

The Asymmetric Impact of Economic Growth on Unemployment in Algeria-Testing the Okun's Law- (Empirical Study for the Period 1980-2018)

MANNA Lamdjed^{*1} RIMI Riadh² TOUITOU Mohammed³

1,2 . University of Hamma Lakhdar Eloued, Algeria

3. University of Algiers 3, Algiers

الأثر اللامتماثل للنمو الاقتصادي على معدلات البطالة في الجزائر - اختبار قانون أوكون-

(دراسة تجريبية للفترة 1980-2018)

ماننة الأمدج^{*1} ريمي رياض² طويطو محمد³

1. جامعة الشهيد حمه لخضر 3. جامعة الجزائر 3 - الجزائر

Received: 02/02/2020

Accepted: 01/07/2020

Published: 15/09/2020

Abstract:

This paper aims at testing the asymmetric effect between the change in unemployment rates and the real economic growth according to the Okun's law of the Algerian economy during the period 1980-2018 by relying on Nonlinear Autoregressive Distributed Lag (NARDL). Empirical results confirmed the absence of the equilibrium relationship - the long-term relationship - which reflects the absence of Okun's law in the long term. The asymmetry test also shows symmetry in the long-term relationship. However, the empirical results show an asymmetry in the short-term relationship.

Keywords: Asymmetry, (NARDL) Model; Okun's Law; Real economic growth ;Unemployment

(JEL) Classification: C01, C10

ملخص:

تهدف هذه الورقة البحثية إلى اختبار الأثر اللامتماثل بين التغير في معدلات البطالة والنمو الاقتصادي حسب قانون أوكون للاقتصاد الجزائري ضمن الفترة 1980-2018 بالاعتماد على منهجية الانحدار الذاتي ذو الابطاءات الموزعة زمنيا للاخطي (NARDL) بحيث أكدت النتائج التجريبية غياب العلاقة التوازنية -العلاقة طويلة الأجل - مما يترجم غياب قانون أوكون في المدى الطويل، كما أن اختبار عدم التماثل يوضح وجود تماثل في العلاقة طويلة الأجل. لكن العلاقة قصيرة الأجل تظهر النتائج التجريبية عدم وجود تماثل.

الكلمات المفتاحية: اللامتماثل، نموذج (NARDL)، قانون أوكون، نمو اقتصادي حقيقي، بطالة،

الترميز الاقتصادي (JEL): C01؛ C10.

I-Introduction :

Many countries strive to achieve the most important objectives of macroeconomic policies, especially concerning the increase in economic growth rates, and the phenomenon of unemployment, as they are indicators of real significance for the stability of the country's economic system. This has led many researchers to study the relationship between these two variables. Okun's law in 1962 is considered as one of the most famous macroeconomic theories that explain this correlation. Quarterly data of the change in unemployment rates (as a dependent variable) and the percentage change in real GDP (as an independent variable) indicate that there is a negative correlation between economic growth and unemployment rates, and by using the standard modeling methods of the difference model and gap model, so that is expected to increase the output by 3% offset by a 1% (Prachowny, 1993) decrease in unemployment, but Okun's simple static model was developed into dynamic models based on symmetry in the relationship between economic growth and unemployment, by comparing the impact of economic growth on unemployment between its two parts; the negative and the positive one. However, this concept may not apply to all the economies of the world, especially developing countries, which led many scholars to rely on nonlinear dynamic models resulting from asymmetry in the relationship between the two variables, including the nonlinear Autoregressive Distributed Lag (NARDL). This takes into account that the impact of the increase in economic growth rates on unemployment may not give the same effect when they decrease.

This study aims at analyzing the reality of economic growth and unemployment in Algeria, where it can be divided into two main stages as follows (See Figure 1):

The first phase from 1980 to 1999 is a period of economic reforms, where the Algerian government has attempted to move from a targeted economy to a market economy through the application of development measures included in the structural adjustment program. It was the result of the difficult economic, social and security conditions that Algeria experienced during this period. This led to get loans from the International Monetary Fund through the first credit standby program (1989-1990) and the second credit program (1991-1992) (Fatiha, 2010). In addition, this period was characterized by a significant fluctuation in economic growth rates, which recorded negative values that started in 1980 with a rate of (- 5.4%), the lowest value at this stage, is due to the last negative value which was in 1994 at a rate of (-0.9%). It also recorded the highest value in 1982, estimated at (6.40%), while the unemployment rate reached the highest value in 1999 at a rate of (29.30%), and the lowest value was in 1983 at a rate of (14.30%). This volatility in unemployment and economic growth is due to several reasons, including the economic and social cost that the State incurred as a result of reforms, or rather, the path of economic liberalization. On the economic front, the State took upon itself a heavy burden as a result of the process of rehabilitation of the public sector and the clearance of its debts, where it exceeded the amount of financial cleansing 500 billion DZ, and a major collapse of productive institutions as a result of this liberalization and the absence of protectionist policy (Hussein, 2013), not to mention the dependence of the national economy on the hydrocarbons sector where oil prices experienced a major collapse in 1986. This oil shock affected

the field of employment in Algeria(Shane, 1995), where a significant slowdown was recorded in the investment field, as these changes follow by the period of the nineties. At that moment, Algeria lived the worst period in all levels, especially the economic level; it was called the period of (non-development)(Hussein, 2013). Algeria entered a period of depression, the decrease of growth rate, and a sharp decline in the creation of jobs in the public sector due to the deterioration of oil prices, rise of external debt and the decline in industrial production.

For the second phase from 2000 to 2018, the first decade of the new millennium marked the beginning of a return to high levels of economic growth, but it is below the level needed to create enough job opportunities for the existing number of unemployed. This phase is called the period of economic recovery(Mohamed, 2012). The Algerian authorities have also adopted a cautious economic policy through austerity in government spending. In general, during this period, Algeria has strengthened structural adjustment and economic stability, and improved its overall indicators, but in light of all the above-mentioned data despite the marked increase in real economic growth rates in Algeria (Hussein, 2013), but the unemployment rates remain high, which leads us to ask the following question:

Is there a symmetry effect of economic growth on the unemployment rate in Algeria based on the test of Okun's Law?

The hypothesis of the study can be determined as follows:

- The absence of the Okun's Law and its incompatibility with the Algerian economy.
- The lack of symmetry in the relationship between economic growth and unemployment in Algeria.

1. Theoretical framework and previous studies

Previous studies that dealt with the topic of the relationship between economic growth and unemployment will be arranged by dividing them into studies that have touched on static models (the gap model and the difference model), then we will address studies that relied on dynamic models, and later the local studies that shed light on the Algerian economy will be presented.

Among the most important previous studies that used the static models, we mention the study of (Lee, 2000); Okun's relationship has been tested for 16 OECD countries, which took annual data for the period from 1955 to 1996 based on the Linear Regression Model, in addition to the use of many standard tools such as unit root test Zivot and Andrews and Augmented Dickey–Fuller test (ADF), as well as filters (HP, BN, Kalman), as the results showed a strong relationship between economic growth and unemployment and that supported Okun's Law. Furthermore, (Noor, 2007) also included the Malaysian economy for the period between 1970 to 2004 based on annual data to test the relationship of Okun in this economy by using the difference model, in which the experimental results showed a negative relationship between unemployment and economic growth in Malaysia, but with a much lower coefficient than Okun coefficient. The study of (Malley, 2008) relied on quarterly data from 1960 to 2001 for G7 countries - the group of major industrialized nations including France, Germany, Italy, Japan, the United Kingdom, and the United States, the gap approach was also applied during this study where it found a relationship between economic growth and unemployment, which was more significant in Germany. For the study of (Ball L., 2012), it was included the United States of America and twenty countries economically developed, which studied the suitability of the Okun's Law with short-term unemployment movements, and this by

using quarterly data from 1948 to 1980, with the application of the least-squares and the gap of the HP filter, where it was found that there is a conformity with the Okun's Law over most of the countries under study. In the study of (Tombolo, 2014), they estimated the relationship of Okun's Law on the State of Brazil by using quarterly data from 1980 to 2013. They obtained an estimate between (-0.1878) and (-0.2055). These values are lower than those obtained in other countries such as Germany (-0.38), France (-0.43), etc.. Another study of (Ball L., 2015) included 09 of the developed countries, which aimed to test the experts' expectation of the conformity of Okun's Law to the relationship between real GDP and unemployment with their economies based on annual data from 1989 to 2012 by using the difference model. The results of the study showed the validity of the hypothesis of the experts' predicting conformity of Okun's law with the economies of these countries (the United States, Japan, Germany, France, Italy, Canada, etc.). (Soylu, 2018) tried to study the relationship between economic growth and unemployment for Eastern European countries by using the panel static models for the period 1992 to 2014. The study concluded that the increase of GDP by 1% leads to a reduction of unemployment by 0.08%. The study of (Bilal, 2019), was also based on annual data for the period 2000 to 2017, the principle aims of this study is to analyze the underlying causes of the level of unemployment in the Sultanate of Oman and examining the relationship between GDP and unemployment rates according to Okun's Law by using a simple linear regression model between the two variables. The results concluded that this relationship is not significant.

For studies using the dynamic models, (Holmes, 2006) used a quarterly data for both real GDP and unemployment rates of USA for the period 1963 to 2004, with taking into account the characteristic of asymmetry between Unemployment and real GDP by using the Markov-switching model, where the results showed a strong inverse relationship. We also relied on the study of (DEMİRGİL, 2010), which used Quarterly data from 1989 to 2007 for economic growth and unemployment in Turkey based on a dynamic linear model. The results showed that Okun's Law was ineffective due to the structural changes that afflict the Turkish economy during this period. For the study of (Lal, 2010), the researchers worked on the validation of Okun's Law in some Asian countries (Pakistan, India, Bangladesh, Sri Lanka, and China). For this purpose, they used annual data for the period 1980-2006. In this study, they used Engle Granger methodology for cointegration test and the ECM model. The results concluded that the Okun's Law is not valid in these developing countries. For (Leshoro, 2013), the Toda-Yamamoto methodology was used to study the causality between employment and economic growth in South Africa by using quarterly data from 2000 to 2012. The results concluded that there was no causality of employment towards economic growth. (Fatai, 2013) used the annual time series data from 1980 to 2008 on the Nigerian economy to verify the validity of Okun's Law by using the co-integration test of Engle Granger and Fully Modified OLS. They obtained a positive coefficient in the empirical results. This indicates the non-conformity of the Okun's Law to the Nigerian economy. (Sadiku, 2015) examined a quarterly data on economic growth and unemployment of the Republic of Macedonia during the period 2000-2012 to test the Okun's Law by using Both the ECM model and the cointegration test of Engel-Granger and also causality tests. The study showed counterproductive results of Okun's Law due to the absence of a relationship between economic growth and unemployment. This is due to the State's reliance on informal employment, in addition to the main resource of employment belongs to the

public sector not the private one.(Mojica, 2017)examined the relationship between unemployment and the real GDP of the Philippines based on the quarterly data for the period 1990 to 2014. They used two approaches:The static approach (the gap issuing + the difference issuing) and the dynamic approach. They adopted the ARDL model to conclude that there was a structural break in the model in 2005 due to a change in the concept of unemployment as well as the compatibility of the method and approach of the gap with Okun's Law. Based on the study of (Awad, 2017), it verified the validity of Okun's Law in Palestine and Israel by using the quarterly time series data for the period 2000 to 2014. Several standard tools were used, such as Engel-Granger, the error correction model. The study concluded that Okun's Law does not apply to both Palestine and Israel.

As for the studies related to the Algerian economy, we find a study of (Dahmani, 2012)used annual data covering the period 1970 to 2010 to test the relationship between unemployment and economic growth, and to obtain estimates of the Okun coefficient. The co-integration test of Johansen and the causality test of granger were used. The results showed the absence of the long-term relationship i.e. the absence of the Okun relationship, and the presence of causality of potential output towards actual unemployment rates according to Granger.(Hassan, 2016)applied the standard modeling by using the VAR models of the economic relationship between the unemployment rate and the real economic growth rate in Algeria during the period (1980- 2014), to understand and explain the economic nature of the relationship between the two variables. He also testedthe causality between them, and evaluated the extent of economic growth to address unemployment and reduce it.The results showed the existence of a causal relationship in both directions.(Abdellah, 2018)worked on assessing the Okun coefficient in Algeria for the period 1970-2015 by using two standard models: the ARDL model and the Bayesian Normal Linear Regression model. The results indicate a negative relationship in both models with two coefficients, which are estimated respectively (-0.19) and (-0.21). This confirms that the coefficient of the relationship between economic growth and unemployment in Algeria is less than Okun coefficient.

Most of the previous studies that dealt with the topic of the relationship between economic growth and unemployment in its static and dynamic parts were based on the presumption of a linear relationship between the study variables resulting from asymmetry in the effect of economic growth on unemployment rates, but this situation is considered as a special case of asymmetry.This is what will be taken into account in this study, based on the NARDL model.

2. Study model and data

The writing of Okun's Law Model is based on the original and developed models as follows:(Knotek II, 2007)

2.1.The difference version

$$\Delta U_t = \hat{a} + \hat{b}\Delta GDP_t.....(1)$$

ΔU_t : Represents the change in the unemployment rate.

ΔGDP_t : Represents the change in the logarithm of GDP and represents economic growth

\hat{a} , \hat{b} : Regression coefficients.

It should be noted that the ratio $(-\hat{a}/\hat{b})$ Expresses the growth rate necessary to keep the unemployment rate unchanged.

2.2.The gap version

$$U_t = \hat{a} + \hat{b}(gap.GDP).....(2)$$

U_t : Expresses the unemployment rate, $gap.GDP$: Expresses the gap between potential and real output, \hat{a} and \hat{b} : Regression coefficients.

The gap model can be written in the following mathematical form(Harris, 2001):

$$gap.U_t = \hat{b}(gap.GDP).....(3)$$

$gap.U_t$: An expression of the gap between potential and real unemployment.

2.3 The dynamic version

It was mentioned by Okun, in one of his observations, that the Past and current production can affect the current level of unemployment in the difference model(Knotek II, 2007). According to this proposal, many economists have used new dynamic models based on the original model of Static models. It is not limited to find the real-time relationship between real output growth and temporary unemployment rates, but also to include the impact of current and previous values of the two variables. This has a greater explanatory capacity for the phenomenon, and it has a different interpretation of the simple interpretation of the original Okun's Law. Therefore, through this study,these dynamic models will be relied on.

II .Methods and Materials:

The increasing popularity of non-linear modeling has led to deeper research in this area by researchers where we find a widespread of regime-switching models. One of the most important researches on nonlinear modeling is the threshold ECM models by(Balke, 1997), as well as Markov-Switching ECM by(Psaradakis, 2004). we also find Smooth Transition Regression ECM models Developed by(Kapetanios, 2006).In fact, the preceding models are confined to presenting asymmetry or non-linearity only to the long-term relationship, but in principle, a standard model can be obtained combining the long and short term relationships (ARDL) and at the same time taking into account the non-linearity (asymmetry).Therefore, this study will be distinguished from the previous studies based on the nonlinear Autoregressive Distributed Lag(NARDL).

1.Autoregressive Distributed Lag (ARDL)

Before relying on a model (NARDL), we should clarify a model (ARDL); it is considered among the linear dynamic models. It includes the lag values of the dependent variable and the lag and current values of the independent variable, so that a model is written ARDL(p,q)according to the following formula(Pesaran, 2001) :

$$U_t = c + \sum_{i=1}^p \gamma U_{t-i} + \sum_{i=0}^q \phi GDP_{t-i} + \varepsilon_t (4)$$

The unrestricted error correction model is derived (UECM)From equation (4) is as follows:

$$\Delta U_t = c + \rho U_{t-1} + \theta GDP_{t-1} + \sum_{j=1}^{p-1} \gamma \Delta U_{t-j} + \sum_{j=0}^{q-1} \phi \Delta GDP_{t-j} + \varepsilon_t (5)$$

In the case of a balanced relationship - a long-term relationship - the error correction model (ECM) can be estimated according to the following relationship:

$$\Delta U_t = c + \rho ECM_{t-1} + \sum_{j=1}^{p-1} \gamma \Delta U_{t-j} + \sum_{j=0}^{q-1} \phi \Delta GDP_{t-j} + \varepsilon_t \dots \dots \dots (6)$$

2. Nonlinear Autoregressive Distributed Lag (NARDL)

The NARDL model proposed by(Shin et al, 2013) differs in the interpretation of economic phenomena from the ARDL model proposed by Pesaran and Shin in 1998 and (Pesaran, 2001),(Alam, 2013).As it takes into account the Asymmetric in the effect of the independent variable in excess or decrease from the dependent variable and therefore one write the model of NARDL (p, q) according to the following general formula(Shin, 2014) :

$$U_t = \sum_{j=1}^p \gamma U_{t-j} + \sum_{j=0}^q (\phi_j^+ GDP_{t-j}^+ + \phi_j^- GDP_{t-j}^-) + \varepsilon_t \dots \dots \dots (7)$$

γ : Represents the regression coefficient. ϕ_j^+, ϕ_j^- : They represent asymmetric distribution coefficients.

So that GDP_{t-j}^+, GDP_{t-j}^- Are partial processes of positive and negative changes to GDP_t can be calculated according to the following approach:

$$GDP_t^+ = \sum_{j=1}^t \Delta GDP_j^+ = \sum_{j=1}^t \max(\Delta GDP_j, 0), GDP_t^- = \sum_{j=1}^t \Delta GDP_j^- = \sum_{j=1}^t \min(\Delta GDP_j, 0)$$

However, through equation (7), the non-linear unrestricted error correction model can be derived (NUECM)For the NARDL model by rewriting it with the first difference of the dependent variable as follows:

$$\Delta U_t = c + \rho U_{t-1} + \theta^+ GDP_{t-1}^+ + \theta^- GDP_{t-1}^- + \sum_{j=1}^{p-1} \gamma \Delta U_{t-j} + \sum_{j=0}^{q-1} (\phi_j^+ \Delta GDP_{t-j}^+ + \phi_j^- \Delta GDP_{t-j}^-) + \varepsilon_t \dots \dots \dots (8)$$

ρ, θ^+, θ^- : Long - term coefficients, $\gamma, \phi_j^+, \phi_j^-$:short - term coefficients

Through equation (8), the long and short-term relationships can be separated and a test of whether there is a Co-Integration relationship as reported by(Pesaran, 2001) based on the F-tests and formulation of the following hypothesis:

$$H_0: \rho = \theta^+ = \theta^- = 0$$

Fisher's statistical value (F-tests) is compared to the critical values of (Pesaran, 2001) by the upper and lower r Critical Bound of a decision on whether to accept or reject a null hypothesis. They also didNarayan and Smyth,Simulates accurate critical values for small samples Fisher test (F-tests),If it is statistical (F-tests)Located outside the upper or lower boundary field of critical values can decide to accept or reject a null hypothesis, but when a statistic occurs (F-tests)between the critical limits can not make a decisive decision in this case. However, when a null hypothesis is rejected(a balanced relationship), there is a representation of the models estimated by the error correction model (ECM) to be estimated by the following formula:

$$\Delta U_t = c + \rho ECM_{t-1} + \sum_{j=1}^{p-1} \gamma \Delta U_{t-j} + \sum_{j=0}^{q-1} (\phi_j^+ \Delta GDP_{t-j}^+ + \phi_j^- \Delta GDP_{t-j}^-) + \varepsilon_t \dots \dots (9)$$

ECM_{t-1} : Represents the error correction limit, ρ : Represents the error correction coefficient.

The general model number (8) can be deduced from the four main cases of asymmetric tests in the NARDL model (Apergis, 2018) shown in the table (01), based on the test Wald, which is based on unrestricted regression, The extent to which unrestricted estimates of unrestricted estimation of convergence of constraints are met under the null hypothesis condition, if constraints are correct, indicates that unconstrained estimates are close to satisfying constraints.

III. Results and discussion:

During this study, the annual time series data for the period 1980 - 2018 will be used for the logarithm of GDP (as an independent variable) and unemployment rates (as a dependent variable) according to the version of the difference model of Okun's Law for the Algerian economy based on the data of the International Monetary Fund - <https://www.imf.org/en/Countries/DZA>- April 2019, so that the study period was determined and selected based on the availability of statistical data, and a set of statistical programs will be used to analyze and measure the impact of real economic growth on the change in Unemployment rates represented in Stata 15.1, Eviews 10.

1. Unit root tests:

In order not to fall into the spurious regression trap Granger And Newbold, the stability of the two chains and the degree of integration of each must be studied. However, before moving on to the unit root tests for each of Augmented Dickey and Fuller Symbolized by ADF and test Phillips-Perron Symbolized by (PP), and test Kwiatkowski Symbolized by KPSS, as well as test Elliott Symbolized by (DF-GLS) , Shown in Table (02), It can be seen from Appendix 01 and Appendix 02, that changes in the unemployment rate series as well as the time series of the real GDP logarithm are unclear. It can be decisive in the presence of an (Intercept) or (Intercept and Trend), Accordingly, in unit root tests for these two series, we choose the model that contains a Trend, as well as the model that contains only an Intercept.

Table 2 represents the results for ADF, PP, KPSS, and ADF-GLS at a critical value of 95%. Whereas, we conclude that it is not possible to reject the null hypothesis of the unit root, which indicates that the series (U and LGDP) have a unit root, and therefore, the two variables are not stationary at the level. On the contrary, at first difference, the null hypothesis is rejected and hence U and LGDP are stationary at the first difference.

2. Estimating the model:

To check the estimated NARDL (1,2,2) model, some diagnostic tests are considered in table (03). The Table(03) shows that there is no evidence of autocorrelation at lag one and two. There is no evidence of Heteroskedasticity, and the errors are normally distributed. Finally, when analyzing the stability of the long-run coefficients together with the short-run dynamics, the cumulative sum (CUSUM) is applied if the plot of these statistic remains within the critical bound of the 5% significance level, the null hypothesis (i.e. that all coefficients in the error correction model are stable) cannot be rejected (See Figure 2).

Some diagnostic tests are needed to check the estimated NARDL (1,2,2) model; they are presented in the table (03). The result in this table(03) confirms that there is no evidence of autocorrelation at lag one and two, and it is for Heteroskedasticity. The error distribution follows the normal distribution. Finally, when analyzing the stability of long-term coefficients with short-term dynamics, a cumulative sum (CUSUM) is applied since the null hypothesis (i.e. - say that all the coefficients of the error correction model are stable) cannot be rejected if the pattern of these statistics remains within the critical limit for the significance level of 5% (see Figure 2). For us to know economically, is the amount of impact of real economic growth when it increases the change in unemployment rates equal to the same effect when it falls? We will use the Wald test, which enables us to find out whether there is asymmetry in the long-term and short-term relationships.

Through the results of the asymmetry test in the short and long-term relationships, it is noticed that the hypothesis can not be rejected as a non-symmetric in the long-term relationship. However, we accept the alternative hypothesis in the short term i.e. there is asymmetric in the impact of economic growth on Unemployment in the short-term relationship.

IV-Conclusion:

In this study, which examined the relationship between economic growth and unemployment according to Okun's Law for the period from 1980 to 2018, the following empirical results were obtained:

- ♦ There is a negative impact of real economic growth on the change in unemployment rates through the negative signal according to the estimation results shown in the table.(03)
- ♦ The absence of the equilibrium relationship - the long-term relationship - between the real economic growth and the change in unemployment rates according to the results of the table (04)
- ♦ One of the results of the table (4) is the lack of asymmetry in the short-term relationship, meaning that in the short term the effect of increased economic growth on the change in unemployment rates does not give an equal effect when it decreases.

According to the results of the asymmetric test, it is clear that there is symmetry in the long-term relationship, but in the short-term relationship there is no symmetry, It means that in the short term the impact of increased economic growth on the change in unemployment rates does not give an equal effect when it declines

References:

- Abdellah, K. Y. (2018). *Estimation of Okun Coefficient for Algeria*. From mpra: <https://bit.ly/31jDTLZ>
- Alam, A. (2013). Nuclear energy, CO2 emissions and economic growth: the case of developing and developed countries. *Journal of Economic Studies*, 40(6), 822-834. <https://doi.org/10.1108/JES-04-2012-0044>.
- Apergis, N., & Vouzavalis, G. (2018). Asymmetric pass-through of oil prices to gasoline prices: Evidence from a new country sample. *Energy policy*, 114, 519-528. <https://doi.org/10.1016/j.enpol.2017.12.046>.
- Awad, I., Hallam, A., & Alialhuseen, M. (2017). Testing the validity of Okun's rule of thumb across Palestine and Israel. *AL-Quds University*, 37-54. <https://bit.ly/31kk732>.
- Balke, N. S., & Fomby, T. B. (1997). Threshold cointegration. *International economic review*, 38(3), 627-645. <https://doi.org/10.2307/2527284>.
- Ball, L., Leigh, D., & Loungani, P. (2012). Okun's law: Fit at 50? *Journal of Money, Credit and Banking*, 49(7), 1413-144. <https://doi.org/10.1111/jmcb.12420>.
- Ball, L., Jalles, J. T., & Loungani, P. (2015). Do forecasters believe in Okun's Law? An assessment of unemployment and output forecasts. *International Journal of Forecasting*, 31(1), 176-184. <https://doi.org/10.1016/j.ijforecast.2014.03.009>.
- Bilal, K. A. (2019). AN Empirical Analysis Of Unemployment In Oman. *Global scientific journals*, 7(3), 201-214. <https://bit.ly/32d1JrP>.
- Dahmani, M. D., & Samir, S. (2012). The Relationship Between Output Growth and Unemployment - Re-validation of the Okun's Law Test for Algeria. *revue cahiers économiques*, 4(2), 103-126. <https://bit.ly/31h1PPX>.
- DEMİRĞİL, H. (2010). A STUDY ON THE LAW APPLY TO READ EMPIRICAL FOR TURKEY. *Journal of Alanya Faculty of Business*, 2(2), 140-151. <https://bit.ly/3lfAWef>.
- Fatai, B. O., & Bankole, A. (2013). Empirical test of Okun's Law in Nigeria. *International Journal of Economic Practices and Theories*, 3(3), 227-231. <https://doi.org/10.1.1.1028.4265>.
- Fatiha, T. (2010). *réformes et transformations économiques en algérie*. From <https://bit.ly/34qv9W8>.
- Harris, R., & Silverstone, B. (2001). Testing for asymmetry in Okun's law: A cross-country comparison. *Economics bulletin*, 5(2), 1-13. <https://bit.ly/3gfRPKZ>.
- Hassan, M. (2016). The relationship between unemployment and economic growth in Algeria 1980-2014. *revue d'économie et de développement humain*, 6(1), 379-392. <https://bit.ly/34AeaRB>.
- Holmes, M. J., & Silverstone, B. (2006). Okun's law, asymmetries and jobless recoveries in the United States: A Markov-switching approach. *Economics Letters*, 92(2), 293-299. <https://doi.org/10.1016/j.econlet.2006.03.006>.
- Hussein, R. (2013). The role of development policies in combating unemployment and supporting employment in Algeria: A model of rural and tourism development. In *Economic growth and sustainable development in the Arab countries* (38-63). Qatar: Arab Center for Research and Policy Studies.
- Kapetanios, G., Shin, Y., & Snell, A. (2006). Testing for cointegration in nonlinear smooth transition error correction models. *Econometric Theory*, 22(2), 279-303. <https://doi.org/10.1017/S0266466606060129>.
- Knotek II, E. S. (2007). How useful is Okun's law? *Economic Review-Federal Reserve Bank of Kansas City*, 92(4), 73-103. <https://bit.ly/2QgbcJn>.
- Lal, I., Muhammad, S. D., Jalil, M. A., & Hussain, A. (2010). Test of Okun's law in some Asian countries co-integration approach. *European journal of scientific research*, 40(1), 73-80. <https://bit.ly/32glM8J>.
- Lee, J. (2000). The robustness of Okun's law: Evidence from OECD countries. *Journal of macroeconomics*, 22(2), 331-356. [https://doi.org/10.1016/S0164-0704\(00\)00135-X](https://doi.org/10.1016/S0164-0704(00)00135-X).
- Leshoro, T. L. (2013). Does Economic Growth Lead Employment in South Africa? *Journal of Economics and Behavioral Studies*, 5(6), 336-345. <https://doi.org/10.22610/jeb.v5i6.409>.
- Malley, J., & Molana, H. (2008). Output, unemployment and Okun's law: Some evidence from the G7. *Economics Letters*, 101(2), 113-115. <https://doi.org/10.1016/j.econlet.2008.06.013>.

Mohamed, M. (2012). Policy of economic recovery in Algeria and its impact on growth . *el-bahith review*,10(10), 147-160. <https://doi.org/10.12816/0005830>.

Mojica, M. A., & Tatlonghari, V. M. (2017). The relationship between output growth and unemployment in the Philippines economy (1990-2014): An empirical analysis of variants of Okun's Law. *Journal of Emerging Economies & Islamic Research*, 5(1), 49-68. <https://doi.org/10.24191/jeeir.v5i1.8796> .

Noor, Z. M., Nor, N. M., & Ghani, J. (2007). The relationship between output and unemployment in Malaysia: Does Okun’s law exist. *International Journal of Economics and Management*, 1(3), 337-344. <https://bit.ly/34kSUPk>.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, 16(3), 289-326. <https://doi.org/10.1002/jae.616>.

Prachowny, M. F. (1993). Okun's law: theoretical foundations and revised estimates. *The review of Economics and Statistics*, 75(2), 331-336. <https://doi.org/10.2307/2109440>.

Sadiku, M., Ibraimi, A., & Sadiku, L. (2015). Econometric estimation of the relationship between unemployment rate and economic growth of FYR of Macedonia. *Procedia Economics and Finance*, 19, 69-81. [https://doi.org/10.1016/S2212-5671\(15\)00009-X](https://doi.org/10.1016/S2212-5671(15)00009-X).

Shane, S., & Streifel (1995). *Review and Outlook For The World Oil Market*. Washington: World Bank Publications.

Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modelling Asymmetric Cointegration and Dynamic Multipliers in a Nonlinear ARDL Framework. In W. Horrace, & R. Sickles. *The Festschrift in Honor of Peter Schmidt*. (281-314). New York: Econometric Methods and Applications.

Soylu, Ö. B., Çakmak, İ., & Okur, F. (2018). Economic growth and unemployment issue: Panel data analysis in Eastern European Countries. *Journal of International Studies*, 11(1), 93-107. <https://doi.org/10.14254/2071-8330.2018/11-1/7>.

Tombolo, G. A., & Hasegawa, M. M. (2014). *Okun's law: evidence for the Brazilian economy*. From mpra: <https://bit.ly/31jknzh> .

Psaradakis, Z., Sola, M., & Spagnolo, F. (2004). On Markov error-correction models, with an application to stock prices and dividends. *Journal of Applied Econometrics*, 19(1), 69-88. <https://doi.org/10.1002/jae.729>.

Appendix:

Table 1: Main Cases of Asymmetry Test in NARDL model

	Hypotheses	The first case	The second case	The third case	The fourth case
the long-term relationship	$H_0: -\frac{\theta^+}{\rho} = -\frac{\theta^-}{\rho}$	Accept H_0	Accept H_0	Reject H_0	Reject H_0
the short-term relationship	$H_0: \sum_{j=0}^{q-1} \phi_j^+ = \sum_{j=0}^{q-1} \phi_j^-$	Accept H_0	Reject H_0	Accept H_0	Reject H_0
Test result		The existence of symmetry	Absence of symmetry in the short-term relationship	Absence of symmetry in the long-term relationship	Absence of symmetry in the two relationships
Optimal model		Symmetric ARDL	NARDL with SR asymmetry	NARDL with LR asymmetry	NARDL with SR and LR asymmetry

Source: Prepared by researchers depending on the reference(36).Apergis, N., & Vouzavalis, G. (2018)

Table 2: Unit root test

<i>LEVEL</i>			
The Test	Trend specification	<i>U</i>	<i>LGDP</i>
ADF	INTERCEPT	-1.531749	-0.324096
	INTERCEPT AND TREND	-2.120450	-1.416226
PP	INTERCEPT	-1.096051	-0.470950
	INTERCEPT AND TREND	-1.513016	-1.619056
KPSS	INTERCEPT	0.279839	0.611945
	INTERCEPT AND TREND	0.162168	0.146349
ADF-GLS	INTERCEPT	-1.521863	0.148762
	INTERCEPT AND TREND	-1.869992	-1.369570
<i>FIRST DIFFERENCE</i>			
ADF	NON	-4.509922***	-5.276392***
	INTERCEPT	-4.456810***	-5.620405***
PP	NON	-4.639785***	-5.401720***
	INTERCEPT	-4.592342***	-5.677127***
KPSS	NON	-	-
	INTERCEPT	0.213460***	0.132228***
ADF-GLS	NON	-	-
	INTERCEPT	-4.506546***	-5.689587***

The statistics are the t-statistic ratios for the ADF, PP and ADF-GLS tests, and the LM-statistic statistics for the KPSS test.***) (**) (*) Indicates the significance of the test at 10%, 5% and 1%, respectively

Table 3:Estimating NUECM

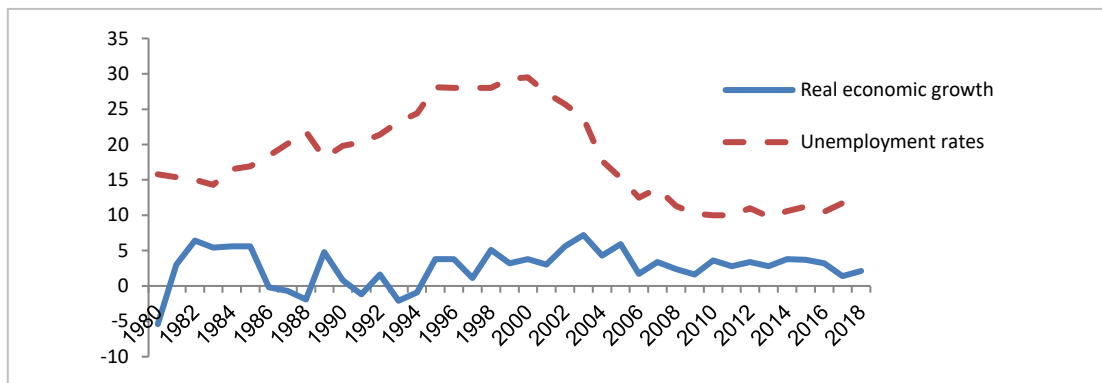
Independent variables	ΔU
CONSTANT	7.078349
U (-1)	-0.270342
LGDP P (-1)	-3.352837
LGDP N (-1)	-5.332186
$\Delta LGDP$ P	-9.977735
$\Delta LGDP$ N (-1)	5.665009
$\Delta LGDP$ P (-1)	-6.014744
NARDL MODEL	NARDL (1,2,2)
R-Squared	0.381991
Adjusted R-squared	0.258389
Ljung-Box(residuals) TEST	9.9490 [0.869]
Ljung-Box (residuals Squared) TEST	16.727 [0.403]
Jarque-Berra TEST	2.06[0.35]
Breusch-Godfrey Serial Correlation LM Test	0.426403 [0.6570]
Heteroskedasticity Test: Breusch-Pagan-Godfrey	1.043136 [0.4177]
Heteroskedasticity Test : ARCH (2)	0.387968 [0.6816]

Table 4:Asymmetric Test

	Asymmetric Cointegration Test		Testing the presence of asymmetry	
			Long- run	Short- run
Wald test	$H_0: C(2) = C(3) = C(4) = 0$ No cointegration		$H_0: -C(3)/C(2) = -C(4)/C(2)$ LR Asymmetry	$H_0: C(5) = 0, C(6) = C(7)$ SR Asymmetry
F-statistic	2.617793		2.956894 [0.0958]	9.395371 [0.0046]
	I(0) :4.94	I(1) :5.58		
TheResult	Accept H_0		Accept H_0	Reject H_0

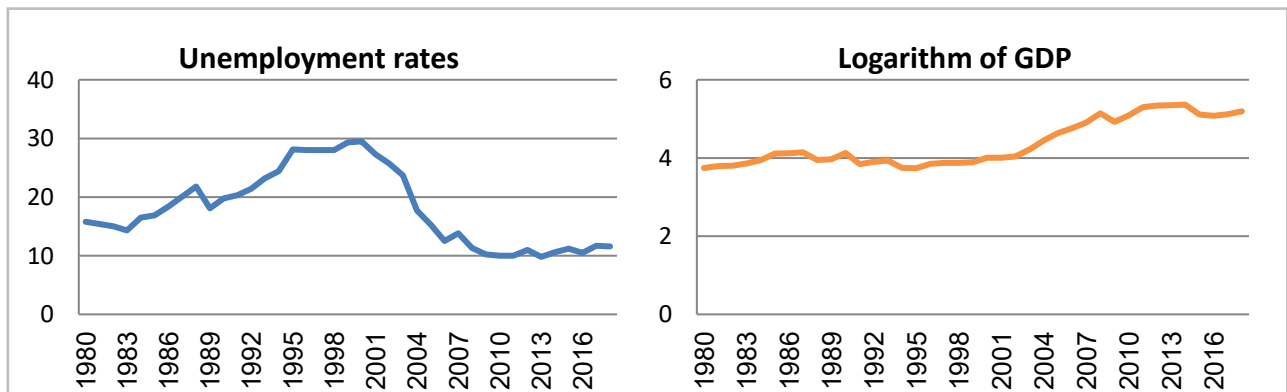
[] Represent P-value,I(0)I(1)Pesaran et al (2001) critical values, C()number of the coefficient.

Figure 1: The evolution of the economic growth rates and the unemployment rates in Algeria



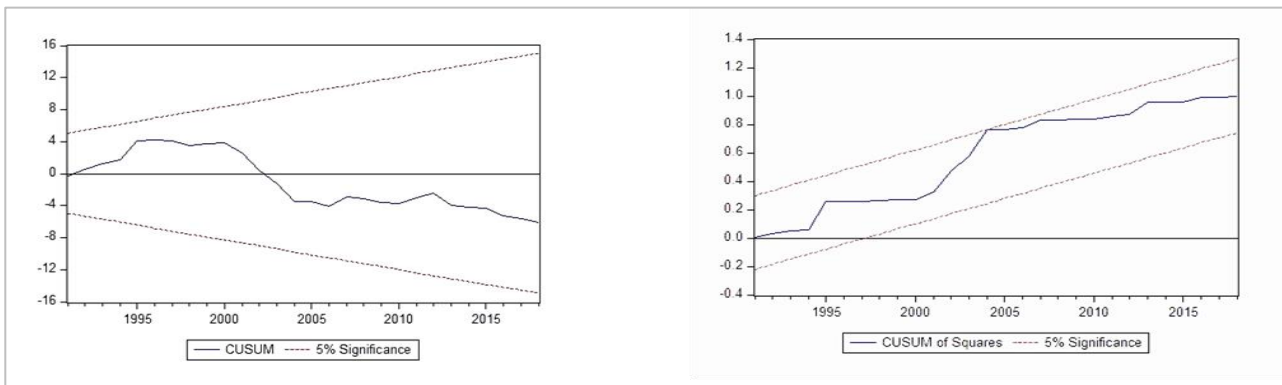
Source: Prepared by Authors based on IMF data
<https://www.imf.org/en/Countries/DZA>

Figure 2: Graphical representation of Unemployment rates&Logarithm of GDP



Source: Prepared by researchers based on IMF data

Figure 3: Graphical representation of CUSUM&CUSUMSQ



Source: Prepared by researchers depending on the Eviews 10

How to cite this article by the APA method:

MANNA Lamdjed, RIMI Riadh,TOUITOU Mohammed. (2020).The Asymmetric Impact of Economic Growth on Unemployment in Algeria -Testing the Okun's Law -(Empirical study for the period 1980-2018) ,**Roa Iktissadia Review**, Algeria: University Eloued.10 (02), 13-26.

The copyrights of all papersthat were published in this journal are retained by the respective authors as per the [Creative Commons AttributionLicense](#).



Roa Iktissadia Review is licensed under a [Creative Commons Attribution-Non Commercial license](#) (CC BY-NC 4.0)