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Economic Growth and Unemployment Relationship in Tunisia: an Empirical Evidence from ARDL Bound Test Approach

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ABSTRACT

The relationship between economic growth and unemployment is considered as an important concept in macroeconomics both theoretically and empirically. The purpose of this paper is to investigate the relationship among these two variables through checking the validity of Okun's law in Tunisia economy. The paper used annual time series data covering the period 1980-2020 obtained from World Bank data bases. Our analysis is carried out in two steps. Firstly, the natural unemployment rate was determined either by applying the linear regression between the obseerved unemployment rate and the economic growth rate or by the modified philips curve provided by Blanchard and Katz (1997). Secondly, the augmented autoregressive distributed lag (ARDL) bounds testing approach is applied in order to examine the long-run and short-run relationship among variables based on difference and gap model with Hodrick-Prescott (HP) filter. Findings indicate a cointegrated relationship among variable only for difference model. The associated equilibrium correction was also significant confirming the existence of long-run relationship. In the long-run, results revealed a significant unidirectional causality between the unemployment rate and the real output. A 1% increase in the real output for the difference model leads to a decrease in the unemployment rate by about 1.6%. Thus, the empirical results of our paper exhibit the relevance of economic policy decisions regarding employment for the tunisian case.

INTRODUCTION

Tunisian economy has been confronted to a low or even negative growth rate during the last decade due to the social and political unrest which has set Tunisia ablaze since 2011, resulting in a 4% drop in GDP and an unprecedented increase in unemployment. This scenario has become a challenge for decision-makers to remedy the economy and re-launch economic growth in order to resolve the unemployment problem. Okun's law is the most relevant method to analyze and describe the negative relationship between GDP and unemployment. However this relationship is considered as an important concept in macroeconomics both theoretically and empirically. Theoretically, Okun's law is the link between the aggregate supply curve and labor employment. Empirically, Okun's coefficient is a useful rule of thumb in forecasting

and policymaking (Harris and Silverstone, 2001). Okun's law drew the conclusion that for each percentage point by which the actual unemployment rate is above the natural rate of unemployment, real GDP is 3 percentage point lower than the potential GDP.

The implementation of adequate policies to continue with the reduction of unemployment and then with a higher growth of output is one of the main goals of Tunisian national and regional policy makers. In order to devise these policies it would be essential to explain if there is a relationship between real GDP and unemployment in Tunisian economy. Okun's law is important not only in order to know by how much the output of this economy causes changes in unemployment rate but also the mechanism through which these effects take place. The knowledge of this relation is also important from the point of view of the implementation of appropriate economic policies.

In this paper, we will study the relationship between the levels of unemployment to the output growth and check whether Okun's historical relationship valid in the Tunisian economy. We include tow version of Okun's law, difference and gap version. The rest of paper is organized as follows. Section 2 briefly reviews literature review and Okun's findings. Section3 depicts methodology and econometric model. Section 4 focuses to analyze the short and long-run relationship between the unemployment rate and economic growth rate whereas section 5 includes results and discussions.

1. LITERATURE REVIEW

The relationship between real output level and unemployment level was first studied and estimated by Okun in 1962, who proposed that an inverse relationship exist between these two variables. This idea was accepted and was commonly known as Okun's law in the economics theory. Using quarterly data from the United States from the years 1947-1960, Okun estimated that 3% change in GDP due to 1% change in unemployment. However advanced econometric techniques and modern data estimated that 1 % change in unemployment cause more or less than 3 % change in Gross Domestic Product. Several researchers checked the validity of Okun's law during different time periods by using different econometric techniques for different economy and confirmed that there are important variations across country of the world and income levels in both magnitude and significance of this relationship (Evans, 1989; Prachowny, 1993 and Lee, 2000).

Bartolucci et al. (2018) distinguish countries in terms of their GDP per capita in four categories (high income, upper middle income, lower middle income and low income) and perform a panel regression with time fixed effects in which labor market outcomes, including Okun's coefficients, are regressed on a series of potential explanatory variables. They find that higher employment growth is linked to lower levels of informality and higher flows of FDI. Moreover, their results show that the magnitude of Okun's coefficients is influenced by better institutions. Ben Amor and Ben Hassine (2017) conducted study to check the validity of Okun's law in Saudi Arabia economy. Using time series data on Gross Domestic Product and unemployment over the period 1980-2015 and adopting a rather new econometric approach (ARDL), Author's used the difference version and gap version of the Okun's law. Findings reveal cointegrated relationship among variable and corroborate the Okun's law and indicate that a 1% increase in the real output for the gap (difference) model leads to a decrease in the unemployment rate by about 0.33% (0.54%). Ball et al. (2013) estimate both gap and difference forms of Okun's law using OLS on US data starting from 1948, as well as a gap form on 20 advanced economies separately and where sample starts in 1980. Their findings prove that changes in the coefficient during the Great recession are modest in size and short-lived. In this study authors point out to a strong and stable relationship in most countries, which did not change substantially during the Great recession. Also authors found that the coefficient in the relationship varies substantially across countries. This variation is partly explained by idiosyncratic features of national labor markets, but it is not related to differences in employment protection legislation.

Employing two extensive (across countries and across states) panel data sets to investigate the validity of Okun's law, Huang and Yeh (2013) estimate an Auto Regressive Distributed Lag (ARDL) model, which allows to distinguish between the long and the short run impact of GDP on unemployment. Ours Empirical results show that unemployment and output are long-run cointegrated and that the unemployment-output linkages are found to be negative and highly significant both in the short- and long-run. Our results not only

confirm the validity of Okun's law in the short-run but also point out that a similar tradeoff exists in the long run. Bankole and Fatai (2013) studies the validity of Okun's law in Nigeria and estimated Okun's coefficient by using the annual data from 1980-2008. By using Engle Granger cointegration test, the empirical evidences showed Okun's coefficient is positive and the Okun's law is not valid for the case of Nigeria. Pierdzioch et al. (2011) reported the Okun's Law is valid in the case of G7 countries. They tested whether professional economists' forecasts of changes in the unemployment rate and the growth rate of real output were consistent with Okun's law for the period 1989-2007 for G7 and found the growth rate of real output and unemployment rate were consistent with Okun's law. Moreover, authors found that professional economists do not believe in potential asymmetries in Okun's law over the business cycle, but are in favour of the classic linear version. Noor et al. (2007) also examined whether there exist an Okun law in Malaysian economy or not. Using Granger causality their empirical results showed the existence of inverse relationship between output and unemployment in Malaysia. However the authors underline that this relationship does not solve unemployment problems. Policymakers must be creative in creating new jobs to ensure that these jobs matched with the job seeker's talents and skills. Malley and Molana (2008) used quarterly data for G7 countries for the period 1960 to 2001 to examine whether the relationship between output and unemployment significantly exhibits such non-linearities. Their results show that the relationship between economic growth and unemployment was more significant and monotonic only in the case of Germany. Harris and Silverstone (2001) test the symmetric relationship between change in unemployment and real output for seven OECD countries. They support the inverse relationship between economic growth and unemployment but the strength of relationship between economic growth and unemployment in the studies differ greatly depending on the sample and the context explored.

This empirical regularity of Okun's law was investigated and confirmed in G7 countries by Moosa (1997) who used OLS, rolling OLS and SUR in order to compare the reaction of economic growth to employment. He proved that the employment was more responsive to the economic growth in the United States and Canada than in Europe and Japan. Furthermore, the employment was more responsive to the economic growth in the United States and Canada because of the lack of job security provisions and restrictions on layoffs. His findings revealed that Okun's coefficient variation resulted from the differences of labor market rigidities.

2. EMPIRICAL MODEL AND DATA

The Okun's first specification used to estimate Okun's relation can be formulated as:

$$UN_t = \delta GDP_t + \omega_t \qquad (1)$$

Where UN_t and GDP_t stand for the unemployment rate and output, respectively and ω_t is an error term. The coefficient of Okun is expressed by δ. The long-run equilibrium relationship between unemployment and output can be stated in the following equation:

$$UN_t = \alpha + \delta GDP_t + \omega_t \qquad (2)$$

The short-run and long-run equilibrium relationship between unemployment and output in equation (2) can be estimated by an autoregressive distributive lag (ARDL) model proposed by Pesaran and Pesaran (1997), Pesaran and Shin (1999) and Pesaran et all (2001). Our study applies the ARDL model to examine both short-run and long-run relationships between unemployment rate and economic growth in case of Tunisia using yearly data over the period of 1980-2020. Within this framework, we use a relatively new estimation technique, which is the bounds testing approach to co-integrate within an autoregressive distributive lag (ARDL) framework. ARDL is extremely useful because it allows us to describe the existence of an equilibrium relationship in terms of long-run and short-run dynamics without losing long-run information. The unrestricted error correction model (UECM) can be specified as:

$$\Delta UN_{kt} = \varphi_0 + \varphi_k UN_{k,t-1} + \theta_k GDP_{k,t-1} + \sum_{i=1}^{l} \pi_{ik} \Delta UN_{k,t-i} + \sum_{i=1}^{p} \gamma_{ik} \Delta GDP_{k,t-i} + \epsilon_t \quad 3)$$

This specification illustrates that changes in unemployment are determined by its own lagged values and the lagged values of changes in real output. Where Δ denotes a first difference operator, $\pi_{ik}$and γ_{ik} are the short-run coefficient parameters, ϑ_k and $\theta_k$are the long run regression coefficient and ϵ_t is a

normally distributed residual term. Following Okun's analyzes published in 1962, the subscript k for $k = (dif, gap)$ means that Eq. (3) is taken respectively in difference or in gap form for all variables and coefficients. GDP_{gap} means gap pattern computing on the difference in natural logarithm between output and potential output. UN_{gap} indicates gap pattern computing on the difference in natural logarithm between observed unemployment rate and natural unemployment rate. Okun's analyzes are also based on a simple deterministic trend for computing potential GDP time series. Approaches for computing natural unemployment rate and potential GDP are specified in the following section.

Following Gilbert (1986) and Pesaran et al. (2001), we over-parameterized the unrestricted regression as an ARDL model of orders (p,q) which are obtained using the Akaike information criterion (AIC). Note that the optimal lag length chosen for each regression was determined through a minimization of the AIC. The null hypothesis of the model is:

$H_0 : \vartheta_k = \vartheta_k = 0$ (there is no long- run relationship)

$H_1 : \vartheta_k \neq \vartheta_k \neq 0$

Following Pesaran et al. (2001), we conduct a bounds test for the null hypothesis of no cointegration. Test of cointegration is based on the comparison of the jointly computed F-statistics of the bounds test to the tabulate two critical values sets for the cases when the variables are all stationary and all non-stationary. Therefore, the null hypothesis of a no long-run relationship can be rejected regardless of whether the underlying order of integration of the variables is 0 or 1 if the empirical F-statistics exceeds the upper critical bound value and there is no cointegration. Similarly, if the empirical F- statistic falls below a lower critical bound value, the null hypothesis is not rejected and the variables are cointegrated. However, if the empirical F-statistic falls between these two critical bounds values, the result is inconclusive.

2.1 Data description and preliminary analysis

The purpose of this paper is to test the causal relationship between the unemployment rate and GDP by using annual time series data of Tunisia country from 1980 to 2020. All variables used in this paper are annual frequency and have been obtained from World Bank data bases.

Table 1. Summary statistics of time series variables

Description	*Mean*	*Median*	*Maximum*	*Minimum*	*Skewness*	*Std. Dev.*
GDP	35741.8	33785	60145.3	15106	0.182305	5402.54
UN	14.25366	14.3	18.3	11.4	0.640831	1.435113
$\boldsymbol{\pi}$	5.473171	4,9	14	1,9	1.045890	2.519030

Table 1 reports some summary statistics (Mean, Median, Maximum, Minimum and skewness). Real gross domestic product (GDP), unemployment rate (UN) and inflation rate (π) are the variables of interest for econometric estimates purposes. We denote also that the last column in the table 1 indicates the skewness values for RGDP, unemployment and inflation variables. It was observed that the mentioned skewness value is considered to be close to the normal distribution of data as the acceptable values generally accepted if it ranged between (- 3) and (+3).

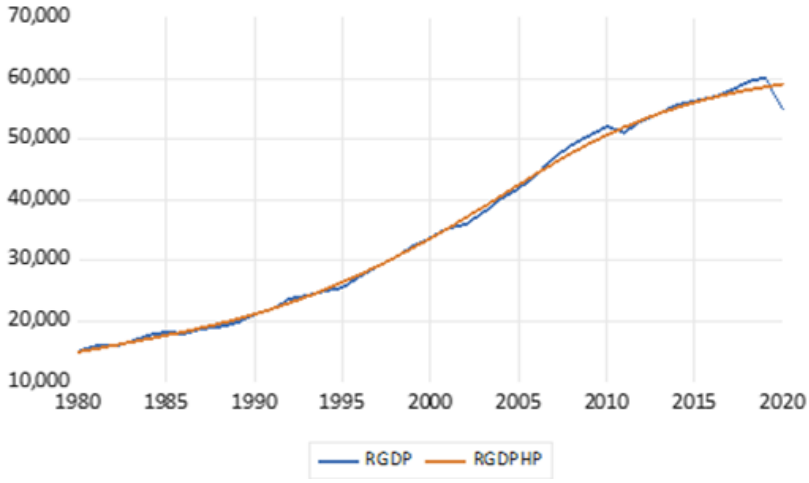


Figure 1. Evolution of Real GDP and Potential real GDP

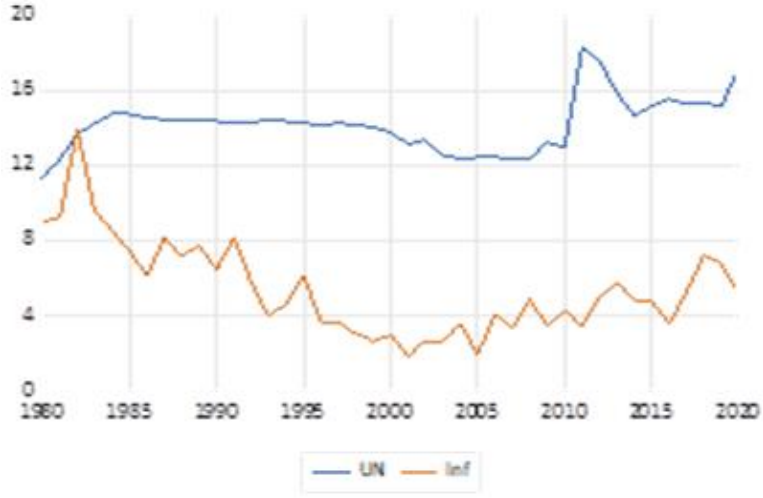


Figure 2. Evolution of Unemployment rate and inflation rate

Figure 1 and Figure 2 plot that since its independence in early 1960'S, Tunisia have been several distinct stages in the economic movement of economic growth and unemployment. With the regional and domestic political and economic stabilization in the last of 1980's, and amid favorable global economic environment, positive growth rates were generated, reaching an average of about 4.67% growth between 1990 and 2010. After the economic fall in 2009 as a result of the global financial crisis, and the tunisian revolution in 2010, the economy continued to grow, but at a slower pace (averaging 1.94% between 2010 and 2020), with the exclusion of 2020, which was however the poorest year in the Tunisian economic history (-8%). Moreover, the Revolution of 2010, distinguished by violent social movements, has exploded unemployment in Tunisia, which rose from 13.0% in 2010 to 18.3% in 2011. While it fell rapidly from 2011 to 2019 (15.1%), it then picked up to increase again and reach around 17% in 2020 (see Figure 2).

In this framework we investigate empirically that whether a relationship between the measures of unemployment gap and output gap is statistically significant in long-run as well as in short run or not in respect to okun's law coefficient for the Tunisian economy. We thus emphazise that Okun's law involved that to keep the unemployment rate constant, the real GDP growth rate should be equal to its potential growth which is determined by the economy's productive capacity, and it grows over time as a result of technological change and factor accumulation. In our analysis, we use the most obvious method where we smooth the output and unemployment series with the Hodrick Prescott (HP) filter by using the default smoothing parameter proposed by Ravn and Uhilg (2002).

A preliminary analysis of the unemployment–output relationship was conducted by determining the natural unemployment rate . However, we can compute the natural unemployment rate by using the linear regression expressed by Eq. (2), where this rate is measured by the parameter α. We can also calculate natural unemployment rate from the modern version of the Phillips curve (the augmented Phillips Curve model) provided by Blanchard and Katz (1997). According to Gujarati (2003), this curve can be expressed in the following format:

$$\pi_t - \pi_t^e = \beta_2(UN_t - U^n) + \mu_t \qquad (4)$$

Where $\pi_t$is the inflation rate at time t, π_t^e is expected inflation rate at time t, U^n is the natural unemployment rate prevailing at time t and μ_t is a stochastic error term.

Given that π_t^e is not directly observable, Blanchard and katz (1997) and Gujarati (2003) assume that $\pi_t^e = \pi_{t-1}$, which mean that the inflation expected this year is the inflation rate that prevailed in the last year. Substituting this assumption into and writing the regression model in the standard form (Eq.4), we obtain the following estimating equation:

$$\pi_t - \pi_{t-1} = \beta_1 + \beta_2 UN_t + \mu_t \qquad (5)$$

Eq.(5) reveals that if unemployment is below the "natural rate", inflation will rise, and vice versa. By using ordinary least squares (OLS), we can compute the underlying natural rate of unemployment which is determined by $\beta_1/_{-\beta_2}$. The econometric estimations results obtained by OLS of both linear regressions Eq. (2) and Eq. (5) respectively are reported in the following table.

Table 2. Preliminary results for computing natural unemployment rate

Variables	*Equation (2)*		*Equation (5)*	
Independent variables	Coefficient	T-statistic	Coefficient	T-statistic
Intercept	5.93311***	9.28510246	-0.037165***	-2.6497219
GDP	0.0000301***	2.13475177	-	-
UN	-	-	0.006268***	2.24017155
F-statistic	4.532345***		4,701910***	

Notes: The *** denotes the critical value at the 1% significance level

From the above results of Eq.(2), we can conclude that the intercept 5.933 indicates the natural unemployment rate as percentage. Nevertheless, estimating the natural unemployment rate by using expectations-augmented Phillips curve equation is considered as the most robust method (Gujarati, 2003). Thus, based on computing $-\beta_1/\beta_2$ from Eq. (5) estimate and according to the OLS results provided in table 2, Tunisian's natural unemployment rate is 5.93%.

As mentioned above, the purpose of this paper is to examine the dynamic relationship between the unemployment rate and the economic growth, for the Tunisian's economy since 1980's, while adopting ARDL method. This approach has several econometric advantages over several methods available for conducting the co-integration test such as Engle-Granger two-step (1987) test, the maximum likelihood based Johansen tests (Johansen, 1991). The main advantage of this testing lies in the fact that it can be applied irrespective of the regressors are I(0) or I(1), and this avoids the pre-testing problems associated with standard co-integration analysis which requires the classification of the variables into I(1) and I(0). Also, by adopting ARDL approach we can describe the existence of an equilibrium relationship in terms of long-run and short-run dynamics without losing long-run information. Moreover, Pesaran and Shin (1999) argued that the ARDL technique can be reliably used in small samples to estimate and test hypotheses on the long run coefficient in both cases where the underlying regressors are I(1) or I(0).

2.2 Unit Root Tests

In order to avoid the spurious regression problem, we start our analysis by testing whether the variables of interest are stationary processes. However, the first practice in applying any cointegration technique is to determine the degree of integration of each variable, precisely to be ensured that integrated order of considered series is not greater than or equal to two. We test the order of integration for each variable using Augmented Dickey-Fuller Test (ADF) and Phillips-Perron (PP) in both cases with intercept, and with intercept and deterministic time trend as a traditional statistics tests without structural breaks. The null hypothesis of ADF and PP tests is a unit root. The results of the ADF test and PP test for both at the level and the first difference on intercept and intercept and trend, the unit root test for RGDPdif, UNdif, RGDPgap, and UNgap are reported in table (3). We note that all variables are transformed in natural logarithms in order to grab their joint dynamics.

Table 3. Time series unit root tests

	ADF		*PP*	
Level data	*Intercept*	*Inter. + Trend*	*Intercept*	*Inter. + Trend*
u_{dif}	-6.0293***	-5.9029***	-6.1011***	-6.0403***
u_{gap}	-2.5152	-2.5789	-2.5152	-2.5787
y_{dif}	-3.4413**	-3.9015**	-3.5412**	-3.9580**
y_{gap}	-3.7597***	-3.6401**	-3.1417**	-3.0502
First difference data				
	Intercept	*Inter. + Trend*	*Intercept*	*Inter. + Trend*
du_{dif}	-10.0598***	-10.0285***	-18.1963***	-23.7139***
du_{gap}	-6.0293***	-5.9029***	-6.1011***	-6.0403***
dy_{dif}	-8.8597***	-5.5414***	-10.4981***	-13.3027***
dy_{gap}	-5.7724***	-5.6651***	-5.3772***	-5.2151***

Notes: The subscripts dif and gap indicate the difference model and the gap model, respectively. The ***, ** and * indicate the rejection of the null hypothesis at 1%, 5% and 10% significance levels, respectively

As can be clearly observed from table (3), Unemployment data indicate to be stationary in level or I(0) as well as the first differences or I(1). The results of the ADF test and PP test reveals also that the hypothesis of a unit root cannot be rejected in two variables (RGDPgap and UNgap), which means that series RGDPgap and UNgap are integrated of order one in the model introducing intercept and deterministic time trend. Furthermore, tests not globally reject the non-stationarity hypothesis for the level variables and accordingly we accept that the two variables are stationary for the first difference, which ensure the use the ARDL model.

After establishing that variables are stationary, the next procedure is to perform cointegration tests both short and long-run relationships between unemployment rate and economic growth.

2.3 ARDL bounds testing approach

In order to check the existence of a co-integration relationship among the variables, the bounds test (Pesaran et al. 2001), was implemented to examinee both short-run and long-run relationships between unemployment rate and economic growth in the Tunisian economy during the last 40's years. The essence models in the ARDL bounds test framework are presented by the unrestricted error correction models (Eq. 3).

Since the calculation of ARDL bounds is sensitive in the selection of the lag length, we select the optimal lag length from the first difference of the dependent variables by the minimum values of criteria Akaike (AIC). Following Pesaran et al. (2001) the null hypothesis of no cointegration is the simultaneous nullity of the long-run parameters i.e. $\vartheta_k = \theta_k = 0$ for $k = (dif, gap)$ i.e. we need to check this hypothesis

for two estimates. Then we compute the F-test applying following models such as $F\left(u_{\text{dif}} / y_{\text{dif}}\right)$ and $F\left(u_{\text{gap}} / y_{\text{gap}}\right)$ for indicating the difference model and the gap model, respectively.

The results of the ARDL Bounds test, regarding the existence of long-run relationships between unemployment and gross domestic product, are presented in Table 4.

Table 4. Results of ARDL Bounds Test

	Critical Values	
	I(0)	*I(1)*
Significance		
10%	5.59	6.26
5%	6.56	7.3
2.5%	7.46	8.27
1%	8.74	9.63
	Difference Model	*Gap Model*
F-statistic	25.98809	3.323978

Following the results reported in Table 4, the computed F-statistics for difference models is 25.988, which is greater than the upper bound critical value (9.63) at 1% level of significance. Thus, the null hypothesis of no co-integration is rejected, implying a long-run co-integration relationship among the unemployment rate and economic growth in Tunisia. However, for the gap model, the computed F-statistics is 3.323, which is below the lower bound critical value (5.59) at 10% level of significance, indicating the absence of co-integration among variables. Once the existence of cointegration relationship among the variables is confirmed, the difference model was estimated for the long-run coefficients with appropriate ARDL specification.

3. SHORT AND LONG RUN ESTIMATES

The results of long-run and short-run relationship between the variables are presented in the next table.

Table 5. Long-run coefficients

Dependent variable	y_{dif}	*Intercept*	*Trend*	*Selected model*
u_{dif}	-1.5935**	0.0923**	0.0021	ARDL(1,0)
t-statistics	-2.6997	2.1490	-1.1402	

Notes: The subscripts dif indicate the difference model. The ** and * indicate the rejection of the null hypothesis at 5% and 10% significance levels, respectively.

According to the above results, Okun coefficient shown a significant impact transmitted from real output to unemployment rate. A 1% increase in the real output for the difference model leads to a decrease in the unemployment rate by about 1.6%, ceteris paribus, meaning that the variables are negatively correlated as predicted by the theory, which implies in turn a significant unidirectional causality among the unemployment rate and the real output in the long-run. From the appropriate ARDL formulation, we attempt to investigate the short-run and long-run dynamics described by an unrestricted ECM (Eq.3). However, we can obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates as follow:

$$\Delta UN_{kt} = \varphi_0 + \sum_{i=1}^{l} \pi_{ik} \Delta UN_{k,t-i} + \sum_{i=1}^{p} \gamma_{ik} \Delta GDP_{k,t-i} + \lambda ECM_{k,t-1} + \epsilon_t \quad (6)$$

Where, ECT is known as an error correction term which is derived from the estimated equilibrium relationship of Equation (3) and indicates the speed of adjustment parameter. Equally, the ECT shows how much of the disequilibrium is being corrected, that is, the extent to which any disequilibrium in the previous period is being adjusted in current point. We remind also that $\pi_{ik}$and γ_{ik} are the short-run dynamic coefficient parameters of the model convergence to equilibrium and λ is the speed of adjustment parameter.

Table 6. Cointegrating form

Independent variables	*Du_{dif}*	*t-statistics*
*Dy*_{dif}	-0.9349*	-1.8663
*D*Intercept	0.0923***	3.1154
*D*Trend	-0.0021	2.0459
ECT(-1)	-0.8891***	-7.3522

Notes: The subscripts dif and gap indicate the difference model and the gap model, respectively. The ***, ** and * indicate the rejection of the null hypothesis at 1%, 5% and 10% significance levels, respectively.

The short-run coefficients highlight that the error correction term is negative and significant at 1% significance level for the difference model, indicating the short-run adjustment among the real output and the unemployment rate. The coefficient of ECT(-1) is -0.889 and meaning that the speed of adjustment to restore equilibrium in the dynamic model is high. About 89% of disequilibria from the previous year's shock converge back to the long-run equilibrium in the current year.

Model validation is done on the basis of a set of tests, which was conducted and was used to measure the estimated parameters such as Lagrange Multiplier (LM) test for autocorrelation, Autoregressive conditional heteroskedasticity (ARCH) test for heteroskedasticity, the Jarque-Berra (JB) test for error normality, RESET test for functional misspecification, and CUSUM and CUSUMSQ test for parameter Stability. Table 4 displays these last empirical values and also the empirical statistics of the different tests.

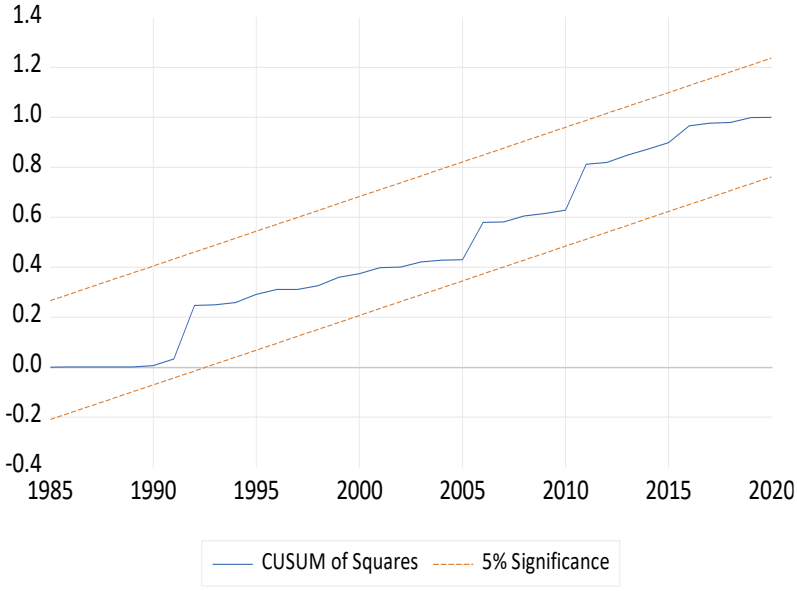
Table 7. Diagnostic tests and F- test

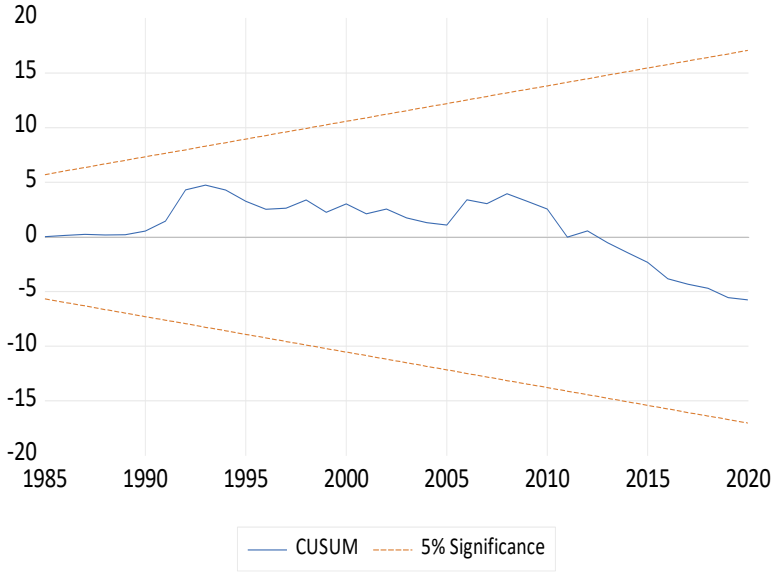
Type model	*LM*	*ARCH*	*JB*	*RESET*
Difference	0.186543	0.045584	1.5130	0.2521
	[0.9110]	[0.8309]	[0.4693]	[0.6188]

Notes: The values in brackets indicate the p-values. For F-statistics of the difference model. The *** and * indicate the rejection of the null hypothesis at 1% and 10% significance levels, respectively.

According to results provided in table 4, all hypotheses on residual are verified. The Breusch-Godfrey LM test and the Jarque-Bera normality test indicate that residuals are uncorrelated and normally distributed. Furthermore, the homoskedasticity hypothesis of the residuals is upheld. The computed Ramsey RESET statistic does not reject the hypothesis of the correct functional form of above Eq. (1) and therefore the model is correctly specified. Furthermore, the representations of CUSUM and CUSUM of Squares are used for examining the residual instability and structural variation. Figure 2 indicates the coefficients stability, the variation of cumulated residuals and of the squares of cumulated residuals being within the limits of the interval corresponding to the confidence level of 95%, confirming the stability of the model at a significance level of 5%, so it can be said that the long-run and short-run outcomes of the estimated model is congruent and stable.

Figure 4. Plots for the CUSUM and CUSUM of Squares





CONCLUSION

Our study sought to contribute to the ongoing debate about the validity of Okun's Law over the past four decades for Tunisia, in a new post-revolutionary economic context characterized by high unemployment rates, decreased growth rates and many other socioeconomics challenges.

In this study, we investigated the long-run and short-run relationship between unemployment and gross domestic product in Tunisia over the period 1980-2020 by employing augmented autoregressive distributed lag (ARDL) bounds testing approach. Findings suggest that there is a strong evidence of co-integration among real gross domestic product growth rate and unemployment rate and confirm Okun's coefficient negativity for the difference model. Our estimation results shows that in the long run, one per cent increase in the economic growth receipts leads about 1.6 per cent decrease in the unemployment.

While, the evidence of validity of Okun's law was confirmed by the difference model, the result of the gap model provides some important implications regarding the Tunisian labor market. Firstly, the Tunisian labor market suffered of its chronic mismatch between supply and demand in light of the incapacity of the economic to generate enough jobs in different sectors (Agriculture, manufacturing and services), especially after revolution. Secondly, the structure of labor market in Tunisia is rigid and the problem of unemployment is more structural than cyclical and that unemployment cannot be cured by merely having an expansionary fiscal policy (El Andari and Bouaziz, 2015) . Thus, economic policies more oriented to structural changes and reform in labor market would be more appropriate in the case of Tunisia. Thirdly, political stability must be maintained in the country because it represents the most crucial contributor to attract Foreign Direct Investment as well as to accelerate economic growth through favoring private investment and supporting industrial policy in order to allow more value-added manufacturing activities and thus creating more employment opportunities.

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