The Relationship Between Unemployment and Economic Growth in OECD Countries: Panel Causality Test*

İşsizlik ve Ekonomik Büyüme Arasındaki İlişki: Panel Nedensellik Testi

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Abstract: Unemployment and economic growth are the most important determinants for the economic success of countries. Therefore, economic growth and unemployment problems are seen as important problems that have been continuing from past to present. Many policies have been implemented in order to reduce unemployment rate. Among these, the most important policy is to increase economic growth. Okun's law, which is a generally accepted theory, also supports this view. According to Okun's law, a low unemployment rate stands out in the years with a high growth rate. In the years with a low economic growth rate, a high unemployment rate emerges. This study analyzes the relationship between unemployment rate and economic growth in 10 OECD countries. The study covers the period between 1969-2018. The data used in the research were derived from the OECD-Stat database. The relationship between the variables was analysed through the panel causality test developed by Konya (2006). This test simultaneously considers the problems of cross-sectional dependency and slope heterogeneity among countries. A one-way causality relationship from economic growth to unemployment rate was determined in Canada, Denmark, France, Greece and Turkey in the result of panel bootstrap causality test developed by Konya (2006). In Australia, Canada, France, Greece, Korea, Netherlands, Sweden, Turkey and UK, a one-way causality relationship from unemployment rate to economic growth was found. In addition, a two-way causality relationship was detected between unemployment and economic growth in Canada, France, Greece and Turkey.

Structured Abstract: Unemployment and economic growth are the most effective determinants for the economic success of countries. In short, economic growth can be described as the continuous increment in the production of goods and services. Economic growth constitutes the focus of the fiscal policies of governments since it basically affects the welfare of a society through increased production. Likewise, unemployment rate is accepted as a very important indicator for governments and reducing unemployment is a significant economic problem in all the economies. What makes unemployment so important is that it drags countries into a chaos environment and causes social problems. Economic growth and unemployment problems are seen as important problems that have been continuing from past to present. Therefore many policies have been

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implemented in order to reduce unemployment rate. Among these, the most important policy is to increase economic growth. Okun's law, which is a generally accepted theory, also supports this view. According to Okun's law, a low unemployment rate stands out in the years with a high growth rate. In the years with a low economic growth rate, a high unemployment rate emerges.

This study aims to determine whether there is a long-term relationship between unemployment rate and economic growth for 10 OECD countries. In this study, data containing a 50-year period between 1969 and 2018 were used. Economic growth and unemployment data were derived the OECD-Stat database. The countries within the scope of the study are Austria, Canada, Denmark, France, Greece, Korea, Netherlands, Sweden, UK and Turkey. For this purpose, the panel bootstrap Granger causality test, which was developed by Konya (2006) and which takes cognizance of the transnational cross-sectional dependency and the heteroscedastic error term conditions in the model, was used. This test developed by Konya is a Granger causality test based on the SUR system and Wald tests with bootstrap critical values specific to units.

Two analyses need to be performed before the causality test developed by Konya (2006). The first one is the cross sectional dependence test. The second one is the heterogeneity test for slope coefficients. As a shock occurring in one country can effect other countries, the cross-section dependency should be tested. The tests used for cross-sectional dependency are the tests developed by Breusch-Pagan (1980), Peseran (2004) and Peseran et al. (2008). Cross-sectional dependence test results, , the null hypothesis, which suggests that there is no cross-sectional dependency, is refused at 1% significance level. In this way, an economic shock in a country can easily affect other countries. Another problem that needs to be examined after performing cross-sectional dependence tests is whether the slope coefficients are homogeneous. This test developed by Pesaran and Yamagata (2008) is called delta ($\tilde{\Delta}$) test. According to the homogeneity test results, the null hypothesis stating that slope parameters are homogeneous is refused at the 1% significance level. According to these results, the precondition regarding that the slope coefficients are heterogeneous under cross-sectional dependence is ensured, and panel causality test can be applied. The panel bootstrap causality test developed by Konya (2006) is depent on the Seemingly Unrelated Regressions (SUR) models and the Wald test which has bootstrap critical values specific to each cross-section in the panel. The test has two advantages. The first advantage is that this method does not require the implementation of pre-tests such as unit root and cointegration tests. The second advantage is that it pays attention to the simultaneous correlation between the cross-sections in the panel and offers more panel information. According to causality test results, economic growth is a cause of unemployment rate in Canada, Denmark, France, Greece and Turkey. In other words, there is a one-way causality relationship from economic growth to unemployment rate in these countries. In addition, unemployment is the cause of economic growth. In Australia, Canada, France, Greece, Korea, Netherlands, Sweden, Turkey and UK, there is a one-way causality relationship from unemployment rate to economic growth. On the other hand, there is a two-way causality between economic growth and unemployment in Canada, France, Greece and Turkey. Therefore The achievement of economic growth has an impact on the prevention of unemployment in Denmark. If unemployment is wanted to be reduced in this country, economic growth should be increased. In Australia, Korea, Netherlands, Sweden and UK, unemployment rate is considered as a factor affecting economic growth. The achievement of economic growth will be possible with a decrease in the unemployment rate in these countries. In Canada, France, Greece and Turkey, there is a mutual relationship between two variables, and these two variables are considered as the causes of each other.

Keywords: Economic Growth, Unemployment, Panel Causality Test.

Öz: Ekonomik büyüme ve işsizlik, ülkelerin ekonomik başarısının en önemli belirleyicileridir. Bu nedenle, ekonomik büyüme ve işsizlik sorunları geçmişten günümüze süregelen önemli bir sorun olarak görülmektedir. İşsizlik oranını azaltmak için birçok politika uygulanmıştır. Bu politikaların en önemlisi ekonomik büyümeyi artırmaktır. Genel kabul görmüş bir teori olan Okun yasası da bu görüşü desteklemektedir. Okun yasasına göre, büyüme oranının yüksek olduğu yıllarda düşük işsizlik oranı göze çarpıyor. Ekonomik büyüme oranının düşük olduğu yıllarda ise yüksek işsizlik oranı ortaya çıkmaktadır. Bu çalışma, 10 OECD ülkesinde ekonomik büyüme ile işsizlik oranı arasındaki ilişkiyi incelemektedir. Çalışma 1969-2018 arasındaki dönemi kapsamaktadır. Araştırmada kullanılan veriler OECD-Stat veri tabanından elde edilmiştir. Değişkenler arasındaki ilişki ise Konya (2006) tarafından geliştirilen panel nedensellik testi ile analiz edilmiştir. Kullanılan bu test, eşzamanlı olarak ülkeler arasındaki kesit bağımlılığı ve eğim heterojenite sorunlarını göz önüne almaktadır. Konya (2006) tarafından geliştirilen panel bootstrap nedensellik testi sonuçlarına göre Kanada,

Danimarka, Fransa, Yunanistan ve Türkiye’de ekonomik büyümeden işsizlik oranına tek yönlü bir nedensellik ilişkisi bulunmuştur. Avustralya, Kanada, Fransa, Yunanistan, Kore, Hollanda, İsveç, Türkiye ve Birleşik Krallık ülkelerinde ise işsizlik oranından ekonomik büyümeye tek yönlü nedensellik ilişkisi bulunmuştur. Yani Kanada, Fransa, Yunanistan ve Türkiye de ekonomik büyüme ve işsizlik oranı arasında İki yönlü nedensellik ilişkisi elde edilmiştir.

Anahtar Kelimeler: Ekonomik Büyüme, İşsizlik, Panel Nedensellik Test.

Introduction

In short, economic growth can be described as the continuous rise in the production of goods and services. Economic growth constitutes the focus of the fiscal policies of governments since it basically affects the welfare of a society through increased production. Likewise, unemployment rate is accepted as a very significant indicator for governments and reducing unemployment is a significant economic problem in all the economies. What makes unemployment so important is that it drags countries into a chaos environment and causes social problems.

In economic theory, the most important policy to be implemented to reduce unemployment is to increase economic growth by creating new employment opportunities. The relationship between these two variables was first examined by Arthur M. Okun in 1962 and he concluded that there was a negative relationship between real growth and unemployment rate in the US economy. This study, which entered into the literature as Okun's law, states that economic growth increases while unemployment rate decreases or economic growth decreases as unemployment rate increases.

This study aims to determine whether there is a long-term relationship between unemployment rate and economic growth for 10 OECD countries. In this study, data containing a 50-year period between 1969 and 2018 were used. For this purpose, the panel bootstrap Granger causality test, which was developed by Konya (2006) and which takes cognizance of the transnational cross-sectional dependency and the heteroscedastic error term conditions in the model, was used. This test developed by Konya is a Granger causality test based on the SUR system and Wald tests with bootstrap critical values specific to units.

The study consists of four sections. Literature review regarding the subject is presented in the first section. The data used in the study are presented in the second section and the method to be used in the analysis is introduced in the third section. In the fourth section, the findings obtained from the analysis are given. In the conclusion section, a general evaluation is presented.

1. Literature Review

The studies questioning the relationship between unemployment and economic growth were examined respectively. In their study, Noor et al. (2007) investigated the relationship between unemployment rate and economic growth in the Malaysian economy and concluded that there was a negative relationship between the two variables. In the study conducted by Kreishan in 2011, the relationship between economic growth and unemployment in Jordan was analyzed through time series analysis for the period between 1970 and 2008, and no relationship was determined between two variables. In the study conducted by Tatoğlu in 2011, the relationship between economic growth and unemployment rate in European countries between 1977-2008 was examined through panel co-integration tests and it was determined that the relationship between two variables differed from country to country. In their study conducted in 2012, Habees and Rumman investigated the relationship between economic growth and unemployment in some Arab countries and Jordan, and it was aimed to reduce the unemployment rate with the necessary economic policies. In the study conducted by Boobtane, Coulibaly and Rault in 2013, the relationship between migration, unemployment rate and economic growth was analyzed by using the panel Granger causality test developed by Konya (2006). The study was conducted for 22 OECD countries in the period between

1980-2005. In the study conducted by Aksoy in 2013, the Toda-Yamamoto method was applied by using the three-month data between 1988-2010 for Turkey and a causality relationship was detected between unemployment rate and economic growth for four among 10 industrial sectors in Turkey. Akeju et al. in 2014 analyzed the relationship between the unemployment rate and economic growth in Nigeria with the Johansen cointegration test. As a consequence of their study, it was found that there was both a long-term and short-term relationship between the two variables. Yılmaz (2014) investigated the relationship among unemployment, economic growth, export and foreign direct investment inflow in Turkey. In this study, the empirical evidence showed that there was a negative relationship between export, unemployment rate and economic growth, and that there was a positive relationship between unemployment and foreign direct investment inflows. Sadiku et al. in 2015 investigated the relationship between economic growth and unemployment by using the three-month data between 2000-2012 in Macedonia. In this study analyzed through the VAR methodology and Engle-Granger cointegration tests, it was concluded that there was no relationship between two variables. They also argued that this resulted from the high level of unregistered unemployment and structural unemployment. Chand, Tiwari and Phuyal analysed the relationship between unemployment rate and economic growth in India in 2017. In their study, they used the correlation and regression analysis for the relationship between the two variables and found a strong negative correlation between economic growth and unemployment. Soylu, Çakmak and Okur in 2018 analysed the relationship between economic growth and unemployment rate covering the period between 1922-2014 in Eastern European countries. Panel unit root, Pooled OLS and Panel Johansen Cointegration tests were used for the analysis, respectively. As a consequence of their study, they concluded that there was a cointegration relationship between these two important macroeconomic variables. In the study conducted by Makaringe Khobai in 2018, the relationship between unemployment rate and economic growth in South Africa was analyzed through the ARDL bound test approach by using the quarterly data in the period between 1994-2016. As a result of the analysis, it was found that there was a negative relationship between the two variables in the long and short term. Louoil et al. in 2019 examined the validity of Okun's law in the Saudi economy. In their study, the relationship between unemployment rate and economic growth between 1991-2017 was examined by using autoregressive distributed lag bounds testing technique and it was concluded that there was a relationship between these two variables.

2. Data

In this article, the long-term relationship between unemployment rate (ur) and economic growth (eg) was examined. The variables used for this purpose were examined through the panel causality test developed by Konya (2006) for 10 OECD countries in the period between 1969-2018. Data used in the study were derived the OECD-Stat database. The countries within the scope of the study are Austria, Canada, Denmark, France, Greece, Korea, Netherlands, Sweden, UK and Turkey.

3. Methodology

3.1. Cross-Sectional Dependency and Heterogeneity Tests

Two analyses need to be performed before the causality test developed by Konya (2006). The first one is the cross-sectional dependence test. The second one is the heterogeneity test for slope coefficients. As a shock occurring in one country can effect other countries, the cross-section dependency should be tested. The tests used for cross-sectional dependency are the tests developed by Breusch-Pagan (1980), Peseran (2004) and Peseran et al. (2008).

The test developed by Breusch-Pagan (1980) is based on the LM procedure. The null hypothesis indicates that there is no cross-sectional dependence in this test.

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij}^2$$

$\hat{\rho}_{ij}^2$ refers to the correlation coefficients among the error terms calculated from the individual OLS estimation. N: constant and $T \rightarrow \infty$ LM test statistics have a chi-square asymptotic distribution at $N(N-1)/2$ degrees of freedom. For bigger panel data, the cross-sectional dependence test developed by Pesaran (2004) is used.

$$CD_{LM} = \left(\frac{1}{N(N-1)} \right)^{1/2} \sum_{i=1}^{N-1} \sum_{j=i+1}^N$$

The CD_{LM} test statistic has a normal distribution, but still requires $T > N$. Pesaran(2004) has also developed the CD test which can be used in the case of $N > T$.

$$CD = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij}$$

In the cross-sectional dependence test developed by Pesaran et al. (2008), while the factor load averages (λ_i) were null in the common factor structure (F_t) defined as $u_{it} = \lambda_i F_t + \varepsilon_{it}$ for error term, it was shown that the CDLM1 test had a tendency not to reject the hypothesis H_0 . The problem was corrected by the test called CDLMadj test and the test statistics had an asymptotic standard normal distribution when $T > N$ (Aytun and Ekiz, 2017: 51).

$$LM_{adj} = \sqrt{\frac{2}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N \frac{(T-k)\hat{\rho}_{ij}^2 - \mu_{Tij}}{v_{Tij}} \hat{\rho}_{ij}$$

Another problem that needs to be examined after performing cross-sectional dependence tests is whether the slope coefficients are heterogeneous. This test developed by Pesaran and Yamagata (2008) is called delta ($\tilde{\Delta}$) test. The aim of this test is to investigate whether the constant term and slope coefficients are heterogeneous for each country.

$$H_0: \beta_i = \beta$$

$$H_1: \beta_i \neq \beta$$

$$\tilde{\Delta} = \sqrt{N} \frac{N^{-1}\tilde{S} - k}{\sqrt{2k}}$$

$$\tilde{\Delta}_{adj} = \sqrt{N} \frac{N^{-1}\tilde{S} - k}{\sqrt{\text{Var}(t, k)}}$$

Here, N: cross-section number, S: Swamy test statistic, k: explanatory variable number and Var (t, k): standard error (Gövdeli, 2018: 383).

3.2. Panel Granger Causality Test

The panel bootstrap causality test developed by Konya (2006) is based on the Seemingly Unrelated Regressions (SUR) models and the Wald test which has bootstrap critical values specific to each cross-section in the panel. The test has two advantages. The first advantage is that this method does not require the implementation of pre-tests such as unit root and cointegration tests. The second advantage is that it pays attention to the simultaneous correlation between the cross-sections in the panel and offers more panel information (Konya, 2006: 979).

The system of equations to be used for the panel bootstrap causality test is as follows;

$$\begin{aligned}
 y_{1,t} &= \alpha_{1,1} + \sum_{t=1}^{mly_1} \beta_{1,1,l} y_{1,t-1} + \sum_{l=1}^{mlx_1} \gamma_{1,1,l} x_{1,t-1} + \varepsilon_{1,1,t} \\
 y_{2,t} &= \alpha_{1,2} + \sum_{t=1}^{mly_1} \beta_{1,2,l} y_{1,t-1} + \sum_{l=1}^{mlx_1} \gamma_{1,2,l} x_{2,t-1} + \varepsilon_{1,2,t} \\
 &\cdot \\
 &\cdot \\
 &\cdot
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 y_{N,t} &= \alpha_{1,N} + \sum_{t=1}^{mly_1} \beta_{1,N,l} y_{1,t-1} + \sum_{l=1}^{mlx_2} \gamma_{1,N,l} x_{N,t-1} + \varepsilon_{1,N,t} \\
 x_{1,t} &= \alpha_{2,1} + \sum_{t=1}^{mly_2} \beta_{2,1,l} y_{1,t-1} + \sum_{l=1}^{mlx_2} \gamma_{2,1,l} x_{1,t-1} + \varepsilon_{2,1,t} \\
 &\cdot \\
 &\cdot \\
 &\cdot \\
 x_{N,t} &= \alpha_{2,N} + \sum_{t=1}^{mly_2} \beta_{2,N,l} y_{N,t-1} + \sum_{l=1}^{mlx_2} \gamma_{2,N,l} x_{N,t-1} + \varepsilon_{2,N,t}
 \end{aligned} \tag{2}$$

In the equation, N indicates the number of countries ($i=1,2,\dots,N$), t indicates the time interval ($t=1,2,\dots,T$) and index l indicates the lag length.

This equations have two separate characteristics: The first one is that each equation has different predetermined variables, the simultaneous relationship within the system is the only possible connection among individual regressions. For this reason, this equation system is based on the SUR system instead of VAR. Since there is a simultaneous relationship among countries, OLS estimators are not effective. In this case, the equations (1) and (2) are gathered and estimated with SUR developed by Zellner (1962). The second one is that the relevant variables are not assumed to be static since the bootstrap critical values specific to the cross-sections in the panel are used, and for this reason, there is no need to perform the unit root test or cointegration tests in advance (Özcan, 2016: 83).

4. Empirical Results

Table 1: Result of Cross-Section Dependence and Homogeneity Tests.

Test	Statistic	p-Value
LM	515.650	0.000
CD _{lm}	49.611	0.000
CD	11.762	0.000
LM _{adj}	69.603	0.000
$\tilde{\Delta}$	7.560	0.000
$\tilde{\Delta}_{adj}$	7.906	0.000

Cross-sectional dependence and heterogeneity tests were applied prior to the panel bootstrap Granger causality test developed by Konya (2006). According to the results reported in Table 1, the null hypothesis, which suggests that there is no cross-sectional dependency, is refused at 1% significance level. In this way, an economic shock in a country can easily affect other countries. Homogeneity test results are also presented in the same table. The null hypothesis stating that slope parameters are homogeneous is refused at the 1% significance level. According to these results, the precondition regarding that the slope coefficients are heterogeneous under cross-sectional dependency is ensured, and panel causality test developed by Konya (2006) can be applied.

Table 2: Results of Panel Causality Test

H ₀ : eg does not case ur					H ₀ : ur does not case eg			
	Statistics	Critic Value			Statistics	Critic Value		
		1%	5%	10%		1%	5%	10%
Australia	3.141	36.466	22.128	13.742	36.226***	10.095	5.434	3.740
Canada	17.479**	26.888	15.412	11.502	33.421***	10.399	6.050	4.100
Denmark	49.464***	32.288	17.899	12.497	0.001	10.720	5.562	3.726
France	26.128**	36.482	22.095	13.719	30.776***	10.095	5.439	3.752
Grece	81.854***	26.902	15.356	11.482	10.034**	10.395	6.040	4.117
Korea	10.505	32.254	17.895	12.533	9.489**	10.709	5.533	3.720
Netherlands	2.327	36.575	22.114	13.812	47.851***	10.067	5.432	3.751
Sweden	8.025	26.842	15.282	11.456	5.443*	10.406	6.034	4.110
Turkey	16.710*	32.170	17.877	12.525	11.548***	10.730	5.542	3.731
UK	4.079	36.629	22.122	13.864	27.473***	10.088	5.438	3.751

Notes: Bootstrap critical values were derived 10.000 replications. *, ** and *** imply rejection of the null hypothesis at the 10%, 5% and 1% levels of significance, respectively.

Table 2 shows the causality relationship between economic growth and unemployment rate. According to the results, economic growth is a cause of unemployment rate in Canada, Denmark, France, Greece and Turkey. In other words, there is a one-way causality relationship from economic growth to unemployment rate in these countries. In addition, unemployment rate is the cause of economic growth. In Australia, Canada, France, Greece, Korea, Netherlands, Sweden, Turkey and UK, there is a one-way causality relationship from unemployment rate to economic growth. On the other hand, there is a two-way causality between economic growth and unemployment in Canada, France, Greece and Turkey.

5. Conclusion

In this paper, the relationship between economic growth and unemployment rate in the period between 1969 and 2018 was examined for 10 OECD countries through the panel causality test developed by Konya (2006). In the first step of the analysis, cross-sectional dependency and heterogeneity tests were performed. Accordingly, it was concluded that both cross-sectional dependence and slope parameters were heterogeneous, which is a precondition of the causality test.

A one-way causality relationship from economic growth to unemployment rate was determined in Canada, Denmark, France, Greece and Turkey in the result of panel bootstrap causality test developed by Konya (2006). In Australia, Netherlands, Canada, France, UK, Greece, Korea, Turkey and Sweden, a one-way causality relationship from unemployment rate to economic growth was determined. In addition, a two-way causality relationship was detected between unemployment rate and economic growth in Canada, France, Greece and Turkey. The achievement of economic growth has an impact on the prevention of unemployment in Denmark. If unemployment is wanted to be reduced in this country, economic growth should be increased. In Australia, Korea, Netherlands, Sweden and UK, unemployment rate is considered as a factor affecting economic growth. The achievement of economic growth will be possible with a decrease in the unemployment rate in these countries. In Canada, France, Greece and Turkey, there is a mutual relationship between unemployment rate and economic growth, and these two variables are considered as the causes of each other.

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