

The Relationship between Unemployment and Economic Growth in Jordan: An Empirical Study using the ARDL Approach

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This paper focusses on investigating the relationship between unemployment, and economic growth in Jordan during the period 1976–2018. The Autoregressive Distributed Lag (ARDL) cointegration analysis was used to determine the relationship between them. This is suitable for small samples, without specifying the natural rate of the gross domestic product (GDP), and the natural rate of unemployment. A negative pattern was found between unemployment, and the real GDP, which matches the funding from Okun's law. We were also able to identify the direction of the relationship between the real GDP, and unemployment in the long and short terms to have bidirectional causality.

Keywords: *Okun's law, ARDL, Causality, Unemployment, Economic growth.*

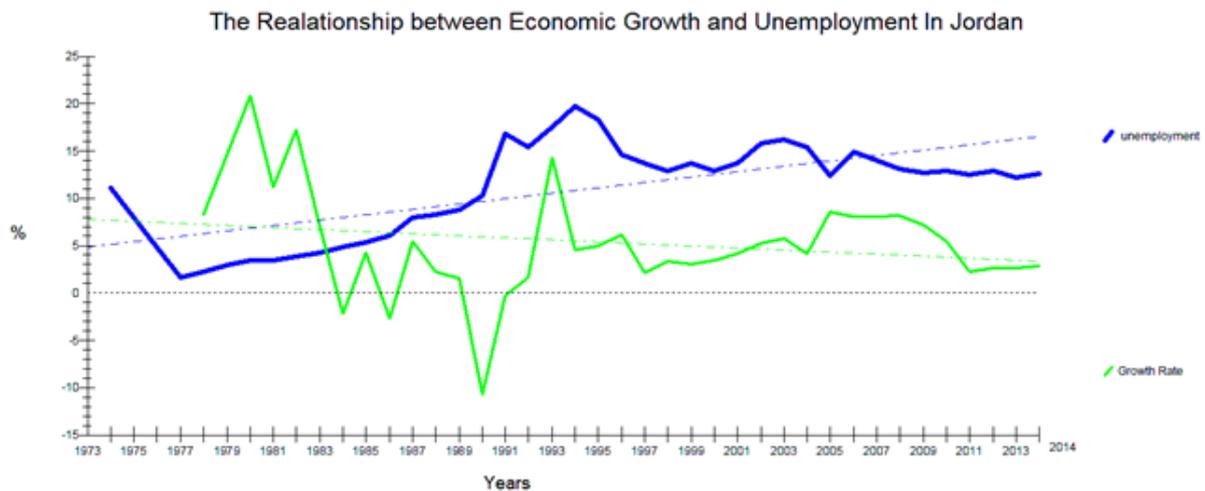
Introduction

Economic growth is directly related to the demand for factors of production. Economic growth, investment, and production may increase demand for factors of production, such as labour, and capital. Therefore, economic growth is affected by the size of employment. Unemployment similarly responds to changes in economic growth. Okun (1962) explained the nature of the relationship between gross domestic product (GDP) growth, and the change in the unemployment rate. He also stated that the decline in GDP growth is causing the unemployment rate to rise, and vice versa.

The study demonstrates how the Jordanian economy is negatively correlated with the growth of the GDP, and unemployment, as shown in Figure 1. This shows a reverse trend between

GDP growth, and the unemployment rate during the period of 1976–2018. Thus, this has raised a question: does reducing the unemployment rate trigger a real GDP growth or does real GDP growth trigger a reduction in unemployment or do both affect one another?

Figure 1. The relationship between economic growth and unemployment in Jordan



Jordan has been suffering from the problem of unemployment for a long time now. This is in addition to the crises surrounding Jordan since the nineteen-eighties. Furthermore, the consequent migration, and asylum has aggravated this problem. Reducing the unemployment was the ambition of all government plans, and programs.

Therefore, this study applies the Okun law in the economy of Jordan to determine the outcome of real GDP growth upon the unemployment rate. The Autoregressive Distributed Lag (ARDL) methodology is used to determine the cointegration and correlation among the variables, as well as the relationship of Okun's law in the long term. The analysis aims to reflect the effects of economic growth on the increase of employment, in order to reduce unemployment in the case of Jordan. This is done in an effort to be able to assess the degree to which Okun's Law applies to the Jordanian economy. This paper covers the complication of unemployment in Jordan, growth in the economic literature, the econometrics model, and the study findings.

Unemployment in Jordan

Unemployment is a challenge for both developed and developing areas. It is estimated that the rate of unemployment in Jordan, within the last decade, nears 13 per cent. Consequently, the number of unemployed is on the increase, as 2014 alone anticipated 15 million unemployed in the Arabic world, and 174,000 of which were in Jordan (Arab Monetary Fund, 2015). Figure 2 shows that the unemployment rate reached its highest level during the

period of 1976–2018, with the highest rate at 19.7 per cent in 1993, and the lowest rate at 2.2 per cent in 1977. However, it has shown a downward trend since 2006.

Figure 2. Unemployment rates during the period 1976–2018

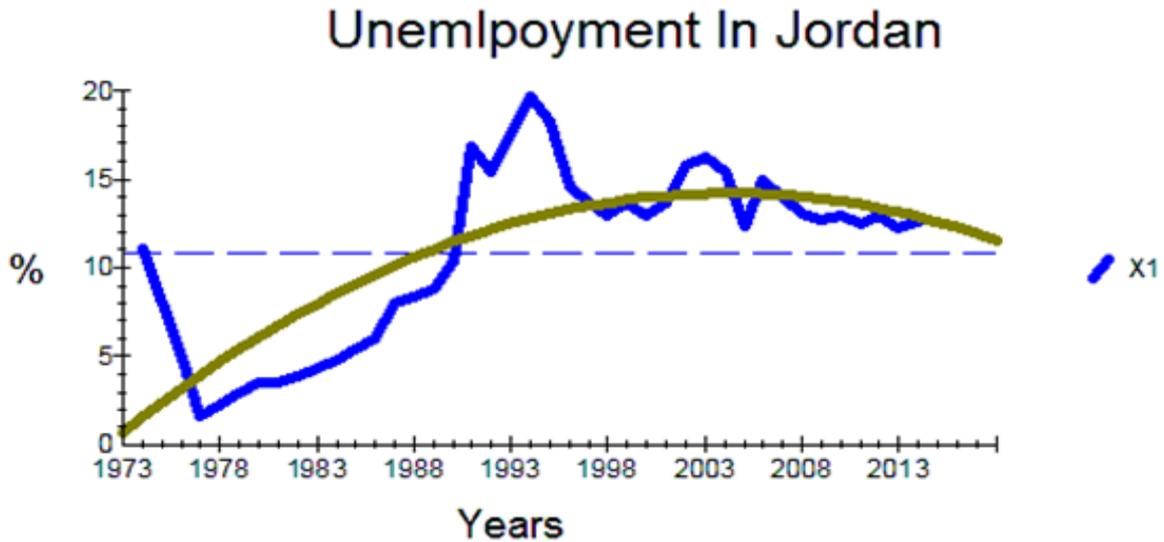
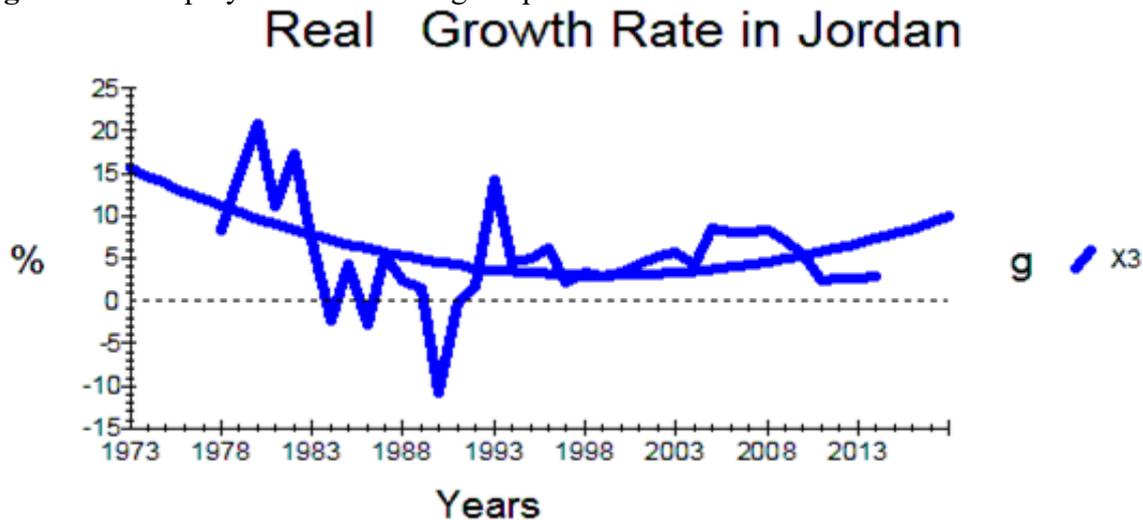


Figure 3 shows changes in the economic growth rate, with a maximum of 20.8 per cent in 1979, and a minimum of -10.7 per cent in 1989. In addition, it has been progressing since 2006.

Figure 3. Unemployment rates during the period 1976–2018



Unemployment is one of the factors that threatens economic stability, and the unity of societies. The emergence of unemployment in Jordan is attributed to economic, social, and political motives. The main reasons for this phenomenon can be summed up by the unnatural increase in population growth in Jordan. This is as a result of the issues neighbouring

countries were experiencing. Such issues include entering Kuwait in 1990, a quarter of a million Jordanians returning from the Arabian Gulf region, the occupation of Iraq in 2003, the reception of nearly half a million Iraqi citizens, the events of the Arab spring in Syria, and the reception of over one million Syrian citizens. This also includes the failure of economic development plans to achieve their objectives, Jordan's falling under the burden of internal and external debt, the inadequacy of Jordanian education, and labour market programs. The implementation of the policies of economic openness, and the accompanying privatisation programs have led to the abandonment of a number of workers in the public sector after privatisation. This is in addition to the lack of investments to develop the economy and build a productive base. Therefore, this has resulted in a fluctuation of economic growth rates; the decline of the Government role, as the main employee; and the effectiveness of fiscal, and monetary policy in achieving adequate growth, and employment.

Literature Review

The inspected literature outlines the relationship between unemployment and economic growth. Okun (1962) revealed a relationship between economic growth and unemployment and later explained the reduction of unemployment on the GDP. A reduction in the unemployment rate by one per cent would increase the GDP by three per cent or a three per cent decrease in the GDP leads to a one per cent increase in the unemployment rate above the normal rate¹. We assume that the most important objective of the Government is to eliminate unemployment. However, economists point out that the normal rate of unemployment is between four and six per cent. This means that the growth rate of the GDP must be equal to its prospective growth, in order to maintain the unemployment rate. Therefore, the GDP must be higher than the prospective growth rate. Hence, the ups and downs of the economy or the expansion and contraction of real GDP, represent a higher or lower employment level when compared to the normal rate. For example, unemployment occurs when the economy faces a recession called 'periodic unemployment' or it occurs as a result of an economic slowdown strike.

Altunöz (2019) has investigated the relationship between economic growth and unemployment in the Eurozone by considering Okun's law using the panel data that covers the period from 2000 to 2012. The study results have shown that Okun's law is achieved, and the coefficient of cointegration is lower than the coefficient of Okun, which has been calculated for the United States (US), and other studies that have been conducted for developed countries.

¹ The unemployment rate corresponds to the normal level of employment, and it is known as the normal unemployment rate. It is not measurable.

The results of Pata et al. (2018) have approved analysis of the relationship between the GDP and unemployment in Turkey through the validity of Okun's law. As such, authors have examined whether an increase in the GDP causes a decline in the unemployment rate with the youth unemployment rate from 15–24 years old, unemployment rate of main years of work from 25–54 years old, and general unemployment rate from 15–64 years old. The results show a negative one-way and statistically significant causal relationship from the GDP to short-term unemployment rates.

Likewise, Pierdzioch, Rülke, and Stadtmann (2011) assured that Okun's law applies to the G7 countries. Besides, they indicated the negative relationship between the unemployment rate, and the rate of growth of real output.

Furthermore, Zagler (2003) has used a vector error correction model to analyse the relationship between the unemployment rate, and the economic growth of four major European countries, including France, Germany, Italy, and the United Kingdom (UK). The results refer that the growth rate, and the unemployment rate are positively complementary. This result refutes Okun's law. However, in the short term, the increase of the unemployment rate leads to a decline of the rate of growth, and such a result agrees with Okun's law.

Evans (1989), on the other hand, has examined the causal relationship between the unemployment, and economic growth rates in the United States for the period of 1950–1985. He found a short-term bidirectional causality between the economic growth, and unemployment rate. Moreover, Attfield and Silverstone have also used Johansen-Juselius' cointegration, and the error correcting model for the UK, from 1959 to 1994. They reported that there was a statistically significant unidirectional causality that extends from the unemployment rate to the economic growth, in the short term. Moreover, Moosa (1999) has used the ARDL method on the US economy to examine the validity of Okun's law. He found that Okun's coefficient is 0.16 in the short term, and -0.38 in the long term.

Hamdan (2013) measured the impact of employment on economic growth during the period of 1995–2010 by using the Solow model to determine the contribution of labour in economic growth. The results revealed that the economic variables were unstable over the period, and it became stable after taking the first difference. Hamdan also verified the cointegration by using the Johansen method. He concluded that the elasticity of labour, and capital was 0.63, and 0.53, respectively. In addition, each contributed to the interpretation of 78.8 per cent of the changes in the GDP growth rate.

Abu (2017) utilized the ARDL to test the applicability of Okun's law in Nigeria during the period of 1970–2014. He concluded that there was a correlation between unemployment, economic growth, and oil prices in the long term. Unemployment affected the economic

growth negatively, at a rate of 0.18 per cent. Therefore, he recommended that policymakers should start taking steps to reduce unemployment, in order to boost Nigeria's economic growth.

Karfakis et al. (2014) examined the relationship between unemployment and output in Greece during the period of 2000–2012. Here, Grainger's probabilities presented the real output to understand the future movements in unemployment. Okun's ratio was at 1:3, which means that an increase of one per cent in unemployment leads to a decrease of real GDP by three per cent. The analysis revealed that the unemployment response to real output was stronger during the contraction of real economic activity.

Abdel-Raouf (2014) examined whether Okun's law was stable over time by focussing on the recession that occurred as a result of the 2007–2009 real estate crisis. She found that Okun's law was not stable and was sensitive to business cycles.

Only a small number of studies have been conducted within the Arabic world. Al-Shorbagi (2009) measured the effect of economic growth on employment in the Egyptian economy, both in the short, and long terms. He used the ARDL methodology to collect the data for the period of 1982–2005 and found a small positive effect on the economic growth in the short term. He also found a positive effect of both foreign investment, and total commodity exports upon long-term employment. However, the impact of imports yielded a negative effect on long-term employment.

Some scholars have studied the relationship between unemployment and production in the context of Jordan. For instance, Kreishan (2011) examined the relationship between unemployment and economic growth in Jordan by applying Okun's law. He used annual data for the period of 1970–2008, and the simple linear regression between the rate of unemployment and economic growth. He found that Okun's law is not compatible to be applied to Jordan. However, Alamro and Al-zdala'ien (2016) measured the effect of economic growth on unemployment in the Jordanian economy, in both the short, and long terms during the period of 1980–2011. They were able to apply Okun's law by using the ARDL methodology, and an ECM model, in both short and long-term unemployment.

The few studies conducted on the relationship between employment and production in Jordan have used some unsuitable estimation methods or failed to perform important tests, which should not be using the OLS method, as some of its data have used unit root (see Kreishan 2011). Furthermore, authors have never conducted post-estimation tests, as autocorrelation, and heteroscedasticity tests, to make sure that estimates were free of these problems.

Accordingly, this study applied the ARDL methodology to reveal the applicability, and compatibility of Okun's law in the Jordanian economy, despite the small size, in addition to the impact of the financial crisis in 2007.

This study introduces a contribution to the economic literature in the relationship between economic growth, and unemployment rates, which will be tested using the ARDL model, and the Granger causality test.

Econometrics Model

Specifications of Model

Many scholars have relied on Okun's law to explain the effect of aggregate demand on production, on labour, and consequently, on unemployment rates. Unemployment is one of the most influential factors in production. This is because reducing unemployment leads to the increased GDP of goods, and services.

To estimate Okun's coefficient, two approaches were used. The first, is the output gap approach, and the second, is the use of output growth, and the first difference in the unemployment rate. Okun used the output gap approach by regressing the unemployment regression (UNEM) on the deviations of the actual output from the potential output, as follows:

$$UNEM - UNEM^* = a + b(Output\ Gap) \quad (1)$$

Assuming that the output gap is calculated as the first difference of output (economic growth rate), the equation is rearranged as follows:

$$\Delta UNEM_t = a - b \left(\frac{\Delta GDP}{GDP} \right)_t \quad (2)$$

On the contrary, we can analyse the demand in Okun's law using the first difference. Also, we can interpret the output response to changes in unemployment, and thus, express the relationship, as follows:

$$\left(\frac{\Delta GDP}{GDP} \right)_t = a - b \Delta UNEM_t + \varepsilon_t \quad (3)$$

(or)

$$\Delta \log GDP_t = a - b \Delta UNEM_t + \varepsilon_t \quad (4)$$

Equation four clearly indicates that the output is dependent on unemployment (UNEM), and the relationship between them is negative. In the equation, 'b' is Okun's coefficient that

determines the effect of the GDP growth on unemployment. When the coefficient is small, job security will increase in the recession. This is the main concern of the negative effect of growth on unemployment. If the unemployment rate is affected by small GDP growth, individuals will find it difficult to live without work, and without income, which would have an adverse effect on the economy.

Therefore, for the purpose of this study, it is assumed that the increase in GDP will lead to a decrease in unemployment. This means that the growth rate of the GDP, and the unemployment rate are negative. Accordingly, the relationship will be determined, as follows:

$$\Delta UNEM_t = \alpha_0 - \alpha_1 \Delta GDP + \varepsilon_t \quad (5)$$

Annual data from the Central Bank of Jordan, and the Department of Statistics were used to test the connection between the unemployment rates, and the real GDP growth rate by using annual data during the period of 1976–2018. All variables were converted to the natural logarithmic form to obtain a direct elasticity estimate.

The bound test methodology for cointegration will be used under the ARDL model, as proposed by Pesaran et al. (2001). This is, however, regardless of the cointegrated order I(0) or I(1), or a mixture of both. Since the Johansen methodology requires a large sample size, the ARDL methodology is best used to demonstrate the relationship of cointegration in smaller samples. This methodology also allows variables to have a different lagged period of ARDL (p, q) to test the cointegration between the unemployment rate, and income. To apply this methodology, we first begin by testing the long-term relationship among the variables, and the cointegrated order of the I(0) or I(1), using the Augmented Dicky Fuller Test (ADF) to test the hypothesis of non-stationary. If the degree of cointegration of the variables is zero or one, we can apply the ARDL procedure to test the cointegration of unemployment, and the GDP gap. This phase includes the detection of a long-term equilibrium relationship between the unemployment rate, and the GDP gap in a multivariate framework by using the following unrestricted error correction model (UECM):

$$\Delta unemp_t = \alpha + \beta_1 unemp_{t-1} + \beta_2 gdp_{t-1} + \sum_{i=1}^n \gamma_{1i} \Delta gdp_{t-i} + \sum_{i=1}^m \gamma_{2i} \Delta unemp_{t-i} + \varepsilon_t \quad (7)$$

Displayed below is the null and alternative hypothesis to be tested:

$$H_0 : \beta_1 = \beta_2 = 0$$

$$H_1 : \beta_1 \neq \beta_2 \neq 0$$

It is assumed for all the parameters to have a low of I(0), and a high of I(1). If the calculated F statistic is less than the low critical value, we cannot reject the null hypothesis of held cointegration. On the other hand, if it is greater than the upper critical value, the null hypothesis will be rejected. This means that there is a stable equilibrium between the variables in the model. If the two variables are cointegrated, we would move on to the third stage, which is the VECM estimate by adding the error term to the unrestricted VAR model, as follows:

$$\Delta unemp_t = \alpha + \sum_{i=1}^n \theta_{1i} \Delta gdp_{t-i} + \sum_{i=1}^m \theta_{2i} \Delta unemp_{t-i} + \eta ECT_{t-1} + e_t \quad (4)$$

Cointegration Test

Root Unit Test

Subsequently, we start by testing the unit root. Table 1 shows the results of the unit root test to analyse the stationary of unemployment, and the GDP:

Table 1: The unit root test

	Model	ADF statistics	Lagged period
	Level		
Unemployment	Constant	-1.665	1
GDP growth	Without constant and without trend	2.165	1
	First difference		
Unemployment	With constant and without trend	-5.578***	0
GDP growth	With constant and without trend	-3.155**	0

Notes: null hypothesis: Non-stationary of the time series or it contains a root unit. The length of the lag was determined according to SC criteria between 0 and 9. * ,**and *** indicate rejection of the null hypothesis of non-stationary at a significant level of 10%, 5%, and 1%, respectively.

The unit root test was calculated at the level, and at the first difference. The unemployment rate, and the GDP showed that the level I(0) is not stationary, and becomes stationary after taking the first difference I(1). As we analyse the regression in the VAR equation system, the variables integrated must be of the same order. Hence, it is clear that the calculated t-statistic value of the first difference variables was greater than the critical t-statistic. Using this

approach, the VAR model can be applied, and the relationship between the variables can be analysed.

Cointegration Test

The Bounds test in Table 2 was performed to assess the hypothesis of cointegration. According to the test, the null hypothesis was rejected at a one per cent significance level. However, the calculated F-statistic was greater than the critical value of the upper limit. Thus, there is a long-term cointegration between the unemployment rate, and its determinant based on the ARDL test result. Also, the periods of lag were selected by Schwarz Criterion (SC).

Table 2: ARDL Bounds Test Results

Test Statistic	Value	k
F-statistic	11.28770	1
Null Hypothesis: No long-run relationships exist		
Critical Value Bounds		
Significance	I ₀ Bound	I ₁ Bound
10%	3.02	3.51
5%	3.62	4.16
2.5%	4.18	4.79
1%	4.94	5.58

Long-Term Relationship

Okun's coefficient revealed the direct proportionality of changes in the GDP at five per cent significant levels. Therefore, a decrease in the GDP growth of one per cent would raise the unemployment rate by 0.256 per cent. This illustrates the relationship between economic growth, and unemployment. A one per cent reduction in the unemployment rate will increase the real GDP growth by 3.9 per cent, and vice versa. The decline in this ratio confirms the workers' sense of job security in the event of an economic recession. Thus, we conclude that Okun's law exists within the Jordanian economy. This is confirmed by the study of Alamro and Al-dala'ien (2016), when they reviewed the relationship between economic growth, and unemployment in the Jordanian economy, and in both the short and long-term during the period of 1980–2011.

Ordinarily, Jordan's natural unemployment rate is 13.0 per cent, when there is no apparent growth in the GDP. However, if the Jordanian economy grows by five per cent under normal conditions, unemployment will drop to 11.7 per cent. This is the reason for the policy of deliberately increasing the economic growth, and making decisions in this regard, whether

fiscal or monetary decisions. This is because these decisions stimulate beneficial projects, attract foreign direct investment, and expand the market economy.

$$uemp_t = 13.0 - 0.2557 gGDPr$$

$t = (13.0583) \quad (-1.7634)$

Table 3: Long-Term Relationship

Long Run Coefficients						
Variable			Coefficient	Std. Error	t-Statistic	Prob.
Real Economic Growth Rate			-0.255686	0.144993	-1.763438*	0.0855
C			13.00859	0.996191	13.05833***	0.0001
Source: check appendix for data. ***significant at 1%, **significant at 5%, *significant at 10%.						

Short-Term Relationship

The causality test was performed with a long lag of error term. The ARDL test showed that the two variables, ‘*unemp*’, and ‘*GDPr*’, are cointegrated. Therefore, we would conduct the causality test by adding the error term to the equation.

The relationship of the cointegration of ‘*unemp*’, and ‘*GDP*’ shows that there is a bilateral relationship. Table 4 shows the results of the short and long terms, according to the error correction model mechanism (ECM). The F-statistic for the explanatory variables in each of the three equations indicates the statistical significance of the short-term causality effects. In addition, the t-statistic for the coefficient of error correction term in the variable, ‘*GDPr*’ equation indicates a significant effect on the long term.

Table 4: Results of the causality test

Dependent	Short term variables		Long term variable
	<i>Unemp</i>	Gdpr	ECT
<i>Unemp</i>	-	5.114*	-0.981***
Gdpr	12.705***	-	-0.840***
* significant at 10%, ** significant at 5%, *** significant at 1%.			

The results of the causal relationships between the ‘*unemp*’, and the ‘*GDP_r*’, shown in Table 4, can be summarised, as follows:

1. Cannot accept the null hypothesis of the causal relationship from real GDP growth to unemployment. This would cause the independent variable, and the economic growth to negatively affect the dependent variable, unemployment, in the short term.
2. Cannot accept the null hypothesis of the causal link from unemployment to the real GDP. This would cause the independent variable, unemployment, to affect the economic growth in the short term.
3. This confirms the bilateral causality between economic growth and unemployment in the short term.
4. The ECT also indicates that there is a need to correct the imbalance between the unemployment rate, and the GDP. This verdict confirms the long-term relationship, and the stability of Okun’s relationship. There is also a long-term causal relationship between the real GDP, and unemployment.

Goodness of the Model

A set of tests was conducted to judge the suitability, and sustainability of the model, which was used to measure the estimated parameters, as shown below:

Autocorrelation Test: the Breusch-Godfrey serial correlation LM Test was used to test for autocorrelation. The values of the Statistic-F, and Chi-Square indicated insignificance in both short, and long terms. This applies to a significance level of five per cent. Therefore, the null hypothesis is not to be rejected, and the model is devoid of the problem of autocorrelation.

Table 5: Results of autocorrelation test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.323141	Prob. F(3.30)	0.8086
Obs × R-squared	1.220799	Prob. Chi-Square(3)	0.7480
* we cannot reject the null hypothesis at the level 5%.			

Normality Test: normality was verified using the Jarque-Bera test. The value of its probability at 0.599 revealed that Statistic-F, and Chi-Square were insignificant up to five per cent. This means that the null hypothesis is not to be rejected. Thus, the distribution is normal.

Heteroskedasticity Test: the Breusch-Pagan-Godfrey test was displayed in Table 6, and the values of the F-statistic, and Chi-Square were insignificant. Consequently, the model did not suffer from the heteroskedasticity problem.

Table 6: Results of heteroskedasticity test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.057888	Prob. F(5.33)	0.4011
Obs × R-squared	5.387601	Prob. Chi-Square(5)	0.3704
Scaled explained SS	4.739091	Prob. Chi-Square(5)	0.4485
* we cannot reject the null hypothesis at the level 5%.			

Structural Stability Test: the structural stability test of the model was carried out through the CUSUM test, which conveys the behaviour of the cumulative total of the residuals, and the cumulative sum of squares (CUSUMSQ) test. These two tests, shown in Figure 5, and Figure 6, demonstrate that both the sum of the residues, and the sum of their squares, fall under the five per cent limit. Hence, this makes the model structurally stable. The results of previous tests demonstrate the suitability of the model used, and the results are of a high quality.

Figure 5. CUSUM test

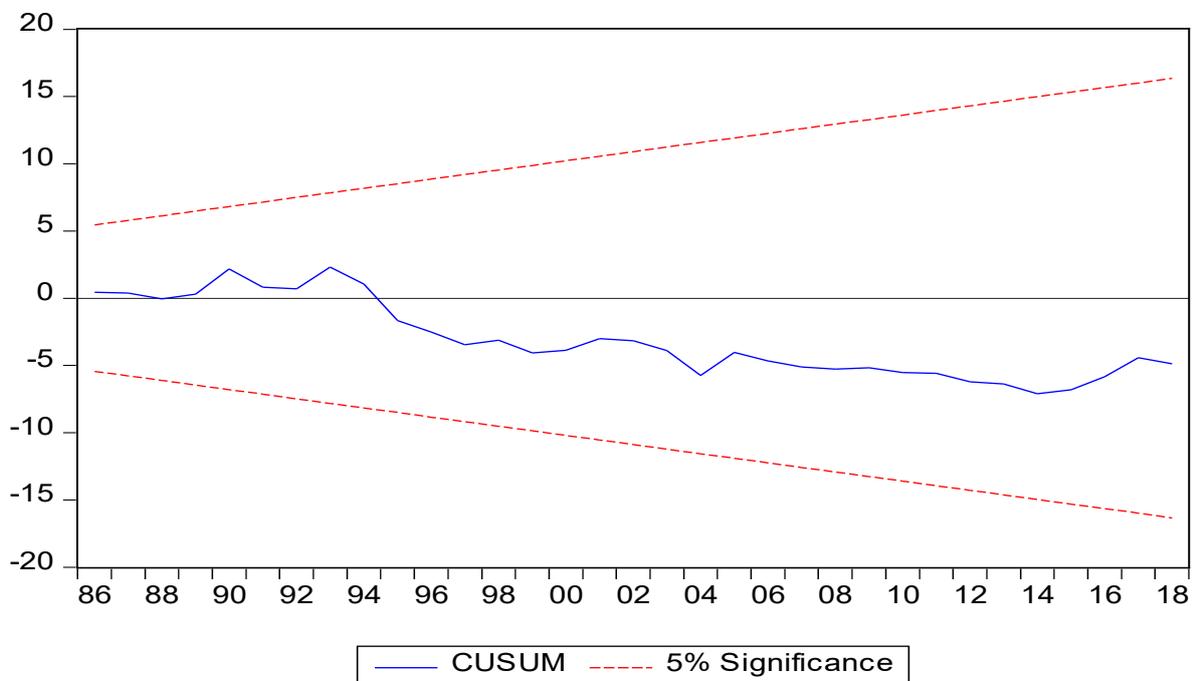
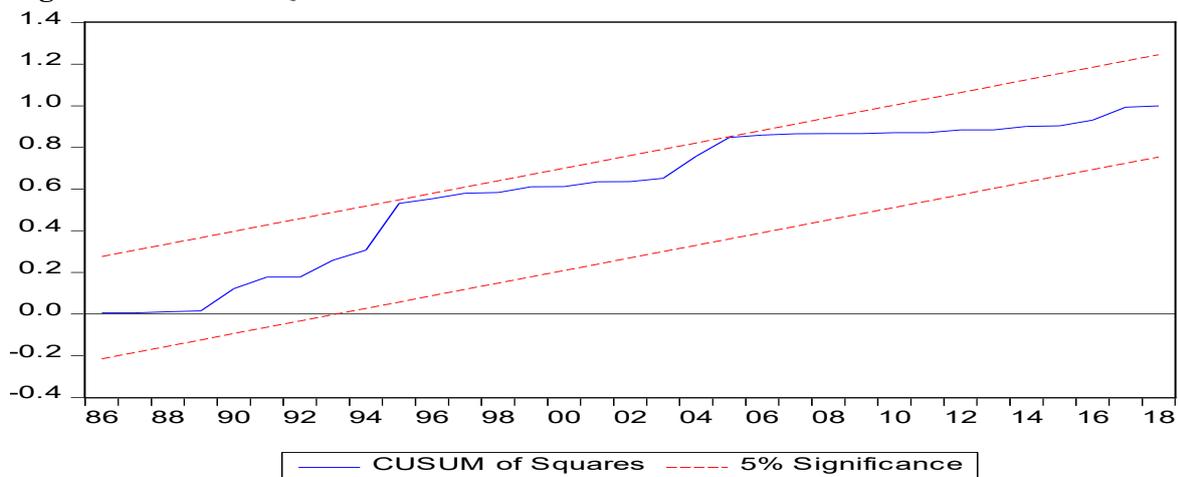


Figure 6. CUSUMSQ test



Conclusion

The analysis disclosed that Okun's law applies to the case of Jordan, and Okun's coefficient was estimated by means of the ARDL methodology to be -0.26. A negative correlation was detected between the unemployment rate, and the output growth in Jordan. A bidirectional relationship exists from the real GDP to unemployment in the long term. However, the real GDP has a negative relationship with unemployment in the short term. The rate of natural unemployment in the absence of economic growth stands at 13.0 per cent.

The long term results have shown that when economic growth increased by one per cent, the expected decline in the unemployment rate would be 0.26 per cent, which means that Jordan's Okun's law equals -0.26 per cent. In other words, in the event of the increase of unemployment by one per cent, expected decline in real production would reach 3.85 per cent in the long run. The results of Okun's law coefficient indicate a negative relationship between the unemployment rate, and the real GDP, since low economic growth is one of the reasons for the increase in unemployment; as the decline in aggregate demand causes the decline in aggregate supply, and as a consequence, a decline in production, which leads to a decline in economic growth rates. As such, companies cut their workers, leading to an increase in unemployment, and this economic situation reinforces long-term unemployment problems. Therefore, we conclude that the finding of the study supports Okun's law, as it shows that increasing the GDP reduces unemployment in the Jordan context.

Funding

This research was funded by the Deanship of Research in Zarqa University, Jordan.

REFERENCES

- Abdel-Raouf, F. (2014). "On the Stability of Okun's Law: Evidence from the Great Recession of 2007-2009." *The Journal of Business and Economic Studies*, 20(1): 75-95.
- Abu, N. (2017). "Does Okun's Law Exist in Nigeria? Evidence from the ARDL Bounds Testing Approach." *Contemporary Economics*, 11(2): 131-144.
- Alamro, H. & Al-dala'ien, Q. (2016). "Validity of Okun's Law: Empirical Evidence from Jordan." *Dirasat, Administrative Sciences*, 43(1): 315-324.
- Altunöz, Utku (2019). "The Relationship between Real Output (Real GDP) and Unemployment Rate: An Analysis of Okun's Law for Eurozone", *Sosyoekonomi*, Vol. 27(40), 197-210.
- Arab Monetary Fund (2015). "*Consolidated Arab Economic Report*."
- Attfield, C.L.F. and Silverstone, B., (1998). "Okun's Law, cointegration and gap variables". *Journal of Macroeconomics*, 20(3), pp. 625-637.
- Evans, G.W., (1989). "Output and unemployment dynamics in the United States: 1950-1985". *Journal of Applied Econometrics*, 4(3), pp. 213-237.
- Hamdan, B. Sh. (2013). "The Impact of Employment on Economic Growth in Palestine." *Al-Azhar University Journal, Gaza, Human Sciences Series*, 15(1): 23-52.
- Karfakis, C., Katrakilidis, C., & Tsanana, E. (2014). "Does output predict unemployment? A look at Okun's law in Greece." *International Labour Review*, 153(3): 421-433.
- Kitov, I. & Kitov, O. (2012). "Modeling Unemployment and Employment in Advanced Economies: Okun's Law with a Structural Break." *Theoretical and Practical Research in Economic Fields*, 3(1): 26-41.
- Kreishan, F. M. (2011). "Economic Growth and Unemployment: An Empirical Analysis." *Journal of Social Sciences*, 7(2): 228-231.
- Moosa, I.A., (1999). "Cyclical output, cyclical unemployment, and Okun's coefficient a structural time series approach". *International Review of Economics and Finance*, 8(3), pp. 293-304.
- Okun, A. (1962). "Potential GNP: Its measurement and Significance." *American Statistical Association: Proceeding of the Business and Economics Statistics Section*.



- Pata, Ugur Korkut; Yurtkuran, Suleyman & Kalca, Adem (2018). "A revisited causality analysis of Okun's Law: The case of Turkey", *Theoretical and Applied Economics*, 25(4): 117-130.
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). "Bounds testing approaches to the analysis of level relationships", *Journal of Applied Econometrics*. 16: 289-326.
- Pierdzioch, C., Rulke, J. C., & Stadtmann, G. (2011). "Do professional economists' forecasts reflect Okun's law? Some evidence for the G7 countries". *Applied Economics*, 43(11), 1365-1373.
- Shorbagi, M. (2009). "The impact of economic growth on employment in the Egyptian economy." *Journal of North African Economics*, 6: 141-174.
- Zagler, M. (2003). "The dynamics of economic growth and unemployment in major European countries: analysis of Okun's law". *Applied Econometrics and International Development*, 3(3), 93-118.