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A revisited causality analysis of Okun's Law: The case of Turkey

Ugur Korkut PATA
Osmaniye Korkut Ata University, Turkey
korkutpata@ktu.edu.tr; korkutpata@osmaniye.edu.tr
Suleyman YURTKURAN
Karadeniz Technical University, Turkey
suleymanyurtkuran@hotmail.com
Adem KALCA
Karadeniz Technical University, Turkey
akalca@ktu.edu.tr

Abstract. *The relationship between the gross domestic product (GDP) and unemployment is analyzed with Okun's Law. Different studies that assess whether the two variables affect one another are examined with regard to Turkey. In this study, the authors examined whether an increase in GDP causes unemployment to fall or not with the youth (15-24 years) unemployment rate, prime working years (25-54) unemployment rate, and general (15-64) unemployment rate in Turkey. The relationship between GDP and unemployment was investigated using the unrestricted VAR and Hsiao's Granger causality test, covering the period of 2006q2 to 2014q4. According to the causality tests, the empirical results show a negative unidirectional and statistically significant causality relationship from GDP to unemployment rates in the short term. Consequently, Okun's Law is valid for Turkey.*

Keywords: economic growth, unemployment, Okun's law, Hsiao's Granger causality, unrestricted VAR.

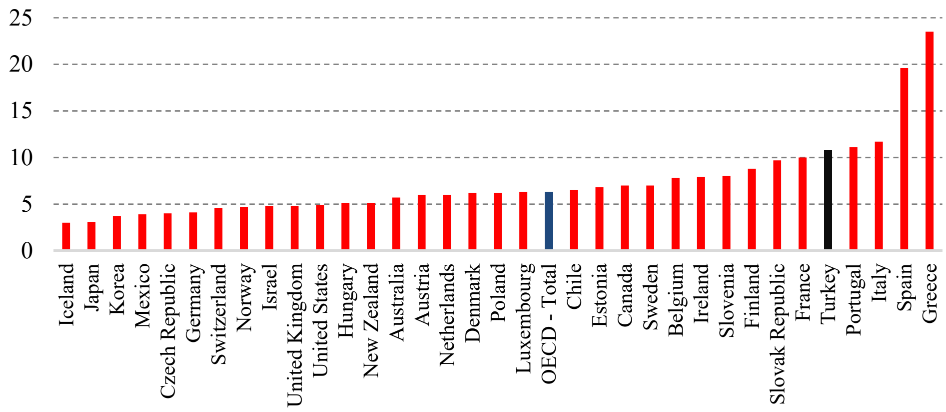
JEL Classification: E24, O40, J64.

1. Introduction

Economic growth and unemployment are two of the most important economic issues that policymakers should focus on because they are related to economic and social events and directly affect the welfare of a society. Defined as the increase in the amount of products and services produced by an economy and considered as one of the main ways to increase living standards, economic growth is a phenomenon that all countries aim to increase continuously. Increases in the factors of production and technological advances serve as the driving forces behind economic growth. These resources should be in harmony with each other to achieve economic growth (Yılmaz, 2004). As one of the factors of production, labor is in constant interaction with economic growth. Therefore, unemployment is a macroeconomic variable that has an important impact on a country's socioeconomic structure. Unemployment is defined as a situation where able-bodied working-age people are unable to find a job. It is a phenomenon that emerges in both less and more developed economies for various reasons. In less developed countries, unemployment is the result of a lack of capital, whereas it is a result of technological advances in developed countries (Yılmaz, 2005). Although there may be one major factor, it is more valid to link unemployment to various reasons rather than a single one. People may be voluntarily unemployed or may be laid off or fired. Factors such as cyclical fluctuations, seasonal events, and technological developments are among the reasons for unemployment (Dilber et al., 2015).

On the one hand, policymakers want to reduce unemployment and they try to increase economic growth by using appropriate instruments. Any increase in production brings economic growth, thus resulting in some increase in social welfare.

Figure 1. *Unemployment rates in OECD countries (2016)*

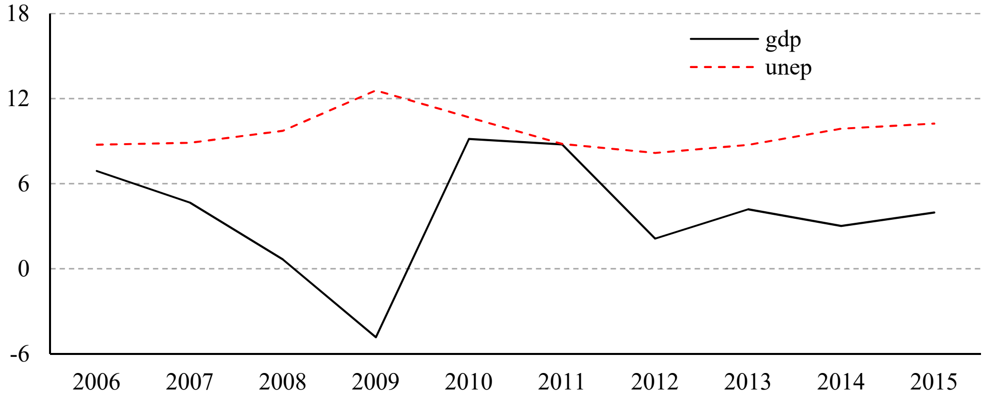


Source: https://data.oecd.org/unemp/unemployment-rate.htm

However, any increase in unemployment rates leads to certain problems for an economy. Unemployment leads to a reduced income for citizens and a subsequent decrease in total demand, which negatively affects the economy. For these reasons, unemployment, which may lead to social, moral, and economic problems in countries, is an important phenomenon for which policymakers should develop and implement policies.

We can see that the problem of unemployment has still not been solved in developed and developing countries due to the lack of meticulous and detailed policies on unemployment rates, even though these countries have achieved their desired economic and financial outcomes. Unemployment rates vary from one country to another due to political, social, economic, and cultural structures. In Figure 1, the unemployment rates for OECD member states in 2016 reveal that Iceland (3%), Japan (3.1%), South Korea (3.7%), and Mexico (3.9%) have the lowest unemployment, whereas Greece (23.5%), Spain (19.6%), Italy (11.7%), and Portugal (11.1%) have the highest unemployment rates. The average unemployment rate in OECD member states is 6.6% in 2016. Turkey is above the OECD average with an unemployment rate of 10.8%.

Figure 2. *Unemployment and economic growth rates in Turkey (2006-2015)*



Source: https://data.oecd.org/unemp/unemployment-rate.htm

Figure 2 shows the economic growth and unemployment rate in Turkey for the period 2006-2015. Unemployment rates increased in the years when economic growth slowed down. In 2009, when the effects of the 2008 global financial crisis were felt in Turkey, the country hit its lowest point with an economic growth rate of -4.58% and an unemployment rate of 12.58%.

After conducting an empirical study using data from the United States from 1947q2 to 1960q4, Arthur Okun (1962) found that the unemployment rate is low in years with high GNP growth rates and high in years with low GNP growth rates. He introduced this relationship as Okun's Law.

Okun (1970) suggested that the relationship between unemployment and economic growth could be examined using two different models: the first difference model and the gap model. Equation (1) shows the logarithm of GDP and unemployment rate (U) according to the first difference model.

$$\Delta U_t = \alpha + \beta \Delta GDP_t + \varepsilon_t \quad (1)$$

In Equation (1), ΔU_t and ΔGDP_t represent changes in the unemployment rate from t-1 to t and output growth, respectively. α is an intercept. β (β < 0) indicates "Okun's coefficient," which explains how changes in the logarithm of output affect variations in the unemployment rate, and ε_t denotes an error term. According to the basic specifications in Equation (1), the lag lengths of variables can be similar or different while computing the relationship between unemployment rate and economic growth (Lopez et al., 2014). β is expected to be negative so that increased economic growth is associated with a falling unemployment rate, and decreased output growth is associated with a rising unemployment rate. The ratio – α/β gives the rate of output growth consistent with a stable unemployment rate – that is, how quickly the economy would need to grow to maintain a given level of unemployment (Knotek, 2007).

An alternative version of Okun's law examined the relationship between the unemployment rate and GDP (the difference between actual GDP and potential GDP). Okun (1970) examined how much the economy would produce under conditions of full employment. He then considered what he believed to be an unemployment level low enough to produce as much as possible without generating too much inflationary pressure. To Okun, a high unemployment rate is related to idle resources. Therefore, the actual rate of output is below its potential. A low unemployment rate prevents the waste of resources and reduces the difference between the actual and potential rate of output. The equation of this alternative model is given below:

$$U_t = \alpha + \beta.(GDP_t - GDP_t^*) + \varepsilon_t \quad (2)$$

In Equation (2), GDP_t denotes the actual GDP, and GDP_t^* denotes the potential GDP; α is an intercept in cases of full employment. β is expected to be positive. For the cases without full employment, Equation (2) can be reformulated as:

$$U_t - U_t^* = \beta.(GDP_t - GDP_t^*) + \varepsilon_t \quad (3)$$

where U_t is the unemployment rate, U_t^* is the natural unemployment rate, and $U_t - U_t^*$ is the unemployment gap. Although Equation (3) is more meaningful than Equation (1), the need to use filtering methods such as the Hodrick-Prescott or pass-band filters before computing this equation makes it difficult to implement in the GDP gap model (Lopez et al., 2014). The main problem of the GDP gap model is the lack of a directly observable macroeconomic indicator that presents both potential output and full unemployment. Therefore, this model is constantly questioned and assessed differently by the researchers (Knotek, 2007).

Okun (1962) assumed that full employment is valid when unemployment was at 4%, and he used this assumption to construct a series for potential output. However, the level of unemployment that constituted full employment changed over time, producing a different measure of potential output. Aside from this, Okun's GDP gap model inspired other economists studying unemployment and economic growth. Although those economists developed different equations than Okun, their models based the causality relations between economic growth and unemployment on Okun's law.

Because it is difficult to define and calculate potential output and full employment in the GDP gap model, we used the first difference method to test the validity of Okun's law in this study. The remainder of the paper is organized as follows: Section 2 presents a literature review of the empirical studies on unemployment and economic growth. Section 3 focuses on the data set and descriptive statistics, and Section 4 examines the findings obtained from Hsiao's version of the Granger causality test and the unrestricted vector autoregressive model (VAR) causality analysis. Finally, Section 5 includes the interpretation of the findings and some policy recommendations.

2. Literature review

Unemployment is an important economic problem in Turkey as well as in other countries around the world. Therefore, the relationships between unemployment rate and economic growth that were first identified by Okun (1962) have been examined in various other studies conducted at the macro and micro levels.

Evans (1989) used unrestricted VAR and Granger causality test on data from the United States for the period 1950-1985 and found a short-term bidirectional causality between economic growth and unemployment rate. Attfield and Silverstone (1998) used the Johansen-Juselius cointegration and the error correction model on data from the United Kingdom for the period 1959-1994 and reported that there is a negative, statistically significant unidirectional causality running from unemployment rate to economic growth in the short-term. Moosa (1999) used the ARDL method on quarterly data from the United States for the period 1947q1-1992q2 to test the validity of Okun's Law and found that the Okun coefficient is -0.16 in the short- and -0.38 in the long-term. Viren (2001) used the error correction model on data from 20 selected OECD countries over the period 1960-1997 to verify the validity of Okun's Law. He found that there is an increase in the unemployment rate when the economic growth rate is higher than the long-term average growth rate. Sögner and Stiassny (2002) performed ordinary least square (OLS) on data from 15 OECD countries for the period 1960-1999 (data from 1960 to 1989 was used for Germany). The authors found that there is a unidirectional causality from economic growth to unemployment rate.

Yılmaz (2005) used Granger and Hsiao's Granger causality analysis covering the period 1978-2004 in Turkey and found a unidirectional causality going from unemployment rate to economic growth. Kızılgöl (2006) used the Johansen-Juselius cointegration, Hsiao's Granger causality analysis, and the vector error correction model on data from Turkey over the period 1988-2006 and found a unidirectional causality from unemployment rate to economic growth.

Moazzami and Dadgostar (2009) applied the error correction model to quarterly data from 13 selected OECD countries to verify the validity of Okun's Law for the period 1988q1 to 2007q4. They concluded that a 1% decrease in the unemployment rate increases economic growth by 2.6-4.7%. Villaverde and Maza (2009) used the OLS on data from 17 different regions of Spain covering the period 1980-2004. They found that an increase in the unemployment rate affects the economic growth negatively, but its effect varies between regions. Barışık et al. (2010) used the Markov regime-switching model to examine the relationship between the unemployment rate and economic growth in Turkey for the period 1988-2008. They found that the techniques of classic and linear time series were inadequate to explain the relationship between these two variables; therefore, techniques of nonlinear time series must be used to analyze these processes. They also indicated that the relationship between the variables was asymmetrical depending on the growth and depression periods, adding that existing growth did not reduce unemployment in Turkey. Ceylan and Şahin (2010) used the TAR and M-TAR cointegration analyses on data from Turkey covering the period 1950-2007. They found that Okun's coefficient is valid in the long-term. Muratoğlu (2011) applied the Engle-Granger, Johansen-Juselius cointegration analyses and the Granger causality test on quarterly data from Turkey covering the period 2001q1-2010q3 and reported that although there is a cointegration in the long-term, there is not a causal relationship between the two variables. The author also reported that economic growth affects the unemployment rate according to variance decomposition analysis. Kanca (2012) applied the Engle-Granger cointegration test, the error correction model, and Granger causality analysis on data from Turkey covering the period 1970-2010 and found a unidirectional causality from economic growth to unemployment in the short-term. Özdemir and Yıldirim (2013) used a wavelet approach to examine the causality relationship between the unemployment rate and economic growth in Turkey over the period 2005-2013 Their findings showed that there was a unidirectional causality running from economic growth to unemployment at the original level. There was also evidence of bidirectional causality as the frequency decreased. However, their findings do not support any causal relation between these two variables in the long-term. Aksoy (2013) used the Toda-Yamamoto causality test to examine data from Turkey for the period 1988-2010 and found a unidirectional causality running from total labor to economic growth, from economic growth to labor in the tourism and trade industry, and from labor to economic growth in the financial industry. In addition, Aksoy discovered a bidirectional causality between economic growth and labor in the energy generation, distribution, and the manufacturing industry. Şentürk and Akbaş (2014) used the same causality test as Aksoy (2013) to examine monthly data from Turkey for the period 2005m1-2012m7, and they found a bidirectional causality between unemployment rate and the industrial production index.

Tombolo and Hasegawa (2014) used OLS to examine quarterly data from Brazil for the period 1980q1-2013q3 and concluded that a 1% increase in economic growth decreases the unemployment rate by 0.19-0.21%. Kargi (2014) investigated 23 OECD member countries for the period 1987-2012 using the Engle-Granger co-integration test and the error correction model, and they found a short-term unidirectional causality running from economic growth to unemployment in 12 OECD countries. Göçer (2015) tested the validity of Okun's law in Turkey by using OLS and Granger causality analysis over the period 2001q2-2015q1. The regression analysis he made showed that every 1% of growth exceeding 4.3% reduced unemployment by 0.11%. He also found a short-term unidirectional causality from economic growth to unemployment as a result of the Granger causality analysis, thus confirming the validity of Okun's law for Turkey. Valadkhani (2015) used OLS to examine quarterly data from Australia covering the period of 1980q3-2014q1 and found that during the normal period a 2.4%, during the recession period a 4.5% increase in the economic growth decreases the unemployment rate by 1%. Arı (2016) used the Hacker-Hatemi-J causality test to examine data from Turkey for the period 1980-2014 and found no causality between growth and unemployment. Dritsakis and Stamatiou (2016) employed the ARDL, bounds testing approach, and error correction model to examine data from Greece for the period 1954-1997 and found a unidirectional causal relationship from unemployment to economic growth in the short- and long-term. Pehlivanoğlu and Tanga (2016) employed the Engle-Granger co-integration test and fully modified OLS to determine whether Okun's law was valid in the BRICS countries and Turkey. They found that Okun's coefficient has a negative value in the cases of Russia, India, and China and a positive value in the cases of Turkey and South Africa, contrary to expectations. Mucuk, Edirneligil and Gerçeker (2017) performed the Johansen cointegration test and vector error correction model to examine quarterly data from Turkey for the period 2002q1-2014q4, and the obtained findings showed that the variables are not cointegrated. This result does not support Okun's Law.

In summary, 20 of 24 studies in the literature and 8 of 13 studies using data from Turkey found that Okun's law was valid. A review of the studies on the relationship between economic growth and unemployment rate shows that there is no consensus regarding the direction of the relationship due to differences in econometric methods, variables, and the periods studied. This study aims to contribute to the literature in that the relationships between economic growth and unemployment rates divided in three age groups (15-24, 25-54, and 15-64) will be tested for the first time using the unrestricted VAR model and Hsiao's version of the Granger causality test.

3. Data and methodology

This study tested the validity of Okun's law for Turkey by examining seasonally adjusted quarterly data for the period 2006q2-2014q4 as well as the reasons for differences in the literature. Among the data used to examine the relationships between unemployment rates and GDP, U1 denotes the unemployment rate of people aged 15 to 24 years, U2 denotes the unemployment rate of people aged 25 to 54 years, U3 denotes the unemployment rate of people aged 15 to 64 years, and GDP denotes real GDP (2000 = 100). Unemployment rates and GDP data were obtained from the OECD's Main Economic Indicators - Complete Database. Table 1 shows the descriptive statistics of the four variables. All variables were included in the analysis by taking their logs.

Table 1. *Descriptive statistics*

Variables	GDP	U1	U2	U3
Mean	10.44	1.25	0.92	0.99
Median	10.42	1.24	0.89	0.97
Maximum	10.50	1.39	1.06	1.13
Minimum	10.36	1.17	0.84	0.91
Std. Error	0.04	0.05	0.06	0.06

3.1. Unit Root Tests

The augmented Dickey-Fuller (ADF) test, developed by Dickey and Fuller (1981) to test whether times series have a unit root, is an improved version of the DF unit root test. The Phillips-Perron (PP) unit root test, developed by Phillips and Perron (1988), is different from the ADF test in that error terms are statistically weakly dependent and heterogeneously distributed.

3.2. Unrestricted VAR causality test

The VAR, developed by Sims (1980), deals with variables as a whole without distinguishing between dependent and independent variables. In this model, there is no distinction between endogenous and exogenous variables. The following equations show the application of the VAR method:

$$Y_t = \alpha_0 + \sum_{i=1}^{m} \alpha_1 Y_{t-i} + \sum_{i=1}^{m} \alpha_2 X_{t-i} + u_{t1} \quad (4)$$

$$X_t = \alpha_3 + \sum_{i=1}^{m} \alpha_4 X_{t-i} + \sum_{i=1}^{m} \alpha_5 Y_{t-i} + u_{t2} \quad (5)$$

where (m) denotes the optimal lag length, and (u_{t1}) and (u_{t2}) denote the error terms. In Equation (4), α_0 denotes the constant term, α_1 denotes the coefficient of the dependent variable Y_t, and α_2 denotes the coefficient of the independent variable X_t. In equation (5), α_3 is the constant term, α_4 denotes the coefficient of the dependent variable X_t, and α_5 denotes the coefficient of the independent variable Y_t. In equations (4) and (5), dependent variables are affected both by their own lags and the lags of the independent variables.

3.3. Hsiao's Granger causality test

In the Granger causality test developed by Hsiao (1981), optimal lag lengths of dependent variables are calculated using the FPE criterion. The independent variables are then included in the model, and optimal lag lengths of independent variables are calculated based on the same criterion. When the FPE value of the dependent variable is greater than that of the independent variable, there is a causality running from the independent variable to dependent variable. Hsiao's causality test is implemented in two steps. In the first step, when the lag length is i = 1, 2,… , m, a regression analysis is performed only to calculate the optimal lag length of the dependent variable. Equation (6) shows this analysis:

$$Y = \alpha_0 + \sum_{i=1}^{m} \beta_1 Y_{t-i} + \varepsilon_t \quad (6)$$

where Y_t denotes the dependent variable, α_0 denotes the constant term, m denotes the optimal lag length, β_1 denotes the coefficient of the lags of the dependent variable, and ε_t denotes the error term. The data obtained from Equation (6) are used to calculate the FPE value (m, 0) in Equation (7):

$$FPE(m,0) = \left(\frac{T+m+1}{T-m-1}\right)\left(\frac{ESS(m,0)}{T}\right) \quad (7)$$

In Equation (7), T represents the number of observations, ESS represents the error sum of squares, and m represents the maximum lag length. To find the optimal lag length, the minimum FPE value is estimated. In the second step, dependent variable is added to Equation (6) to form Equation (8) that estimates the lag length j = 1, 2,… , n of the independent variable:

$$Y_t = \alpha_0 + \sum_{i=1}^{m} \beta_1 Y_{t-i} + \sum_{i=1}^{n} \beta_2 X_{t-i} + \varepsilon_{2t} \qquad (8)$$

In Equation (8), Y_t represents the dependent variable, α_0 represents the constant term, m denotes the optimal lag length of the dependent variable, n represents the optimal lag length of the independent variable, β_1 denotes the coefficient of the lags of the dependent variable, β_2 denotes the coefficient of the lags of the independent variable, X_t represents the independent variable, and ε_{2t} represents the error terms. The FPE (m, n) criterion is calculated as follows using Equation (9):

$$FPE(m,n) = \left(\frac{T+m+n+1}{T-m-n-1}\right)\left(\frac{ESS(m,n)}{T}\right) \qquad (9)$$

According to the results obtained from Equations (7) and (9), if FPE (m, 0) is larger than FPE (m, n), there is a causality running from the independent variable, X_t, to the dependent variable, Y_t. The model is re-estimated by replacing the dependent variable with the independent variable, and vice versa. If the FPE value of the dependent variable is found to be larger than that of the independent variable again, then there is a bidirectional causality between the variables.

4. Empirical results and discussion

The results of the ADF and PP unit root tests given in Table 2 show that four series have unit roots at their levels and they are stationary at the first difference.

Table 2. *ADF and PP unit root tests results*

	ADF		PP	
Variables	**C**	**C+T**	**C**	**C+T**
GDP	-0.73 (1)	-2.45 (1)	-0.28 [0]	-1.95 [1]
U1	-1.71 (0)	-1.74 (0)	-1.89 [3]	-1.85 [2]
U2	-1.72 (1)	-1.68 (1)	-1.61 [3]	-1.65 [4]
U3	-2.07 (1)	-2.04 (1)	-1.62 [3]	-1.61 [3]
ΔGDP	-3.96 (0)***	-3.90 (0)**	-3.88 [3]***	-3.82 [3]**
Δ U1	-5.13 (0)***	-5.05 (0)***	-5.11 [2]***	-5.03 [2]***
Δ U2	-3.69 (0)***	-3.64 (0)**	-3.79 [3]***	-3.74 [3]**
Δ U3	-3.03 (0)**	-2.97 (0)	-3.02 [2]**	-2.97 [2]

Notes: **: significant at %5 level, *: significant at %1 level, ( ) optimal lag determined by the SIC, [ ] optimal bandwidth selected with Newey-West.

The results of the unrestricted VAR analysis given in Table 3, obtained using the seemingly unrelated regression and OLS, show that there is a unidirectional causality running from GDP to U1, U2, and U3. The coefficients of these variables were found to be -2.00, -1.88, and -1.18, respectively. In other words, a 1% increase in GDP lowers youth unemployment by 2%, unemployment among the working-age population by 1.88%, and overall unemployment by 1.18%. Increased GDP reduces unemployment in all three age groups.

Table 3. *Unrestricted VAR causality test results*

Model	Causality [Coefficient]	SUR Wald Test	OLS Wald Test	R^2	k
GDP=*f*(U1) U1=*f*(GDP)	- **GDP→U1[-2.00]*****	χ^2=11.46***	F= 4.83** χ^2=9.67***	0.27	2
GDP=*f*(U2) U2=*f*(GDP)	- **GDP→U2[-1.88]****	χ^2=8.29**	F= 3.50** χ^2=7.00**	0.34	2
GDP=*f*(U3) U3=*f*(GDP)	- **GDP→U3[-1.18]***	χ^2=4.84*	F= 2.04 χ^2=4.09	0.39	2
Diagnostic Tests	**AR Roots max;min**	**LM Statistics**	**Jarque Bera**	**White χ^2**	
Model 1	0.55; 0.43	4.18 (0.38); 3.13 (0.54)	3.05 (0.55)	29.26 (0.21)	
Model 2	0.44; 0.42	1.08 (0.90); 7.70 (0.10)	0.59 (0.96)	27.60 (0.28)	
Model 3	0.54; 0.44	2.08 (0.72); 3.56 (0.47)	2.12 (0.71)	32.19 (0.12)	

Note: ***, ** and * denote significant at 1%, 5% and 10% levels respectively. The diagnostic tests performed for all three models showed that the models do not include any heteroscedasticity or autocorrelation and that the error terms are normally distributed. The roots of AR less than 1 indicated that the coefficients of the VAR models were stable.

Table 4. *Hsiao's Granger causality test results*

Model	FPE 1	FPE 2	Causality	BGP	White	JB	R^2
U1=*f*(U1(-1), GDP(-1))	0.001025	0.000826	GDP→U1 [-1.83]***	0.006 (0.94)	0.75 (0.48)	1.44 (0.49)	0.25
U2=*f*(U2(-1), GDP(-2))	0.000658	0.000575	GDP→U2 [-2.83]***	0.09 (0.23)	0.33 (0.81)	0.26 (0.88)	0.34
U3=*f*(U3(-1), GDP(-1))	0.000445	0.000418	GDP→U3 [-0.90]***	0.35 (0.70)	0.61 (0.55)	2.69 (0.26)	0.37

Note: *** significant at 1% level. ( ) in the diagnostic tests are the probability values.

The results of the Hsiao's Granger causality test given in Table 4 show that there is a unidirectional causality from GDP to U1, U2, and U3. The coefficients of these variables were found to be -1.83, -2.83, and -0.90, respectively. This means that any increase in GDP reduces unemployment in all three age groups. The diagnostic tests performed for all three models showed that the models do not include any heteroscedasticity or autocorrelation problems and that the error terms are normally distributed.

Table 5. *Cusum and Cusum-sq test results*

Model	Cusum	P-value	Cusum-sq	P value
U1=f(GDP)	0.73	0.21	0.13	0.87
U2=f(GDP)	0.77	0.16	0.19	0.43
U3=f(GDP)	0.77	0.16	0.22	0.28

Cusum and cusum-sq tests, developed by Brown et al. (1975), are used to test whether the coefficients obtained from the analysis are stable. Cusum and cusum-sq structural break tests are updated recursively and plotted against the model's break points (Jalil and Mahmud, 2009). The null hypothesis of no structural break could not be rejected for the three models shown in Table 5. In the models estimated using causality analyses, no structural break was found and the coefficients were found to be stable.

5. Conclusion

Reduced economic growth is one of the reasons for increased unemployment. Due to the concern for the future that emerged in societies following the 2009 global economic crisis, total demand and investments reduced. Reduced total demand caused total supply to decrease, regressing the economic growth rates. Because companies were not able to manufacture as many goods as they could previously, they resorted to laying off their workers, which led to increased unemployment rates. We see that economic growth showed an upward trend in Turkey following this period; however, sustainable economic growth was not achieved. Thus, the unemployment problem was not solved.

This study examined the causality relationship between economic growth and unemployment rates for Turkey over the period between 2006q2 and 2014q4. The causality relationships between GDP and the unemployment rate of people aged 15 to 24 years (U1), the unemployment rate of people aged 25 to 54 years (U2), and the unemployment rate of people aged 15 to 64 years (U3) were analyzed using unrestricted VAR and Hsiao's Granger causality analysis. At the end of the unit root tests, all variables were found not to be stable at their levels but stable at first difference. The results of the unrestricted VAR and Hsiao's Granger causality analysis show that there was a negative, unidirectional, and statistically significant causal relationship running from GDP to U1, U2, and U3.

Okun (1962) found that an increase in the unemployment rate would reduce GDP. Another study of Okun (1970) used both the first difference model and the GDP-gap model and reported that there was a causality running from GDP to unemployment. The study also showed that unemployment decreased with increasing GDP. Our findings support Okun's law because they showed that an increase in GDP reduced unemployment in all three groups.

To achieve sustainable economic growth and to reduce unemployment, policymakers should eliminate ambiguities about the future, keep the risks to a minimum, and boost the market through the implementation of monetary and fiscal policies. In order to support economic growth and increase employment, it is important to use fiscal policy instruments such as offering loan incentives, increasing public expenses, and reducing tax rates. The findings of this study reveal that, with increased economic growth, youth unemployment in Turkey will be reduced more compared to overall unemployment. For a country with a young and dynamic population, the effective and efficient employment of young people is highly important.

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