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Testing The Validity of Okun's Law in Islamic Cooperation Organization Countries: Panel Data Analysis

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ABSTRACT

Okun's law was first studied in the United States sample and appeared in the literature with the study published by Okun in 1962 as an economic law stating that the relationship between unemployment and production loss variables is negative. Okun's law, supported by subsequent studies, is an important research topic in macroeconomic literature in terms of examining the relationship between unemployment and economic growth variables. Testing the validity of Okun's law is taken into consideration in evaluating the role of employment in the growth of national economies. This study analyses the validity of the Okun law on the Organization of Islamic Cooperation countries between 1991 and 2023. As a result of the study examining the relationship between economic growth and unemployment variables with panel data analysis, a general assessment was made that Okun's law is valid. This study contributes to the literature as a result of the study choosing the countries of the Organization of Islamic Cooperation as a sample and not finding any study in this framework.

ملخص

تم دراسة قانون أوكون لأول مرة في عينة من الولايات المتحدة، وظهر في الأدبيات من خلال الدراسة التي نشرها أوكون عام 1962، حيث تم عرضه كقانون اقتصادي يؤكد على أن العلاقة بين متغيري البطالة وخسائر الإنتاج هي علاقة سلبية. ويعد قانون أوكون، الذي دعمته دراسات لاحقة، من المواضيع البحثية الهامة في أدبيات الاقتصاد الكلي فيما يتعلق بدراسة العلاقة بين متغيري البطالة والنمو الاقتصادي. ويؤخذ اختبار صحة قانون أوكون بعين الاعتبار عند تقييم دور التوظيف في نمو الاقتصادات الوطنية. وتتناول هذه الدراسة تحليل مدى صحة قانون أوكون في بلدان منظمة

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التعاون الإسلامي خلال الفترة الممتدة بين عامي 1991 و2023. ونتيجة لدراسة العلاقة بين متغيري النمو الاقتصادي والبطالة باستخدام تحليل بيانات اللوحة، تم التوصل إلى تقييم عام يفيد بصحة قانون أوكون. وتسهم هذه الدراسة في إثراء الأدبيات من خلال اختيار بلدان منظمة التعاون الإسلامي كعينة للدراسة، مع عدم وجود دراسات سابقة تناولت هذا الإطار تحديدا.

RÉSUMÉ

La loi d'Okun a été étudiée pour la première fois dans l'échantillon des États-Unis et est apparue dans la littérature avec l'étude publiée par Okun en 1962 en tant que loi économique stipulant que la relation entre le chômage et les variables de perte de production est négative. La loi d'Okun, soutenue par des études ultérieures, est un sujet de recherche important dans la littérature macroéconomique en termes d'examen de la relation entre le chômage et les variables de la croissance économique. Le test de la validité de la loi d'Okun est pris en compte dans l'évaluation du rôle de l'emploi dans la croissance des économies nationales. Cette étude analyse la validité de la loi d'Okun sur les pays de l'Organisation de la coopération islamique entre 1991 et 2023. L'examen de la relation entre la croissance économique et les variables du chômage à l'aide d'une analyse de données de panel a permis de conclure à la validité de la loi d'Okun. Cette étude contribue à la littérature en choisissant les pays de l'Organisation de la coopération islamique comme échantillon et en ne trouvant aucune étude dans ce cadre.

Keywords: Okun's Law, Panel Data Analysis, Organization of Islamic Cooperation, Economic Growth, Unemployment

JEL Classification: O47

1. Introduction

While reducing unemployment rates forms the basis of macroeconomic studies, economic growth and inflation, which are among the factors affecting unemployment, are among the most studied keywords. Although there are multiple factors that affect economic growth and are affected as a result of economic growth, such as financial markets, political arrangements, and social development (Araç & Özcan, 2014; Gallas et al., 2024; Ameziane, 2024), the most frequently studied concepts in the literature are unemployment and inflation. The relationship between inflation and unemployment has been widely discussed in the literature after Phillips (1958) study, and many studies have produced different results on the direction of the relationship between the variables. The negative relationship between economic growth and unemployment

entered the literature with Okun (1962) macroeconomic study. As a result of the examination conducted by Arthur Okun in the United States sample, the negative relationship between variables was explained and evaluations on the concept of Okun's law as an important economic theory started. Although Okun explained that the relationship between the variables was negative by conducting an analysis between 1947 and 1960, the outputs that the relationship between the variables was positive increased with the 2000s. The increase in unemployment rates despite the growth of the economy is explained by the concept of unemployment growth, and capacity utilization can be shown as the reason for this situation. (Ayvaz & Öztürk, 2018; Uras, 2016). Although the increase in the capacity utilization rate is expressed as the amount of production produced in the country exceeding the current production, if the reason for this increase is not integrated with the increase in employment rates and is evaluated within the framework of productivity, employment rates do not increase while growth occurs in the economy. This can be a significant cause of jobless growth. As a matter of fact, the increase in capacity utilization rates in the early 2000s leads to growth without employment (Ataman, 2006; Uras, 2016) and Okun's law loses its validity. The positive relationship found in the studies targeting the early 2000s can be explained by this situation.

In this direction, the main starting point of macro-based studies is to reduce unemployment rates by reducing unemployment rates with Okun's law, to encourage employment and to identify the factors that reduce unemployment. Achieving economic growth, just like reducing unemployment, is seen as the main objective of countries and the focus of academic studies in the discipline of economics. The direction of the relationship between economic growth and unemployment has been examined in different studies (Altunöz, 2015, 2019; Barışık et al., 2010; Bilge & Erden, 2021; Binet & Francois, 2013; Canbay, 2020; Christopoulos, 2004; Daştan, 2024; Dixon et al., 2017; Pierdzioch et al., 2011; Rahman & Mustafa, 2017; Soylu et al., 2018; Tari & Abasiz, 2010; Tekgün & Eroğlu, 2023; Üzar & Akyazi, 2018; Villaverde & Maza, 2009; Yayar & Öztaş, 2020; Yüksel & Oktar, 2017) as well as the study in which the Okun’s law was adopted (Altunöz, 2019; Bilge & Erden, 2021; Binet & Francois, 2013; Canbay, 2020; Daştan, 2024; Dixon et al., 2017; Pierdzioch et al., 2011; Soylu et al., 2018; Tekgün & Eroğlu, 2023; Üzar & Akyazi, 2018; Villaverde & Maza, 2009; Yayar & Öztaş, 2020; Yüksel & Oktar, 2017) is much higher than the number of studies in which it is not accepted(Altunöz, 2019; Barışık et al., 2010; Tari & Abasiz, 2010)

and it is seen that the common belief is that the Okun's law is valid. In addition to these studies, studies by Binet & Francois (2013), Christopoulos (2004) and Rahman & Mustafa, (2017) among others, show that Okun's law is valid for some of the countries they examined, while it is not valid for others. Detailed information is provided in the literature review section.

This study is designed to examine the validity of Okun's law for the Organization of Islamic Cooperation Countries over the period 1991-2023. While the aim of the Organization is to enhance cooperation among its members, the economic development and stability of countries with economic differences are also among its founding objectives. Although one of the objectives of the organization is to provide a common movement among Islamic countries and to support economic growth, the fact that the countries within the union have different socio-economic structures strengthens the contribution of the output obtained as a result of the review.

Based on this idea, the selected Organization of Islamic Cooperation Countries were subjected to panel data analysis to examine the relationship between economic growth and unemployment.

When the studies in the literature where the validity of Okun's law is tested are analyzed, it is observed that Western countries are commonly evaluated. The fact that this study examines the member countries of the Organization of Islamic Cooperation is different in this respect and the fact that OIC countries have not been examined in the literature before increases the originality of the study and strengthens its contribution. The heterogeneous structure of OIC countries is important in determining the policy necessity and the impact of country differences.

The results of the homogeneity and horizontal cross-section dependence tests applied in the study necessitated the use of 2nd generation unit root tests and the CADF unit root test was used to test for stationarity. After determining whether the series contain unit roots or not, Westerlund (2006) co-integration test is used to provide information about the break periods. Finally, the long-run relationship is identified using the "refige" estimator. The fourth section of the study provides detailed test results.

2. Literature Review

When the literature is analysed, it is seen that there are studies that present outputs that Okun's law is valid as well as studies that evaluate that it is not valid. When the outputs obtained are evaluated, it is seen that there is a widespread belief that economic growth and unemployment are two negatively related variables, and it can be evaluated that growth without employment is a less common situation In this section, Table 1 is included in the second part of the study in order to express the studies that are considered to contribute to the literature, the years of publication, the country selected as the sample, the time interval, the methodology used and the output obtained. Fifty per cent of these studies were published in -SC indexed journals and approximately 27% of these studies were included in the literature with TR Index indexed journals. The fact that half of the studies selected from the academic literature within the scope of the subject are preferred from sources that are highly indexed and referenced by most researchers ensures that the scope is at international standards. In addition, the TR Indexed examination provides information about the direction, content and scope of evaluations in the national context.

Table 1: Literature Review

Article	Time Period	Country/Countries	Method	Conclusion
Christopoulos (2004)	1971-1993	Greece	Panel Data Analysis	In 6 regions Okun's law is valid. It is not valid in other regions.
Zagler (2008)	1970:Q1-2000:Q2 1968:Q1-1997:Q4 1970:Q1-2000:Q2 1968:Q1-2000:Q1	France Germany Italy United Kingdom	VECM	Okun's law applies.
Villaverde & Maza (2009)	1980-2004	Spain	Panel Data Analysis	Okun's law applies.
Barışık et al. (2010)	1988-2008	Turkiye	Time Series Analysis	Okun's law does not apply.
Tari & Abasiz (2010)	1968-2008	Turkiye	Error Correction Model	Okun's law does not apply.

Article	Time Period	Country/Countries	Method	Conclusion
Kreishan (2011)	1970-2008	Jordan	Durbin-Watson Cointegration Test	Okun's law does not apply.
Pierdzioch et al. (2011)	1955-1996	G-7 Countries	Panel Data Analysis	Okun's law applies.
Binet & Francois (2013)	1990-2008	France	Panel Data Analysis	Okun's law is valid except for 8 regions.
Dilber et al. (2015)	2001-2011	Turkey EU Countries	Panel Data Analysis	Okun's law applies.
Altunöz (2015)	2000:Q1-2014:Q1	Turkiye	Johansen Cointegration Analysis	Okun's law does not apply.
Dixon et al. (2017)	1985-2013	20 OECD Countries	Panel Data Analysis	Okun's law applies.
Yüksel & Oktar (2017)	1993-2015	10 Developed and 10 Developing Countries	Panel Data Analysis	Okun's law applies.
Tatoğlu Yerdelen (2017)	2008-2016	AB Countries	Panel Data Analysis	The Okun law applies in 13 countries.
Yildiz et al. (2017)	2005-2015	Turkiye	LM Test	Okun's law applies.
Rahman & Mustafa (2017)	1970-2013	13 Developed Countries	Panel Data Analysis	Okun's law is valid except for 1 country.
Soylu et al. (2018)	1992-2014	Eastern European Countries	Panel Data Analysis	Okun's law applies.
Üzar & Akyazi (2018)	2000-2016	34 OECD Countries	Panel Data Analysis	Okun's law applies.
Altunöz (2019)	2000-2012	Eurozone	Panel Data Analysis	Okun's law applies.
Canbay (2020)	1991-2018	BRICS Countries	Panel Data Analysis	Okun's law is valid except for 2 countries.
Bayrak (2019)	2005-2017	Turkiye	Maki Cointegration Test Toda Yamamoto Causality Test	Okun's law applies.
Yayar & Öztaş (2020)	1998-2017	D-8 Countries	Panel Data Analysis	Okun's law applies.
Bilge & Erden (2021)	1990:01-2017:04	45 Countries	Panel Data Analysis	Okun's law applies.
Mohsin Hashmi et al. (2021)	1991-2018	BRICS Countries	Panel Data Analysis	Okun's law applies.

Article	Time Period	Country/Countries	Method	Conclusion
Tekgün & Eroğlu (2023)	1991-2019	Fragile Five Countries	Panel Data Analysis	Okun's law applies.
Campos et al. (2024)	1979-2019	Eurozone	Panel Data Analysis	Okun's law applies.
Mohamed (2024)	2000-2021	Somalia	FMOLS/DOLS	Okun's law does not apply.
Nasir et al. (2024)	1988-2021	Malaysia	OLS	Okun's law applies.
Andreescu (2024)	2010-2019	Central and Eastern European Countries	Panel Data Analysis	Okun's law applies.
Ibour & El Aynaoui (2024)	1991-2015	39 African Countries	Panel Data Analysis	Okun's law applies.
Daştan (2024)	1991-2021	BRICS Countries	Panel Data Analysis	Okun's law applies.

When the studies using panel data analysis are analyzed, it is seen that Christopoulos (2004) evaluated the relationship between unemployment and inflation in 13 regions of Greece. In the study, it is determined that Okun's law is valid for 6 regions and these regions are Epirus, Ionian Islands, Western Greece, Central Greece, Peloponnese and Crete. For other regions, it can be stated that the relationship between unemployment and inflation is positive.

Zagler (2008) also examined the relationship between economic growth and unemployment and analyzed the related evaluation for 4 different countries in different year intervals and in the short and long run separately. The study, which was conducted between 1970:Q1-2000:Q2 in France, 1968:Q1-1997:Q4 in Germany, 1970:Q1-2000:Q2 in Italy and 1968:Q1-2000:Q1 in the United Kingdom, concluded that Okun's law holds in the short run. In the long term, there is no assessment that the law is valid.

The study of Villaverde & Maza (2009) analyzed Spain and tested the relationship between unemployment and economic growth in 17 different regions of Spain. Although the results of the study suggest that Okun's law is valid for Spain, a relationship in the same rate and direction has not been detected for all regions. From 1980 to 2004, the study, which presents a wide range of outputs, has an important place in terms of showing that regional growth and development-oriented regulations are needed rather than determining a general economic policy for Spain.

Pierdzioch et al. (2011) test the validity of the law in G-7 countries for the period 1955-1996. It is found that the relationship between unemployment and economic growth is negative for all countries analysed in the study in the relevant year interval. In the same year (Kreishan, 2011) also examined the cointegration relationship and stated that Okun's law was not valid for Jordan between 1970-2008.

Binet & Francois (2013) also used panel data analysis in their study and evaluated unemployment and economic growth variables in 22 different regions of France. It is widely accepted that Okun's law is valid and there is no negative relationship between unemployment and inflation for 8 regions. The study is important in terms of identifying the factor that has an impact on the validity of the law by taking regional differences into account, and the intensity of public employment is considered as a factor that prevents the relationship between unemployment and inflation from being negative. It is among the evaluations that the high value added creation rate of the labour force employed in the public sector may have increased economic growth. In addition, the fact that the study provides information on the differentiating factors of 8 regions increases the effectiveness of the study in the literature.

In his study, also included the relationship between unemployment and economic growth variables for the European Union member countries and Turkey between 2001-2011. Westerlund panel cointegration analysis is applied to evaluate short-run and long-run effects separately. In the long run, an increase in unemployment is found to increase economic growth significantly and in the short run, there is a negative relationship between unemployment and economic growth. Although the validity of Okun's law has been established, the relevant assessment is considered to be valid only in the short term.

Yüksel & Oktar (2017), on the other hand, applied panel causality analysis to test the validity of Okun's law, which argues that the relationship between unemployment and economic growth is inverse. Economic growth and unemployment rates of 20 countries are taken into account in the study and countries are selected according to their development levels. In addition to the aim of the study to determine the effect of the level of development on the Okun's law, the fact that the study provides an output on which variable is the cause of another variable allows an assessment to be made on whether unemployment or inflation will be the starting point in the policy regulations to be implemented in

the field. The fact that Okun's law is valid in all countries shows that economic development has no effect on the validity of the law.

Tatoğlu Yerdelen (2017) also utilized panel data analysis in his study and conducted an analysis in 23 countries among the European Union countries. In the study, in which Okun's law is found to be valid in 13 countries, it is stated that the validity of the law is provided with very low coefficients and it is not possible to talk about the existence of a high negative relationship between unemployment and economic growth. Although Turkey is among the countries with low correlation in the study, it can be considered that the validity will disappear from year to year. As in the study of Tatoğlu Yerdelen (2017), Bilge & Erden (2021) show that the coefficient calculated according to Okun's law is very low and therefore the negative relationship between variables is not very decisive. In the same year, Dixon et al. (2017) tested the validity of Okun's law in OECD countries. As a result of the analysis, it was found that the law is valid for all countries, but the effectiveness of economic growth in reducing the unemployment rates of the young working population is also among the results evaluated. The study of Rahman & Mustafa (2017) , which examines Okun's law in more than one country, uses panel data analysis and evaluates Canada, USA, Netherlands, Finland, France, South Korea, Japan, Italy, New Zealand, UK, Australia and Sweden. As a result of the study, the Okun's law is not completely rejected and it is seen that a validity cannot be mentioned only for the Netherlands and that an existing negative relationship can be mentioned for economic growth and unemployment, even if the relationship is weak in other countries. (Yildiz et al., 2017) also found that Okun's law is valid in the evaluation for Turkey between 2005 and 2015.

Soylu et al. (2018) analyzed 8 countries, namely Belarus, Bulgaria, Czech Republic, Romania, Poland, Ukraine, Hungary and Slovakia. When the countries defined as Eastern European countries are evaluated in general, it is determined that 1% growth in the economy has a negative effect of 0.08% on unemployment and thus the validity of Okun's law is accepted. In 2018, another study (Üzar & Akyazi, 2018) tested the validity of the law by considering 34 OECD countries. It is found that there is a bidirectional causality, and the law is valid for all countries considered in the study and appropriate policy recommendations are made.

The study by Altunöz (2019), which evaluates the relationship between variables for the Euro regions, evaluated a 12-year period between 2000

and 2012, which was formed using panel data analysis. In the study, the relationship between unemployment and inflation is analyzed for 17 different countries and these countries are the Netherlands, Spain, Slovakia, France, Slovenia, Portugal, Greece, Cyprus, Luxembourg, Finland, Germany, Ireland, Italy, Estonia, Austria, Malta, Malta and Belgium. Okun's law is valid and it is stated that the relationship between the variables is negative.

Yayar & Öztaş (2020), on the other hand, analyzed the D-8 country group consisting of Bangladesh, Indonesia, Iran, Malaysia, Egypt, Nigeria, Pakistan and Turkey and made an evaluation between 1998-2017. The results obtained in the countries analyzed differ and it is stated that the Okun's law is valid for Indonesia and in this case, Indonesia's high population and population growth are effective. When analyzed for Turkey, it is found that there is no significant inverse relationship between unemployment and economic growth, in other words, the coefficient of the arrow is low. The fact that D-8 countries have agriculture-intensive economies has an impact on the validity of the Okun's law and economic efficiency can be stimulated through agriculture-based policies. The study of Canbay (2020), which was introduced to the literature in 2020, examined the BRICS countries and evaluated the validity of Okun's law between 1991-2018 and stated that Okun's law was valid only in Brazil, South Africa, Russia and India in the relevant time period. Accordingly, it is concluded that the relationship between unemployment and economic growth is positive for China and Turkey.

Tekgün & Eroğlu (2023), utilizing the Panel ARDL method, examined Brazil, Indonesia, India, South Africa and Turkey. This study, which analyses the fragile five countries, contributes to the literature by evaluating the relationship between unemployment and economic growth variables both in the short run and in the long run. When the results obtained are evaluated, it is seen that the Okun's law is not valid in the short run and the inverse relationship between economic growth and unemployment is accepted in the long run.

Daştan (2024) also presented a comprehensive output by testing the period between 1991-2021 using the panel data analysis method and made an evaluation among BRICS countries. It not only analyses the relationship between economic growth and unemployment, but also includes renewable and non-renewable energy consumption as a variable in the study and is taken into consideration in this study as it tests the

validity of Okun’s law. As a result of the study, the employment power of the renewable energy sector is evaluated and it is concluded that it does not have the effect of increasing employment at the required level and in this respect, the Okun’s law remains valid. The study of Campos et al. (2024), which is among the recent studies, is also included in the literature as another study that provides output that Okun's law is valid. In the study, the Euro area countries were evaluated and the specific evaluations on crisis periods and gender at the end of the study increased the effectiveness of the study in literature. Mohamed (2024) is among the authors who conducted a study in the same year and carried out a study in Somalia between 2000-2021. The study, which finds that Okun's law is not valid, emphasizes the importance of building sustainable economic growth policies in Somalia. Nasir et al. (2024), who conducted a comprehensive analysis in the Malaysian sample between 1988 and 2021 using the least squares method, took into account variables such as population, foreign direct investments and inflation in addition to economic growth and unemployment. As a result of the study, the author concluded that Okun's law is valid. Andreescu (2024) analyzed the sample of Bulgaria, Czech Republic, Hungary, Poland and Romania. The study analyzed the relationship between economic growth and unemployment by using Granger causality test and found that Okun's law was valid between 2010-2019.

3. Data and Methodology

In this section of the study, information about the variables to be used and the tests to be applied in order to determine the validity of Okun's law are given. The variables to be analysed in the study are economic growth and unemployment, and the data are evaluated in the period 1991-2023 for the countries in the Organisation of Islamic Economics. Graphs of the variables are presented in Figures 1 and 2.

Figure 1: 1991-2023 Economic Growth Data

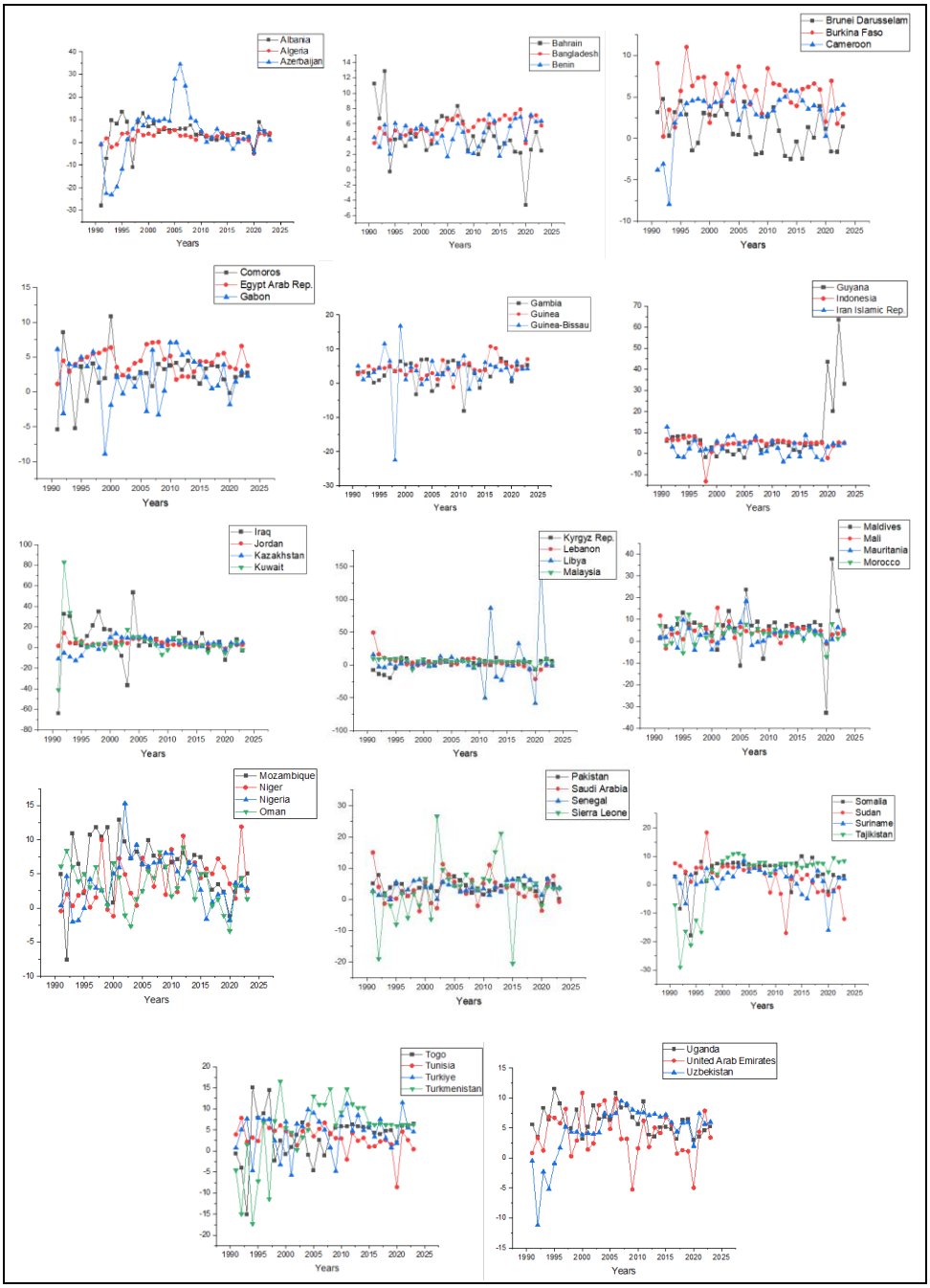
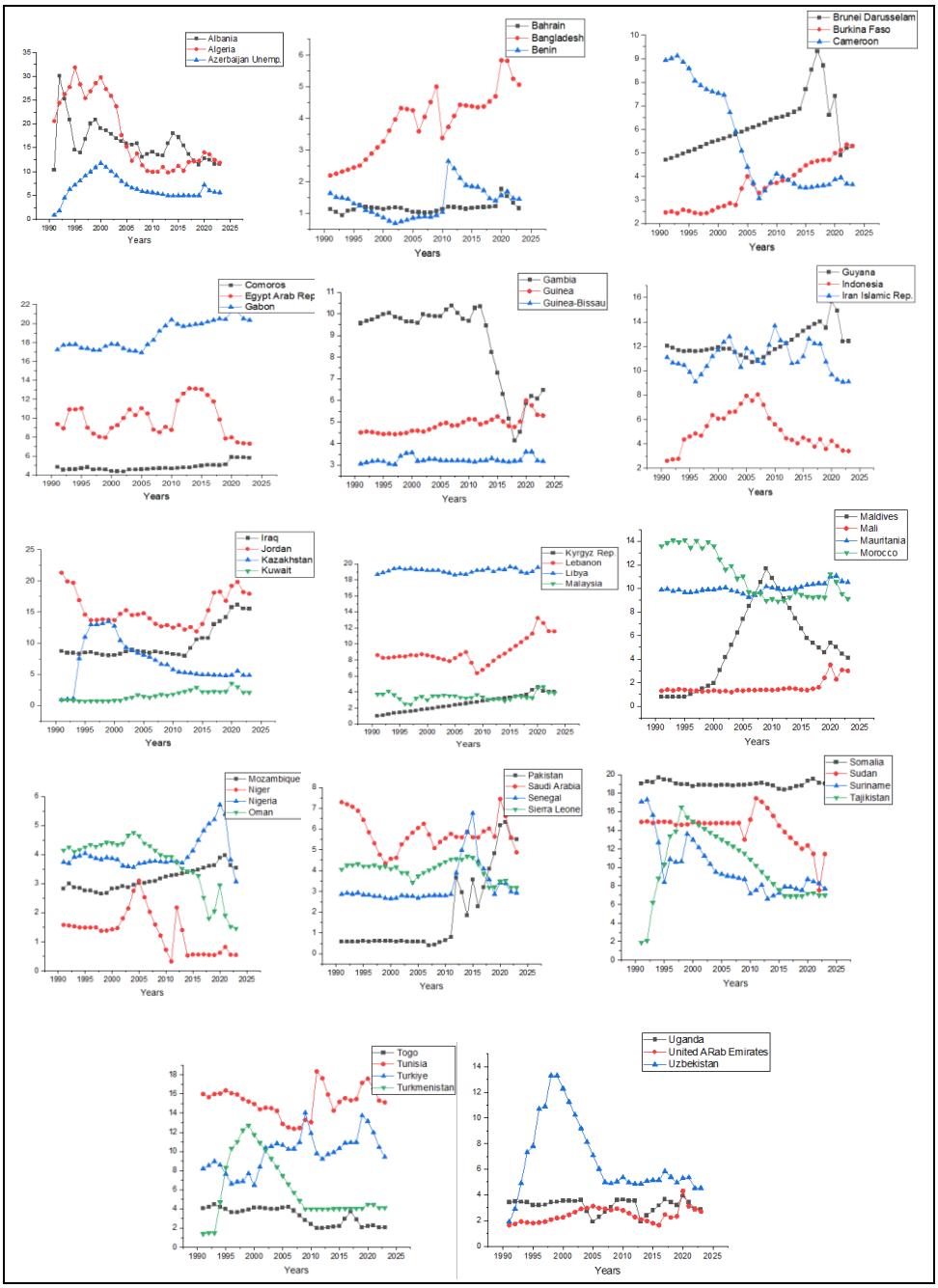


Figure 2: 1991-2023 Unemployment Data



 unemployment data of the countries or the proximity of the variables to each other according to the countries. The definitions, average values, minimum and maximum values of economic growth and unemployment variables on a country basis between 1991 and 2023 are presented in Table 2.

Table 2: Descriptive Statistics

Countries	Mean		Median		Max.		Min.		Std. Dev	
	GDP	Unemp.	GDP	Unemp.	GDP	Unemp.	GDP	Unemp.	GDP	Unemp.
Albania	3.477971	16.03164	4.536524	15.626	13.32233	30.007	-28.0001	10.304	7.480819	4.12069
Algeria	2.651515	17.8107	3.1	13.79	6.5	31.84	-5	9.82	2.355992	7.616328
Azerbaijan	3.916412	6.546848	4.714802	5.86	34.5	11.78	-23.1	0.9	12.14487	2.449942
Bangladesh	5.647596	3.877091	5.571788	4.075	7.881915	5.828	3.448018	2.2	1.17017	1.020143
Bahrain	4.400952	1.173424	4.110006	1.166	12.87001	1.767	-4.64463	0.943	3.084756	0.149737
Benin	4.679205	1.354061	4.811223	1.402	7.191434	2.647	1.713165	0.69	1.644352	0.4938
Brunei Darusselam	1.156586	6.116152	1.133573	5.886	4.758581	9.316	-2.50835	4.7	2.292272	1.161624
Burkina Faso	5.413927	3.595424	5.889205	3.67	11.01474	5.348	0.232711	2.414	2.451393	0.97581
Cameroon	3.115348	5.422515	3.832418	3.989	7.048863	9.118	-7.93206	3.063	2.943553	2.173095
Comoros	2.478611	4.845667	2.646955	4.709	10.84788	5.884	-5.39563	4.369	2.944872	0.420238
Egypt	4.371185	9.892879	4.372019	9.38	7.156284	13.154	1.125405	7.306	1.567936	1.797378
Gabon	2.141004	18.81667	2.676203	18.258	7.091753	21.273	-8.93262	16.91	3.523218	1.45153
Gambia	3.254916	8.709333	4.058074	9.681	7.23489	10.383	-8.13044	4.127	3.477598	1.921693

Countries	Mean		Median		Max.		Min.		Std. Dev	
	GDP	Unemp.	GDP	Unemp.	GDP	Unemp.	GDP	Unemp.	GDP	Unemp.
Guinea	4.455219	4.863697	4.133016	4.834	10.82063	5.993	-1.12264	4.423	2.292326	0.377643
Guinea- Bissau	3.472474	3.245818	4.19999	3.204	16.81502	3.628	-22.4457	3.03	5.760945	0.149056
Guyana	8.109272	12.24624	4.440913	11.81	63.43986	15.701	-1.95096	10.7	13.56111	1.147775
Indonesia	4.633964	5.067394	5.069786	4.611	8.220007	8.06	-13.1267	2.617	3.692055	1.53416
Iran	3.154663	11.04145	3.189804	10.772	12.71615	13.679	-3.74717	9.085	3.79542	1.187434
Iraq	5.825633	10.00912	5.513791	8.596	53.38179	16.173	-64.0471	7.965	19.81385	2.685853
Jordan	4.236652	15.35227	3.384078	14.6	14.34978	21.311	-1.10275	11.9	2.898301	2.681247
Kazakhstan	2.948485	7.013424	4.1	5.77	13.5	13.46	-12.6	0.9	6.476454	3.467596
Kuwait	5.07678	1.616545	2.479757	1.64	82.80933	3.535	-41.0078	0.694	17.60254	0.779492
Kyrgzstan	1.900405	2.609727	4.024039	2.558	10.91547	4.63	-20.0852	1	7.404023	1.01348
Lebanon	4.263985	8.999576	2.685779	8.565	49.44738	13.235	-21.3999	6.355	10.45996	1.5769
Libya	5.434241	19.15394	0.749659	19.186	153.4926	19.649	-58.3182	18.613	34.85245	0.283692
Malaysia	5.303581	3.429667	5.584847	3.41	10.0027	4.64	-7.35941	2.45	3.95951	0.462862
Maldives	6.065349	5.143394	7.054539	5.021	37.68719	11.697	-32.9088	0.79	10.73936	3.390453
Mali	4.526026	1.606697	4.756161	1.394	15.37624	3.528	-3.21866	1.206	3.559073	0.575598
Mauritania	3.278914	10.01548	3.383555	9.931	18.3332	11.068	-4.04469	9.287	4.332164	0.398688
Morocco	3.576569	11.09952	3.499557	10.539	12.37288	14.089	-7.17821	8.91	4.038261	2.008605
Mozambique	6.183889	3.155121	6.679729	3.065	12.85168	3.984	-7.57665	2.646	4.177795	0.362691
Niger	4.189538	1.330333	3.550641	1.426	11.9	3.1	-1.20848	0.317	3.409201	0.709446

Countries	Mean		Median		Max.		Min.		Std. Dev	
	GDP	Unemp.	GDP	Unemp.	GDP	Unemp.	GDP	Unemp.	GDP	Unemp.
Nigeria	4.017535	4.021212	4.195924	3.827	15.32916	5.712	-2.03512	3.074	3.728781	0.577514
Oman	3.408548	3.687273	3.875774	4.142	8.863122	4.756	-3.37971	1.46	3.061159	0.969368
Pakistan	3.999102	1.885667	4.217942	0.597	7.831256	6.338	-1.27408	0.398	2.1219	1.958608
Saudi Arabia	3.154067	5.794545	2.788406	5.636	15.0079	7.45	-3.76325	4.346	4.293611	0.782639
Senegal	3.823093	3.264273	3.821856	2.853	7.407486	6.757	-0.04752	2.648	2.001163	0.961646
Sierra Leone	3.010586	4.022061	3.753803	4.159	26.52413	4.678	-20.4911	3.174	8.975328	0.439826
Somalia	4.293358	18.98952	6.694352	18.947	9.9468	19.686	-17.8469	18.372	5.492214	0.285196
Sudan	2.41086	14.24291	3.858242	14.783	18.31266	17.44	-17.0047	7.53	6.147911	1.81927
Suriname	1.703498	9.865697	2.69035	8.832	8.5	17.28	-15.9752	6.6	4.57296	2.841925
Tajikistan	2.778825	10.05161	7.000003	10.187	11	16.5	-29	1.9	10.17732	3.710764
Togo	3.49548	3.259273	4.79506	3.636	14.98241	4.47	-15.0958	1.982	5.477669	0.887979
Tunisia	3.169156	15.18691	3.178411	15.33	7.805729	18.334	-8.59183	12.365	2.965743	1.505166
Turkiye	4.630711	9.847303	5.533469	10.227	11.43938	14.026	-5.75001	6.495	4.453097	1.924988
Turkmenistan	4.919237	6.058818	6.2	4.452	16.5	12.7	-17.2998	1.4	7.973539	3.279061
Uganda	6.165041	3.178576	5.637612	3.418	11.52324	3.914	2.951306	1.9	2.258537	0.498011
United Arab Emirates	3.94344	2.423758	3.403857	2.331	10.8527	4.294	-5.24292	1.64	3.747154	0.578196
Uzbekistan	4.450784	6.77	5.879743	5.345	9.473005	13.3	-11.2	1.9	4.338084	2.972327

Source: World Bank

Descriptive statistics for a total of 49 countries are presented in the table. When the maximum values of the series for the GDP variable expressing economic growth are considered, the first 5 countries are Libya (153.492), Kuwait (82.809), Guyana (63.439) and Iraq (53.381). The top 5 countries with the lowest economic growth in the relevant year range are Libya (0.749), Brunei Darussalam (1.1335), Kuwait (2.479), Comoros (2.646) and Gabon (2.676). It is noteworthy that Libya and Kuwait are among the countries with both the highest economic growth and the lowest economic growth.

In the study, the data of 49 countries, whose variable graphs and descriptive statistics are expressed, are evaluated by using Panel data analysis and the outputs obtained are expressed in tables in the fourth section. In the study, firstly, Cross-sectional Augmented Dickey Fuller (CADF) unit root test will be applied, then the co-integration test introduced to the literature by Westerlund (2006) will be used to evaluate the relationship between the variables and finally the 'Regife' estimators will be used to test the existence of a long-run relationship.

The choice of CADF unit root test is based on the results of homogeneity test and horizontal cross-section dependence test, which indicate that first or second generation unit root tests should be used in the study. In this direction, firstly, the homogeneity of the series of economic growth and unemployment variables to be analyzed was evaluated. For the homogeneity test, Peseran (2006) 's study is utilized, and it is evaluated that homogeneity is accepted in case the H0 hypothesis is accepted and a heterogeneous output is provided in case the H1 hypothesis is accepted. At this point, the test equation to be used in the study is expressed in lines (i) and (ii).

$$LM_{adj} = \left(\frac{2}{N(N-1)}\right)^{\frac{1}{2}} \quad \text{(i)}$$

$$\hat{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}S-k}{v(T,k)}\right) \text{ N(0,1)} \quad \text{(ii)}$$

Following the results obtained as a result of the expressed equations, Horizontal cross-section dependence test was applied in the study. The test results with 4 different methods are presented in Table 4. The applied equations are expressed between lines (iii-vi) respectively. In the Results

section, the outputs obtained as a result of the tests are expressed and interpreted.

$\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}(\widehat{p}_{ij}^{2})\ \ X^{2}{}_{\frac{N(N-1)}{2}}$ (Breusch & Pagan, 1980) (iii)

$\sqrt{\frac{1}{N(N-1)}}\sum_{i-1}^{N-1}\sum_{j=i+1}^{N}\left(T_{ij}\rho_{ij}^{2}-1\right)\rightarrow N(0.1)$ (Pesaran, 2004) (iv)

$\sqrt{\frac{1}{N(N-1)}}\sum_{i-1}^{N-1}\sum_{j=i+1}^{N}\left(T_{ij}\rho_{ij}^{2}-1\right)-\frac{N}{2(T-1)}\rightarrow N(0.1)$ (Pesaran, 2004) (v)

$\left(\frac{2}{N(N-1)}\right)^{\frac{1}{2}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}[\widehat{p}_{ij}^{2}(\frac{T-K-1\widehat{p}_{ij}-\widehat{\mu}_{Tij}}{v_{Tij}})]N(0.1)$ (Pesaran et al., 2008) (vi)

The outputs obtained as a result of the application of the tests to the relevant variables indicate that it is necessary to utilise the 2nd generation unit root tests in the study. In this direction, CADF unit root test will be used to analyse the stationarity of the series. The related method was introduced to the literature by Peseran (2006) and the equations related to the method are expressed in lines (vii-viii).

$$\Delta\gamma_{it}=\ \alpha_{i}+\rho_{i}^{*}\gamma_{i,t-1}+d_{0}\bar{y}_{t-1}+d_{1}\bar{y}_{t}+\ \varepsilon_{it} \quad \text{(vii)}$$

$$\frac{1}{N}\sum_{i-1}^{N}CADF_{i} \quad \text{(viii)}$$

The co-integration relationship will be analysed with the study of Westerlund (2006) as stated, and finally, Regife estimators and long-run relationships will be tested with the equations obtained from the study of Bai (2009). In the next section of the study, the outputs obtained as a result of the application of the tests in this section are presented and interpreted in tables.

The study is constructed with the aim of seeking an answer to the question of whether Okun's law is valid in the Organisation of Islamic Cooperation countries in a certain time interval, and among the tests selected to answer this question, the CADF unit root test was selected as appropriate methods to test the existence of a long-run relationship between the variables examined, the use of Regife estimator to strengthen the detection of the relationship between variables, and the Horizontal Cross-Section Dependence test to test the relationship between the samples and the

effect of countries on each other by making homogeneous and heterogeneous distinction.

4. Empirical Results

In the findings section of the study, homogeneity and horizontal cross-section dependence test results are determined, followed by stationarity analysis, cointegration relationship estimation and determination of the validity of the law in the long run. In this direction, firstly, homogeneity test results are presented in Table 3.

Table 3. Homogeneity Test

Variables	Stat.	Prob.
Delta Tilde	-2.125	0.983
Delta Tilde adj	-2.229	0.987

Notes. H_0: Coefficients are homogenous. H_1: Coefficients are not homogenous.

The table shows that the probability values for Delta Tilde and Delta Tilde adj are 0.983 and 0.987, respectively. These results lead to the acceptance of H_0 hypothesis since the probability value is greater than the constraint value. Accordingly, the coefficients will be evaluated as homogenous.

Table 4: Horizontal Cross Section Dependence

Applied Tests	Source	Statistical Value		Prob.	
		Unemp.	GDP	Unemp.	GDP
Lagrange Multiplier (LM)	Breusch & Pagan. 1980	8651.427	2326.949	0.000***	0.000***
Cross-Sectional Dependence Lagrange Multiplier (CDlm)	Pesaran. 2004	154.141	23.732	0.000***	0.000***
Cross-Sectional Dependence (CD)	Pesaran. 2004	-2.264	-2.978	0.012**	0.001***
Bias-Adjusted Cross Sectionally Dependence Lagrange Multiplier (LMadj)	Pesaran et al. 2008	83.204	2.561	0.000***	0.005***

Note. In the probability values in the table, '***' indicates that the series is significant at 1% level.

Horizontal cross-section dependence can be calculated with 4 different equations as shown in Table 4. With the equation that started to be used as a result of the study brought to the literature by Breusch & Pagan (1980), it was determined that horizontal cross-section dependence was accepted with a probability value of 0.000 for both unemployment and economic growth. The same conclusion is reached for the tests in Pesaran, (2004) and Pesaran et al. (2008) the hypothesis H_0 is accepted. In this direction, it can be concluded that the values of economic growth and unemployment variables have an effect between each other in the analysed sample. The obtained result requires the use of 2nd generation unit root tests and Table 5 presents the CADF test results.

Table 5: CADF Unit Root Test Results

Countries	GDP				Unemployment			
	Constant		Constant and Trend		Constant		Constant and Trend	
	Lags	CADF	Lags	CADF	Lags	CADF	Lags	CADF
Albania	1	-4.554***	1	-4.473**	1	-4.558***	1	-4.765***
Algeria	1	-2.328	1	-2.301	1	-4.366***	1	-4.691***
Azerbaijan	1	-3.218*	1	-3.243	1	-4.362***	1	-4.752**
Bangladesh	1	-3.575**	1	-3.474	1	-4.221***	1	-4.945***
Bahrain	1	-4.314***	1	-4.288**	1	-3.839**	1	-5.533***
Benin	1	-3.616**	1	-3.545*	1	-3.91**	1	-4.941***
Brunei Darusselam	1	-4.549***	1	-4.455**	1	-4.055**	1	-4.951***
Burkina Faso	1	-3.532**	1	-3.492*	1	-4.047**	1	-5.036***

Cameroon	1	-3.353**	1	-3.276	1	-3.729**	1	-4.868***
Comoros	1	-3.785**	1	-3.775*	1	-3.405**	1	-4.461**
Egypt	1	-3.615**	1	-3.628*	1	-3.209*	1	-4.556**
Gabon	1	-3.622**	1	-3.523*	1	-3.312*	1	-3.961**
Gambia	1	-3.834**	1	-3.754*	1	-3.053*	1	-3.754*
Guinea	1	-4.096**	1	-4.228**	1	-3.089*	1	-3.68*
Guinea- Bissau	1	-4.977***	1	-4.852***	1	-3.446**	1	-3.832*
Guyana	1	-3.038*	1	-2.961	1	-3.91**	1	-3.904**
Indonesia		-3.683**		-4.115**		-3.119*		-3.096
Iran	1	-4.104**	1	-4.061**	1	-3.198*	1	-3.204
Iraq	1	-5.326***	1	-5.406***	1	-3.664**	1	-3.552*
Jordan	1	-4.608***	1	-4.976***	1	-5.045***	1	-5.183***
Kazakhstan	1	-3.053*	1	-3.229	1	-3.632**	1	-4.382**
Kuwait	1	-4.034**	1	-3.992**	1	-3.783**	1	-4.51***
Kyrgzstan	1	-4.426***	1	-4.337**	1	-3.803**	1	-4.176**
Lebanon	1	-3.699**	1	-3.808*	1	-3.306*	1	-3.583*
Libya	1	-4.227***	1	-4.217**	1	-4.187***	1	-4.913***
Malaysia	1	-2.505	1	-2.659	1	-4.429***	1	-5.321***
Maldives	1	-3.146*	1	-3.085	1	-4.214***	1	-4.868***
Mali	1	-4.457***	1	-4.718***	1	-4.19***	1	-4.727***
Mauritania	1	-2.561	1	-2.714	1	-3.926**	1	-4.625**
Morocco	1	-4.968***	1	-4.964***	1	-3.685**	1	-4.562**
Mozambique	1	-4.818***	1	-4.832***	1	-3.686**	1	-4.871***
Niger	1	-3.655**	1	-3.826*	1	-3.319*	1	-4.822***
Nigeria	1	-3.958**	1	-3.899**	1	-4.115***	1	-4.093**

Oman	1	-3.241*	1	-3.317	1	-4.501***	1	-4.432**
Pakistan	1	-2.74	1	-2.727	1	-4.855***	1	-4.767***
Saudi Arabia	1	-3.695**	1	-3.57*	1	-5.035***	1	-4.943***
Senegal	1	-3.562**	1	-3.521*	1	-5.539***	1	-5.852***
Sierra Leone	1	-3.347**	1	-3.361	1	-5.68***	1	-5.761***
Somalia	1	-2.978*	1	-3.102	1	-5.088***	1	-5.096***
Sudan	1	-4.426***	1	-4.717***	1	-4.919***	1	-4.876***
Suriname	1	-3.3*	1	-3.241	1	-5.032***	1	-5.003***
Tajikistan	1	-5.111***	1	-5.095***	1	-5.297***	1	-5.216***
Togo	1	-5.459***	1	-5.361***	1	-6.43***	1	-6.339***
Tunisia	1	-4.235***	1	-4.239**	1	-7.687***	1	-7.917***
Türkiye	1	-3.023*	1	-2.99	1	-7.706***	1	-8.101***
Turkmenistan	1	-3.134*	1	-3.101	1	-6.417***	1	-6.297***
Uganda	1	-3.641**	1	-3.672*	1	-6.054***	1	-5.944***
United Arab Emirates	1	-3.964**	1	-3.856*	1	-5.553***	1	-5.532***
CIPS-Stat.		**-3.828****		**-3.843***		**-4.422*****		**-4.861*****

Note: ****.** and * indicate that the series are stationary at 1%, 5% and 10% significance levels. Critical values are taken as -4.11, -3.34 and -2.96 for the constant and -4.68, -3.87 and -3.49 for the constant and trend series, respectively. The expressed values are obtained from the study of Peseran (2006).*

Table 5 expresses the stationarity analyses of the series separately for 49 countries and presents the output for the country group with CIPS-statistic values in the last row of the table. When a collective evaluation is made, it is seen that the probability values for the constant and constant-trend series are -3.828, -3.843 for economic growth and -4.422 and -4.861 for unemployment, respectively. Related values will be interpreted based on the values expressed in Peseran (2006) study. The constraint values expressed in the study are -4.11, -3.34 and -2.96 for the constant series and -4.68, -3.87 and -3.49 for the constant and trend series, respectively. Accordingly, when the results are interpreted, it should be stated that -3.828 is stationary at 5% and 10% levels and -3.843 is stationary at 10% significance level. When the same evaluation is performed for the unemployment variable, it is observed that -4.422 and -4.861 values are calculated for the constant and trend series, respectively, and it is observed that the results obtained show stationarity at all significance levels. It is evaluated that the series do not contain unit root in both variables and in a total of 4 possibilities. If the assumption of non-stationarity of the series on a country basis is evaluated and the countries presenting output in this direction are identified, it can be stated that the series are non-stationary in Mozambique and Maldives in economic growth.

Table 6. Westerlund Panel Cointegration Test Results

Wasterlund (2006)	**Constant**				**Model with Constant Trend**			
LM Stat.	13.702				38.184			
Asymptotic Value	0.000***				0.000***			
	Constant Term				**Constant and Trend**			
Country	**Fractures**	**1.Fracture**	**2. Fracture**	**3. Fracture**	**Fractures**	**1. Fracture**	**2. Fracture**	**3. Fracture**
Albania	-	-	-	-	1	1996	-	-
Azerbaijan	2	1996	2008	-	1	2007	-	-
Bangladesh	1	2004	-	-	-	-	-	-
Bahrain	-	-	-	-	-	-	-	-
Benin	-	-	-	-	-	-	-	-
United Arab Emirates	-	-	-	-	1	2006	-	-
Brunei Darussalam	-	-	-	-	-	-	-	-

Burkina Faso	-	-	-	-	-	-	-	-
Algeria	1	2001	-	-	1	2005	-	-
Indonesia	-	-	-	-	2	1997	2003	-
Morocco	-	-	-	-	-	-	-	-
Gabon	1	2009	-	-	2	1998	2009	-
Gambia	-	-	-	-	-	-	-	-
Guinea	2	2009	2015	-	1	2015	-	-
Guinea-Bissau	-	-	-	-	-	-	-	-
Guyana	1	2017	-	-	1	2017	-	-
Iraq	-	-	-	-	-	-	-	-
Iran Islamic Rep.	-	-	-	-	-	-	-	-
Cameroon	1	2004	-	-	1	1996	-	-
Kazakhstan	2	1999	2007	-	1	1999	-	-
Kyrgyz Republic	1	1996	-	-	1	1996	-	-
Comoros	-	-	-	-	-	-	-	-
Kuwait	-	-	-	-	-	-	-	-
Libya	-	-	-	-	-	-	-	-
Lebanon	1	1996	-	-	1	1996	-	-
Maldives	-	-	-	-	-	-	-	-
Malaysia	1	1996	-	-	1	1998	-	-
Mali	-	-	-	-	-	-	-	-
Egypt	-	-	-	-	2	2000	2008	-
Mozambique	1	2000	-	-	-	-	-	-
Mauritania	-	-	-	-	2	1996	2006	-
Niger	1	2004	-	-	-	-	-	-
Nigeria	2	1999	2014	-	1	2001	-	-
Pakistan	-	-	-	-	-	-	-	-
Uzbekistan	3	1993	1996	2003	1	1996	-	-
Senegal	-	-	-	-	-	-	-	-
Sierra Leon	2	2001	2014	-	1	2014	-	-
Somalia	-	-	-	-	-	-	-	-
Sudan	2	2008	2017	-	2	2006	2012	-
Suriname	1	2013	-	-	-	-	-	-
Saudi Arabia	-	-	-	-	1	2002	-	-
Tajikistan	1	1996	-	-	1	1996	-	-
Togo	-	-	-	-	1	1997	-	-
Tunisia	1	2000	-	-	-	-	-	-
Turkey	1	2001	-	-	1	2001	-	-
Turkmenistan	1	1997	-	-	1	1997	-	-
Uganda	1	2011	-	-	2	1996	2011	-
Jordan	1	2009	-	-	1	2016	-	-
Oman	1	2016	-	-	1			

The cointegration relationship between the variables was introduced to the literature by Westerlund (2006) With his study, the author has contributed to the literature in terms of evaluating the long-run relationship between variables. This evaluation provides important information on the assessment of the years of economic growth and unemployment by years on a country basis.

When Table 6 is analysed, it is observed that the countries that did not experience any break between 1991 and 2023 under the assumption that the series contain a constant term and trend are Bahrain, Benin, Brunei Darussalam, Burkina Faso, Morocco, Gambia, Guinea, Iraq, Iran, Comoros, Kuwait, Libya, Maldives, Mali, Pakistan, Senegal and Somalia. When the entire panel is taken into account, the asymptotic value is found to be 0.000, indicating that there is no cointegration relationship in the entire panel.

Table 7: Regife Predictor Results

GDP	Coefficient	Standard Dev.	Prob.
Inflation	-0.1900008	0.0755826	0.012**

The results obtained in Table 7 are obtained by applying the equation in the study by Bai (2009) to the variables. Determination of the long-run relationship can be expressed as the purpose of using the Regife estimator. The result of the analysis shows that the probability value is 0.012, in other words, it is lower than the constraint value. Although the results obtained are interpreted as economically significant, they show that the relationship between economic growth and unemployment is negative and accordingly Okun's law is valid

5. Conclusion

This study, which bases the relationship between economic growth and unemployment variables on Okun (1962) study, is designed to test the validity of Okun's proposition that the relationship between unemployment and economic growth variables is negative. Although it is a common belief that reducing unemployment and increasing employment rates are among the factors that ensure economic growth, some studies have shown that economic growth and unemployment rates have a positive relationship for several different countries in different

periods (Barışık et al. 2010; Tari & Abasiz 2010; Rahman & Mustafa 2017; Tatoğlu Yerdelen 2017; Altunöz 2019; Canbay 2020). When this situation is analysed, the concept of growth without employment (Uras 2016; Ayvaz & Öztürk 2018) has emerged and studies involving sectoral evaluations have been focused on. When the capacity utilisation rate is low in a sector or sectors operating in a country, the effectiveness on economic growth is low, and it can be seen that the output obtained as a result of production increases although there is no positive effect on unemployment within the framework of both innovative orientations and productivity studies. Such a situation leads to the conclusion that although there is growth in the economy, there is no increase in employment rates and causes the concept of growth without employment to be used. The increase in the capacity utilisation rate is justified among the reasons for unemployment growth.

The evaluation of the effectiveness of employment in the growth of a country's economy may serve as a guide for macroeconomic-based political arrangements. From this point of view, the aim of the study is to determine the validity of the Okun's law and to draw a template for the countries examined both in academic and political level. While conducting the study, the countries of the Organisation of Islamic Cooperation have been selected as a sample and a comprehensive evaluation will be made between 1991 and 2023. In order to carry out the analysis, two different variables, namely economic growth rates and unemployment rates, have been analysed. By examining the variables in the study, it has been determined that the series are homogeneous and as a result of the analysis carried out in line with this information, it has been concluded that the series are stationary and do not contain unit root. Although it is seen that the economic growth and unemployment series of the Organisation of Islamic Cooperation countries examined between 1991 and 2023 have a co-integration relationship, an economically significant relationship was found and it was concluded that Okun's law is valid. The countries of the Organisation of Islamic Cooperation are among the countries that do not have a high level of economic development but are rich in terms of abundance of natural resources. The fact that countries are rich in natural resources leads to the result that they are considered relatively backward in terms of industrial production and technological development compared to developed and developing countries. Determining the validity of the Okun's law in such a group of countries contributes to the literature in terms of developing appropriate

policies for this group of countries by providing information within the framework of natural resource-rich countries. At the same time the fact that the countries considered constitute a specific group united under a certain roof, that the country characteristics adopt a heterogeneous structure on a political, social and economic basis, that the study covers the entire data range accessed through databases, that the methods applied are preferred among modern methods instead of traditional analysis methods, and that they shed light on the diversity of factors affecting the outputs obtained make this study valuable for the literature. The countries of the Organization of Islamic Cooperation have come together with the desire to establish political, social and economic cooperation, and the output that the Okun's law determined as a result of this study is valid will provide an important guidance in the political economy regulations of the countries. Political arrangements designed to create employment will provide a driving force for the acceleration of economic growth.

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