was declared a candidate country in June 2014 (http://ec.europa.eu/environment/enlarg/candidates.htm). Albania has made imposing economic progress during the past three decades. Due to strong economic growth, Albania became a middle-income country from one of the poorest nations in Europe. The poverty declined by half during that period (https://www.worldbank.org/en/country/albania/overview).

In Albania the annual GDP growth rate averaged 4.8 percent from 1999 to 2018, reaching a high of 12.89 % in 1999 and a record low of 1.00 % in 2013. From 1999 to 2018, the unemployment rate was on average 15.83 %. The annual unemployment rate reached 18.6 % in 1999 and a record low of 13.1 % in 2008 (Appendix A).

To analyse the relationship between output growth and unemployment rate in Albania we followed Okun's original first difference estimation method and compared it with the gap method described in section 3. We also tried to examine

if additional lags can change the current level of unemployment applying corrected Akaike Information criteria (AICC), due to limited sample size. According to AICC, two lags of past unemployment can be included in the model.

Table 1: Albania: Results for Difference Method and Gap Method

	First-Difference Method		Gap Method	
	SOLS	DOLS	SOLS	DOLS
β	-0.298**	-0.432***	-0.475***	-0.450***
	(0.113)	(0.128)	(0.097)	(0.101)
γ_1		0.199		0.430**
		(0.195)		(0.177)
γ_2		-0.481**		-0.464**
		(0.199)		(0.150)
α	1.054*	1.466**	8.91e-09	0.134
	(0.546)	(0.544)	(0.179)	(0.147)
N	19	17	20	18
R^2	0.289	0.556	0.570	0.803

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Okun's original first difference estimation method (Table 1 and Table 9, Appendix C) illustrates, on average, a one percentage point increase in GDP in Albania is associated with a decrease in unemployment rate by 0.30% points compared to the previous period. This result is significant demonstrating validity of Okun's Law for the given period. The dynamic version incorporates two lags of the change in the unemployment rate. Additional lags increase Okun's coefficient up to -0.43% points. The gap method displays that a one percentage point increase in GDP leads to -0.47% points decrease in unemployment rate and the additional lags of cyclical unemployment decrease Okun's coefficient up to -0.45 (Table 1 and Table 10, Appendix C). It demonstrates that Okun's coefficient of first difference method and gap method differ from each other substantially.

As shown in graph Figure 1 and Figure 2 (Appendix B), the economic growth and unemployment rate in Albania demonstrate the negative relationship except 2009 and 2010 after the global financial crisis.

5.2 Montenegro

Montenegro applied for the EU membership in December 2008 and after two years in December 2010 became candidate country. The first negotiations took place in June 2012 (http://ec.europa.eu/environment/enlarg/candidates.htm).

Annual GDP Growth Rate in Montenegro averaged 2.45 percent from 1999 to 2018, reaching high of 8.6 % in 2006 and a record low of -9.4 % in 1999. The average unemployment rate from 1999 to 2018 was 22.8% and reached its highest in 2003 with 31.04 %. A record low of unemployment rate with 15.5 % was recorded in 2018 (See Appendix A).

The relationship between economic growth and unemployment rate in Montenegro is analysed using Okun's original first difference estimation method and gap method proposed in Section 3. For the gap method we used the Hodrick-Prescott filter to extract cyclical unemployment (natural unemployment rate) and cyclical output (potential output). Furthermore, we investigate if additional lags of the change of the unemployment rate in first difference method and cyclical unemployment in gap method can change the results from static models.

For both first difference and gap methods, the lag length was chosen using AICC. The AICC is preferred because of the limited sample size. As maintained by AICC two lags of the dependent variable can be included in the dynamic models in case of Montenegro.

The evidence on Okun's Law for Montenegro can be summarized as follows:

According to Okun's first difference estimation method, on average, a one percentage point increase in GDP in Montenegro is associated with a decrease in the unemployment rate by -0.44% points compared to the previous period (Table 2 and Table 9, Appendix C). The dynamic model with two lags decreases Okun's coefficient up to -0.36 and change of the unemployment rate in previous period has positive significant effect on present unemployment. The gap method shows that a one percentage point increase in GDP leads to -0.58% points decrease in unemployment rate and the additional lags decrease Okun's coefficient up to -0.36 and cyclical unemployment from previous period has positive significant effect on present unemployment (Table 2 and Table 10, Appendix C). Okun's coefficients in the static

Table 2: Montenegro: Results for Difference Method and Gap Method

	First-Difference Method		Gap Method	
	SOLS	DOLS	SOLS	DOLS
β	-0.436***	-0.363***	-0.577***	-0.359***
	(0.093)	(0.101)	(0.084)	(0.096)
γ_1		0.409*		0.629***
		(0.194)		(0.195)
γ_2		-0.172		-0.264
		(0.192)		(0.173)
α	0.559	0.515	-5.64e-09	-0.038
	(0.409)	(0.455)	(0.269)	(0.219)
N	19	17	20	18
R^2	0.566	0.684	0.725	0.864

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

first difference method (-0.44) and in the gap method (-0.58) differ substantially, whereas for dynamic versions they are almost identical. The findings demonstrate that for Montenegro Okun's Law is valid for the examined period, meaning that economic growth reduces unemployment.

As we can see in Figure 1 (Appendix B), the output growth and change of the unemployment rate indicate a clear negative relationship. Similarly, in Figure 2 (Appendix B) the cyclical output and cyclical unemployment indicate the inverse relationship, in other words if output increases the unemployment decreases and vice versa.

5.3 North Macedonia

Before we demonstrate our empirical results, we would like to give a short historical overview of North Macedonia which is economically relevant for our analysis.

North Macedonia became a candidate country in December 2005. The negotiations will start depending on the progress made in adjustment to the EU acquis. The further accession negotiations were obstructed due to the long-lasting name dispute with Greece (http://ec.europa.eu/environment/enlarg/candidates.htm). Finally, in June 2018, Macedonia and Greece resolved the conflict with an agreement that the

country should rename itself Republic of North Macedonia instead of Former Yugoslav Republic of Macedonia. This renaming came into effect in February 2019 (https://www.mfa.gr/en/the-question-of-the-name-of-the-republic-of-north/).

Republic of North Macedonia is one of the poorest countries in Europa with the highest unemployment rate. The economy of North Macedonia was ranked as a lower income economy by the World Bank but shifted to middle-income country in the last decade. Over the examined period from 1999 to 2018 the country had an average 2.9% growth rate. The highest growth rate of 6.5% was recorded in 2007 and the lowest -3.1% in 2001. The average unemployment rate in the country is at 31.0 %, and is one of the highest in Europe, despite it has dropped in recent years and reached 21.6 % in 2018 (Appendix A).

Table 3: North Macedonia: Results for Difference Method and Gap Method

	First-Difference Method		Gap Method	
	SOLS	DOLS	SOLS	DOLS
β	0.026	-0.171	-0.117	-0.088
	(0.162)	(0.218)	(0.135)	(0.149)
γ_1		0.514**		0.871***
		(0.265)		(0.225)
γ_2		-0.056		-0.420
		(0.277)		(0.274)
α	-0.640	-0.259	-2.11e-08	0.044
	(0.588)	(0.831)	(0.326)	(0.275)
N	19	17	20	18
R^2	0.001	0.244	0.040	0.533

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Okun's relationship for North Macedonia is explored using the first difference method and gap method explained in Section 3. For both methods we also use a dynamic version to check whether additional lags can stabilise the results from the static versions. The optimal lags can be chosen using the AICC, due to limited sample size. According to AICC results, two lags of past unemployment can be included in the dynamic model for first difference method and two lags of the cyclical unemployment in the gap method.

After we have executed Okun's first difference method and gap method, we find that unemployment and economic growth in North Macedonia do not indicate any significant relationship. The dynamic versions do not enhance the results (Table 3 and Appendix C). The findings demonstrate the invalidity of Okun's Law in case of North Macedonia for the examined period, meaning that economic growth does not lead to reduction of the unemployment rate. These results are in line with findings obtained by Sadiku et al. (2015). They show that Okun's Law is not supported for North Macedonia. As we can see in Figure 1 and Figure 2 (Appendix B), the movement of the change in unemployment rate and output growth does not indicate any stable negative or positive relationship.

The explanation for this result could be North Macedonia's poor-functioning market economy and its incomplete transition to a well-functioning and inclusive market economy. Therefore, the new reform agenda which was outlined in the Government Program 2017-2020 (http://www.worldbank.org/en/country/north macedonia/overview) could potentially change this unclear relationship in the future. Nevertheless, this hypothesis could be only tested after the reforms are effective with the new data.

5.4 Serbia

Serbia applied for the EU membership in December 2009 and received the candidate status in March 2012. The formal accession negotiations between EU Commission and Serbia started in January 2014. (http://ec.europa.eu/environment/enlarg/candidates.htm).

The annual economic growth in Serbia was on average 3.0 percent from 1999 to 2018, reaching a record low of -12.1 % in 1999 and high of 9.7 % in 2006. The mean of the unemployment rate from 1999 to 2018 was 17.2%. The annual unemployment rate reached 24.0% in 2012 and a record low of 12.6 % in 2000 (See Appendix A).

Okun's relationship for Serbia is examined using the first difference method and gap method as for the other countries. We also apply a dynamic version for both methods to check whether additional lags can change results from the static versions.

The corrected Akaike Information criteria (AICC) is used to choose the optimal lags. According to AICC, three lags of the unemployment can be included to the dynamic version of the first difference method and three lags of the cyclical unemployment to the gap method.

Table 4: Serbia: Results for Difference Method and Gap Method

	First-Difference Method		Gap Method	
	SOLS	DOLS	SOLS	DOLS
β	-0.026	-0.104	-0.221	-0.190*
	(0.167)	(0.160)	(0.176)	(0.091)
γ_1		0.639**		0.755***
		(0.276)		(0.246)
γ_2		-0.163		-0.283
		(0.332)		(0.317)
γ_3		-0.393		-0.424
		(0.283)		(0.246)
α	0.088	0.427	-1.04e-08	-0.301
	(0.852)	(0.728)	(0.555)	(0.292)
N	19	16	20	17
R^2	0.001	0.552	0.080	0.858

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

After both Okun's first difference method and gap method, the unemployment and economic growth in Serbia do not indicate any significant relationship (Table 4 and Table 9, Appendix C). After the inclusion of three additional lags in the first difference method, the coefficient remaines insignificant. The coefficient of the change in the unemployment rate from previous period is positive and shows a significant effect on the current unemployment. Furthermore, the inclusion of three lags of cyclical unemployment in the gap method does not change the insignificance of Okun's coefficient at 5% significance level (Table 4 and Table 10, Appendix C). The results demonstrate the invalidity of Okun's Law in case of Serbia for the examined period. The coefficient of cyclical unemployment rate from previous period is positive and highly significant.

As we can see in Figure 1 and Figure 2 (Appendix B), the movement of the change

in unemployment rate and output growth and movement of cyclical unemployment and cyclical output do not indicate any stable negative or positive relationship.

5.5 Turkey

Turkey received a candidate country status in December 1999 (http://ec.europa.eu/environment/enlarg/candidates.htm). Since Turkey took step for full EU-membership, the Turkish economy has experienced a dramatic transformation and radical reforms towards adaptation to free market, protection of competition, regulation of non-standard working forms. Adjustment to ILO norms and EU regulations has been implemented. The ILO norms and EU regulations had great influence on the Turkish labour market. Through the new Labour Law, Turkey attempts to adjust its labor market policies to those of European Union (Yorgun, 2004).

Annual GDP Growth Rate in Turkey averaged 4.7 percent from 1999 to 2018, reaching a high of 11.1% in 2011 and a record low of -5.96% in 2001. The unemployment rate for the same period was on average 9.7%. The annual unemployment rate reached 12.6% in 2009 and a record low of 6.5% in 2000 (See Appendix A). The data shows that the unemployment rate level increased in 2002 and stayed high after on. The labor force participation rate amounted to 52.2 percent in 2018. The rate for the male population was 71.8% and the female rate was 33.4%. The large difference between male and female participation rate is noteworthy, with the female participation rate being much lower (http://www.turkstat.gov.tr/HbPrint.do? id=27694).

To analyse the relationship between output growth and unemployment rate in Turkey, we follow Okun's first difference method and gap method as we have done it for the other countries.

The lag length can be chosen using corrected Akaike Information criterion (AICC) among lags between one and six. The AICC is used due to limited sample size. As shown by AICC, two lags of past unemployment can be included in the dynamic version.

Table 5: Turkey: Results for Difference Method and Gap Method

	First-Difference Method		Gap Method	
	SOLS	DOLS	SOLS	DOLS
β	-0.202***	-0.195***	-0.185***	-0.114**
	(0.053)	(0.072)	(0.054)	(0.054)
γ_1		0.182		0.511**
		(0.192)		(0.178)
γ_2		-0.193		-0.385*
		(0.194)		(0.188)
α	1.197***	1.239**	-4.68e-09	0.059
	(0.353)	(0.475)	(0.207)	(0.187)
N	19	17	20	18
R^2	0.463	0.489	0.398	0.597

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The evidence on Okun's Law in Turkey can be summarized as follows:

According to Okun's original first difference estimation method, on average, a one percentage point increase in GDP in Turkey is associated with a decrease in unemployment rate by 0.20% points compared to the previous period (Table 5 and Table 9, Appendix C). Adding additional lags to the model decreases Okun's coefficient slightly (-0.195) and the lags of unemployment rate remain insignificant. The gap method showed that a one percentage point increase in cyclical output leads to a -0.185% point decrease in cyclical unemployment and dynamic version with two lags of cyclical unemployment indicate lower Okun's coefficient (-0.11), and cyclical unemployment from previous period exhibits a positive significant effect (Table 5 and Table 10, Appendix C). The findings demonstrate that Okun's Law for Turkey is valid for examined period meaning that economic growth reduces unemployment. Okun's coefficients of the first difference methods are higher than coefficients of the gap methods.

Many other studies (Arabaci et al. (2010), Arabaci et al. (2018), Tiryaki et al. (2011), Yildiz et al. (2017)) show that the results may change when different periods are analysed (not stable over time) and the coefficients depend on the model specification used. Whereas the economy exhibits strong and quick recovery after

recessions the unemployment rate does not show the same recovery in reduction of unemployment and remains relatively high (Tiryaki, 2011).

Arabaci et al. (2010) studied the correlation between changes in the unemployment rate and output in Turkey using quarterly data for the period from 1999 to 2009. They used first difference method and gap method to examine this relationship. Their results showed a significant asymmetry in the relationship between changes in unemployment and output growth, especially in phases of economic downturn. Okun's coefficient in the first difference version is -1.62, in downturn, and -1.18, in upturn. In the gap version the coefficient is -1.16 in upswings and -1.31 in downswings.

Arabaci et al. (2018) applied the gap method and flexible nonlinear inference methodology using quarterly dataset from 2001 to 2012 and found significant negative relationship between cyclical unemployment and economic growth. The coefficients found for the linear gap method and for the flexible nonlinear inference method were -0.26 and -0.28, respectively.

Tiryaki and Özkan (2011) tried to find out what causes high unemployment and what is the relationship between economic growth and unemployment in Turkey applying the gap method for quarterly data from $1998:1$ to $2010:4$. They found a negative relationship between unemployment rate and economic growth, and they found asymmetry in this relationship.

Yildiz et al. (2017) applied the regression model that explains the effect of deviation from growth trend (4.12%) in the unemployment rate to test the validity of Okun's Law for Turkish economy using data between 2005 and 2015. They find a significant negative relationship (-0.075) between unemployment rate and output growth and demonstrated that every 1% growth exceeding 4.12% decreased the unemployment by 0.07% points, supporting the validity of Okun's Law.

5.6 Ukraine

We consider Ukraine as one of the potential candidate countries to European Union. The political dialogue to deepen the partnership between the EU and

Ukraine started in 1994 when the Partnership and Cooperation Agreement (PCA) was signed. The Association Agreement was ratified in 2014 and replaced the PCA signed in 1994 that ensures Ukraine's partial integration in the EU without providing any membership perspective. (*Van der Loo et al., 2014*).

The annual GDP growth rate in Ukraine averaged 2.4 percent from 1999 until 2018, reaching a high of 12.1% in 2004 and a record low of -14.8% in 2009. The unemployment rate for the same period was on average 8.8%. The annual unemployment rate reached 11.9% in 1999 and a record low of 6.3% in 2007 (see Appendix A). According to International Labour Organization the country's labour force participation rate was about 54% in 2018.

To analyse the relationship between output growth and unemployment rate in Ukraine we follow the same Okun's original first difference estimation method and gap method as for the other countries proposed in Section 3. We also examine if additional lags affect the current level of unemployment.

By the corrected Akaike Information criteria (AICC) the optimal lag length was chosen. AICC recommends one lag of past unemployment to be included in the dynamic model for both first difference method and gap method.

Table 6: Ukraine: Results for Difference Method and Gap Method

	First-Difference Method		Gap Method	
	SOLS	DOLS	SOLS	DOLS
β	-0.102***	-0.124***	-0.115***	-0.126***
	(0.023)	(0.025)	(0.016)	(0.022)
γ_1		-0.329*		-0.121
		(0.179)		(0.158)
α	0.130	0.125	-2.73e-09	0.015
	(0.163)	(0.159)	(0.091)	(0.097)
N	19	18	20	19
R^2	0.529	0.620	0.730	0.741

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The evidence on Okun's Law for Ukraine can be summarized as follows:
According to Okun's first difference estimation method, on average, a one percentage point increase in GDP in Ukraine is associated with a decrease in unemployment

rate by 0.10% points compared to the previous period (Table 6 and Table 9, Appendix C). An additional lag increases Okun's coefficient up to -0.124. The gap method demonstrates that a one percentage point increase in GDP leads to -0.115% points decrease in unemployment rate and the lag of cyclical unemployment increase the coefficient up to -0.126 (Table 6 and Table 10, Appendix C). Okun's coefficients submitted from first difference method and gap method do not show noteworthy differences. The findings demonstrate that Okun's Law holds for Ukraine in the examined period and that economic growth leads to a reduction of the unemployment rate.

Other studies (*Ibragimov et al., 2017, Ball et al., 2016*) showed that Okun's coefficient is not stable over time and depends on the model specification. Okun's coefficient for Ukraine obtained by Ibragimov et al. (2017) using an instrumental variable approach was -0.05. and the coefficient found by Ball et al. (2016) was -0.04.

As we can see in Figure 1 (Appendix B), the change in unemployment rate and output growth indicate a negative relationship. Figure 2 (Appendix B) illustrates the inverse relationship between cyclical output and cyclical unemployment. If GDP exhibits a positive growth rate the unemployment decreases and vice versa.

6 Conclusion

This study analysed the relationship between unemployment rate and economic growth using the first difference method and gap method for five EU-Candidate countries and Ukraine.

After analysing Okun's relationship for the selected countries, we came to the conclusion that it holds for Turkey, Albania, Montenegro and Ukraine whereas we cannot confirm that it is valid for North Macedonia and Serbia. The results for North Macedonia and Serbia do not exhibit any correlation between unemployment and economic growth while other countries indicate obvious negative relationships. We determined noteworthy differences in Okun's coefficients among countries, time

periods and models used. Our results demonstrate the very well-studied phenomena of Okun's coefficients with the most recent data and highlight the existing differences. For example, the coefficient in Turkey is -0.20 in comparison to results found by Yildiz et al. (2017) and Ball et al. (2016) with -0.07 and -0.11, respectively. In Ukraine the coefficient is -0.10 whereas the coefficients found by Ibragimov et al. (2017) and by Ball et al. (2016) are -0.05 and -0.04, respectively. For Albania and Montenegro we observed relatively higher Okun's coefficients. The explanation could be the institutional differences in selected countries that determine the labor market flexibility.

7 Appendix

For analysis we used raw annual unemployment rate and real GDP (in constant 2010 US$) for six countries: Albania, Montenegro, North Macedonia, Serbia, Turkey and Ukraine. The GDP growth rate variable is generated using real GDP data.

Real GDP (constant 2010 US$)

Time range: 1999-2018

Source: World Bank national accounts data, and OECD National Accounts data files.

Unemployment Rate

Time range: 1999-2018

Source: International Labour Organization, ILOSTAT database.

7.1 Appendix A

Table 7: Annual GDP growth Rate and Unemployment Rate, 1999-2018

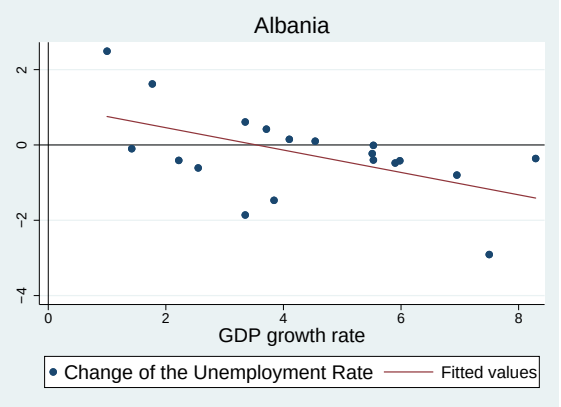
	1 1999	2 2000	3 2001	4 2002	5 2003	6 2004	7 2005	8 2006	9 2007	10 2008	11 2009	12 2010	13 2011	14 2012	15 2013	16 2014	17 2015	18 2016	19 2017	20 2018
GDP growth Rate																				
Albania	12.9	6.9	8.3	4.5	5.5	5.5	5.5	5.9	6.0	7.5	3.3	3.7	2.5	1.4	1.0	1.8	2.2	3.3	3.8	4.0
Montenegro	-9.4	3.1	1.1	1.9	2.5	4.4	4.2	8.6	6.8	7.2	-5.8	2.7	3.2	-2.7	3.5	1.8	3.4	2.9	4.7	4.9
North Macedonia	4.3	4.5	-3.1	1.5	2.2	4.7	4.7	5.1	6.5	5.5	-0.4	3.4	2.3	-0.5	2.9	3.6	3.9	2.8	0.2	2.7
Serbia	-12.1	7.8	5.0	7.1	4.4	9.1	5.5	9.7	6.4	5.7	-2.7	0.7	2.0	-0.7	2.9	-1.6	1.8	3.3	2.1	4.3
Turkey	-3.4	6.6	-6.0	6.4	5.6	9.6	9.0	7.1	5.0	0.8	-4.7	8.5	11.1	4.8	8.5	5.2	6.1	3.2	7.4	2.6
Ukraine	-0.2	5.9	9.2	5.2	9.5	12.1	3.0	7.4	7.6	2.3	-14.8	3.8	5.5	0.2	-0.03	-6.5	-9.8	2.4	2.5	3.3
Unemployment Rate																				
Albania	18.6	17.8	17.4	17.5	17.5	17.3	16.9	16.4	16.0	13.1	13.7	14.1	13.5	13.4	15.9	17.5	17.1	15.2	13.8	13.9
Montenegro	30.4	30.4	30.1	30.8	31.0	30.7	30.3	24.7	19.4	17.1	19.1	19.6	19.7	20.0	19.5	18.0	17.5	17.7	16.1	15.5
North Macedonia	32.4	32.2	30.5	31.9	36.7	37.2	37.3	36.0	34.9	33.8	32.2	32.0	31.4	31.0	29.0	28.0	26.1	23.7	22.4	21.6
Serbia	13.7	12.6	12.8	13.8	15.2	18.5	20.9	20.9	18.1	13.7	16.1	19.2	23.0	24.0	22.2	19.2	17.9	15.3	13.5	13.5
Turkey	7.7	6.5	8.4	20.4	10.5	10.8	10.6	8.7	8.9	9.7	12.6	10.7	8.8	8.1	8.7	9.9	10.2	10.8	10.8	10.9
Ukraine	11.9	11.7	11.1	10.1	9.1	8.6	7.2	6.8	6.3	6.4	8.8	8.1	7.9	7.5	7.2	9.3	9.1	9.4	9.5	9.4

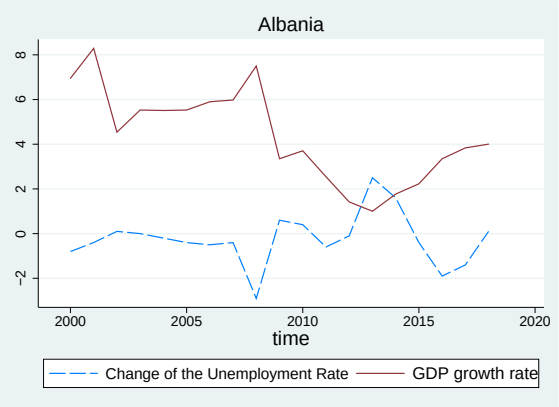
Source: World Bank Database. GDP growth rate is calculated from real GDP in constant 2010 US$

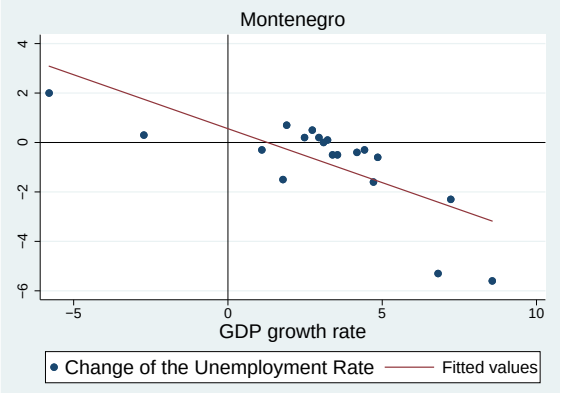
Table 8: Descriptive Statistics

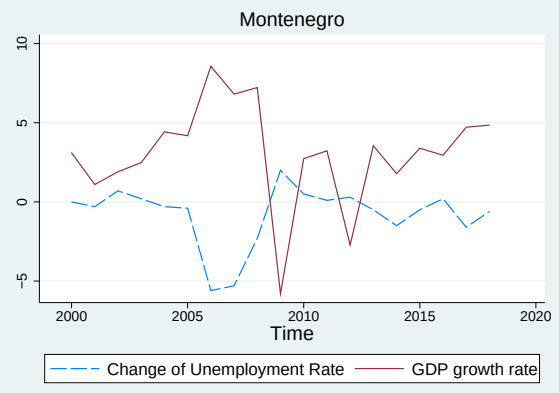
Country	Obs	Mean	St.Dev	Min	Max
GDP growth Rate					
Albania	20	4.79	2.79	1.00	12.89
Montenegro	20	2.45	4.22	-9.40	8.57
North Macedonia	20	2.85	2.35	-3.07	6.47
Serbia	20	3.03	4.93	-12.20	9.70
Turkey	20	4.68	4.73	-5.96	11.11
Ukraine	20	2.44	6.56	-14.76	12.11
Unemployment Rate					
Albania	20	15.83	1.81	13.01	18.57
Montenegro	20	22.88	6.04	15.50	31.00
North Macedonia	20	31.01	4.69	21.60	37.30
Serbia	20	17.20	3.67	12.60	24.00
Turkey	20	9.68	1.43	6.50	12.60
Ukraine	20	8.77	1.63	6.30	11.90

7.2 Appendix B









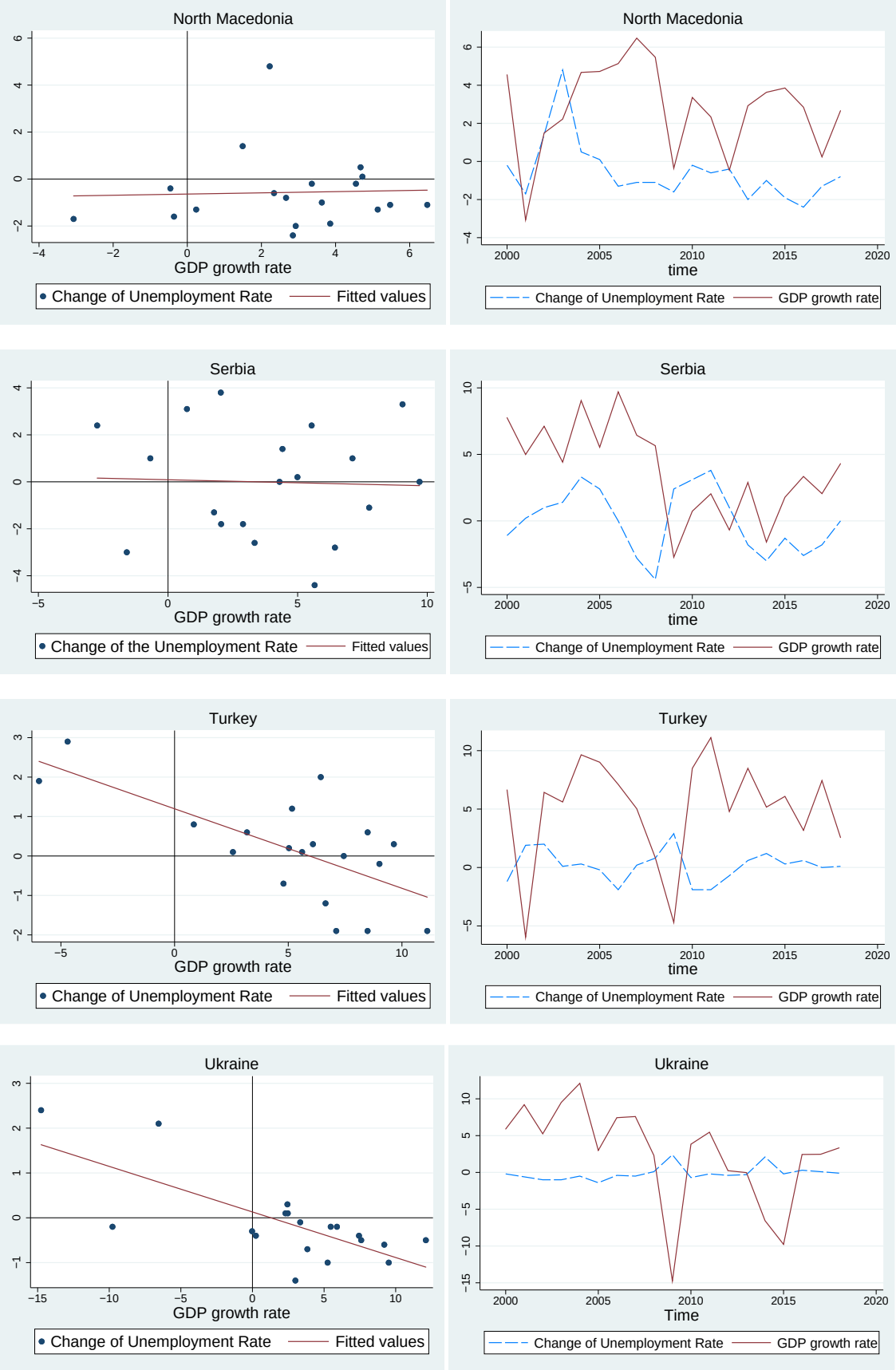
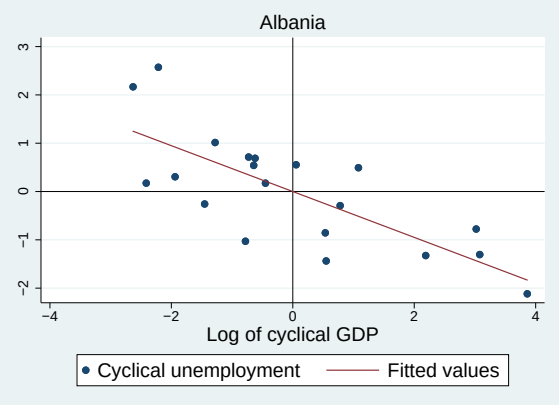
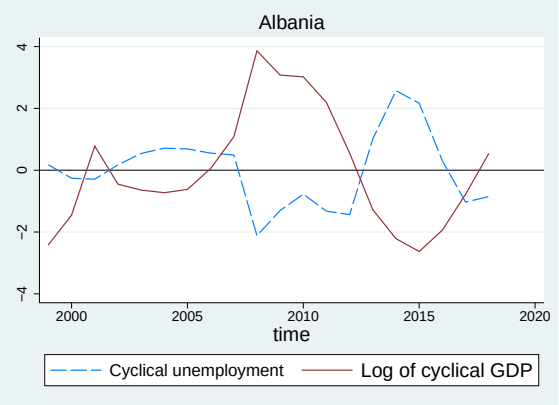
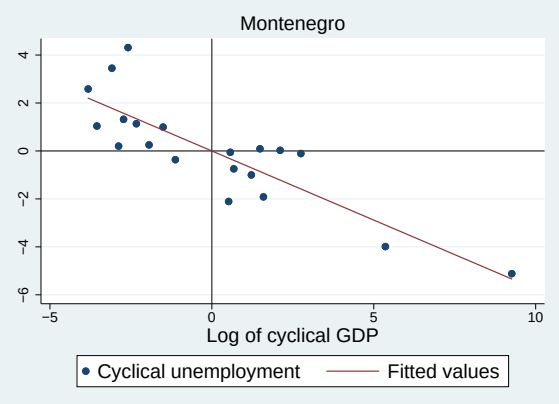
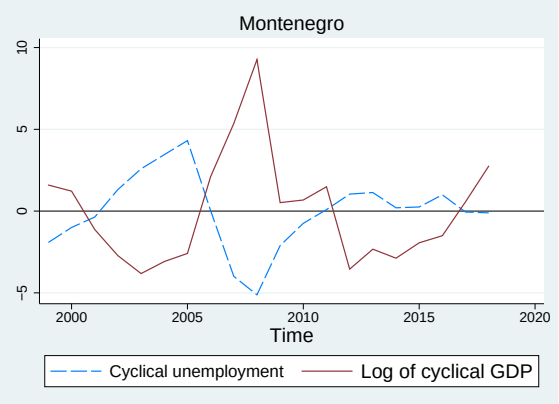


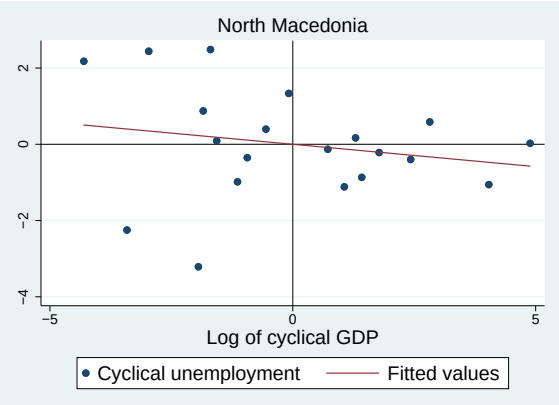
Figure 1: Change of the Unemployment rate and Economic growth

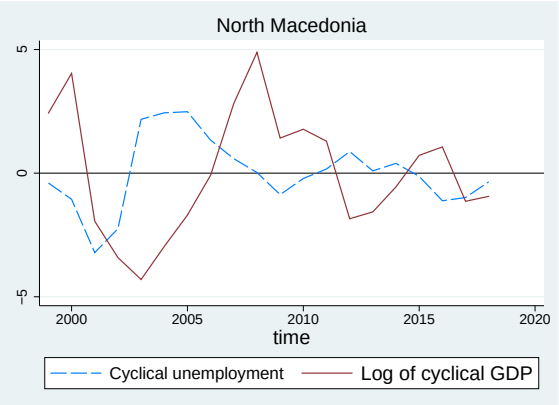

Albania
Log of cyclical GDP
Cyclical unemployment
Fitted values

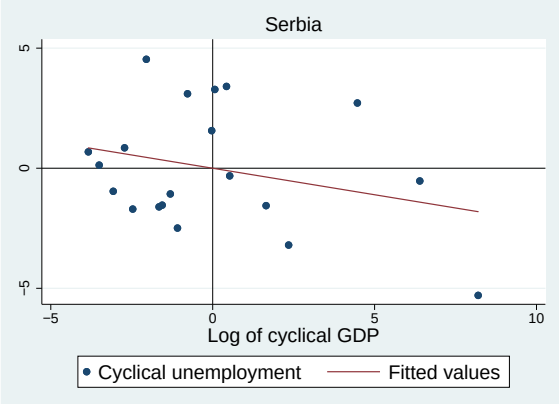

Albania
time
Cyclical unemployment
Log of cyclical GDP

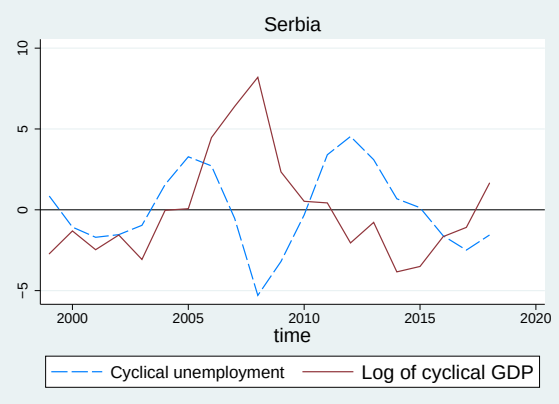

Montenegro
Log of cyclical GDP
Cyclical unemployment
Fitted values


Montenegro
Time
Cyclical unemployment
Log of cyclical GDP


North Macedonia
Log of cyclical GDP
Cyclical unemployment
Fitted values


North Macedonia
time
Cyclical unemployment
Log of cyclical GDP


Serbia
Log of cyclical GDP
Cyclical unemployment
Fitted values


Serbia
time
Cyclical unemployment
Log of cyclical GDP

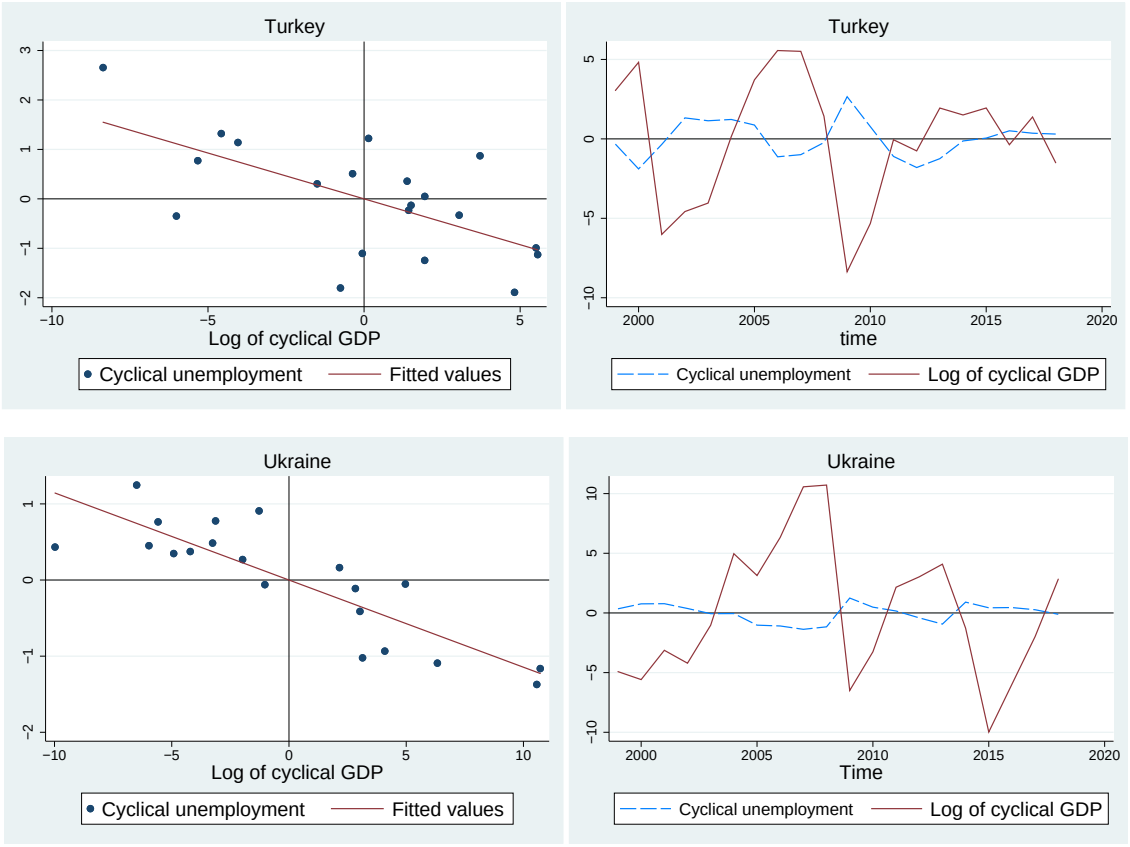


Figure 2: Cyclical Unemployment rate and Cyclical Output

7.3 Appendix C

Table 9: Estimates of Okun's Coefficient using First-Difference method

ΔU_t	Albania		Montenegro		North Macedonia		Serbia		Turkey		Ukraine	
	SOLS	DOLS	SOLS	DOLS	SOLS	DOLS	SOLS	DOLS	SOLS	DOLS	SOLS	DOLS
β	-0.298**	-0.432***	-0.436***	-0.363***	0.026	-0.171	-0.026	-0.104	-0.202***	-0.195**	-0.102***	-0.124***
	(0.113)	(0.128)	(0.093)	(0.101)	(0.162)	(0.218)	(0.167)	(0.160)	(0.053)	(0.072)	(0.023)	(0.025)
ΔU_{t-1}		0.199		0.409*		0.514*		0.639**		0.182		-0.329*
		(0.195)		(0.194)		(0.265)		(0.276)		(0.192)		(0.179)
ΔU_{t-2}		-0.481**		-0.172		-0.056		-0.163		-0.193		
		(0.199)		(0.192)		(0.277)		(0.332)		(0.194)		
ΔU_{t-3}								-0.393				
								(0.283)				
α	1.054*	1.466**	0.559	0.515	-0.640	-0.259	0.088	0.427	1.197***	1.239**	0.130	0.125
	(0.546)	(0.544)	(0.409)	(0.455)	(0.588)	(0.831)	(0.852)	(0.728)	(0.353)	(0.475)	(0.163)	(0.159)
N	19	17	19	17	19	17	19	16	19	17	19	18
R^2	0.289	0.556	0.566	0.684	0.001	0.244	0.001	0.552	0.463	0.489	0.529	0.620

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Estimates of Okun's Coefficient using Gap method

U_t^c	Albania		Montenegro		North Macedonia		Serbia		Turkey		Ukraine	
	SOLS	DOLS	SOLS	DOLS	SOLS	DOLS	SOLS	DOLS	SOLS	DOLS	SOLS	DOLS
β	-0.475***	-0.450***	-0.577***	-0.359***	-0.117	-0.088	-0.221	-0.190*	-0.185***	-0.114*	-0.115***	-0.126***
	(0.097)	(0.101)	(0.084)	(0.096)	(0.135)	(0.149)	(0.176)	(0.091)	(0.054)	(0.054)	(0.016)	(0.022)
U_{t-1}^c		0.430**		0.629***		0.871***		0.755***		0.511**		-0.121
		(0.177)		(0.195)		(0.225)		(0.246)		(0.178)		(0.158)
U_{t-2}^c		-0.464**		-0.264		-0.420		-0.283		-0.385*		
		(0.150)		(0.173)		(0.274)		(0.317)		(0.188)		
U_{t-3}^c								-0.424				
								(0.246)				
α	8.91e-09	0.134	-5.64e-09	-0.038	-2.11e-08	0.044	-1.04e-08	-0.301	-4.68e-09	0.059	-2.73e-09	0.015
	(0.179)	(0.147)	(0.269)	(0.219)	(0.326)	(0.275)	(0.555)	(0.292)	(0.207)	(0.187)	(0.091)	(0.097)
N	20	18	20	18	20	18	20	17	20	18	20	19
R^2	0.570	0.803	0.725	0.864	0.040	0.533	0.080	0.858	0.398	0.597	0.730	0.741

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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