

## Asymmetry relationship between economic growth and unemployment rates in the Saudi economy: Application of Okun's law during the period 1991–2017

Bilal Louail \*, Siham Riache

College of Business Administration, Northern Border University, Arar, Saudi Arabia

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### ABSTRACT

The purpose of this paper is to examine Okun's law in the Saudi economy by examining the impact of the OUTPUT gap on the unemployment rates' gap, and the contribution of economic growth to reducing unemployment. This investigation intends to fill a major gap regarding empirical literature on OKUN law drivers in developing countries in general and Arab countries in particular. The autoregressive distributed lag bounds testing technique is used to examine the existence of Okun's law in the Saudi Economy during 1991–2017. The empirical results reveal the existence of Okun's law in the Saudi economy. Coefficients estimated by using the Gap Version and concluded that there was a negative and significant impact of the gross domestic product gap on unemployment rates, with a 1% increase in Gross Domestic Product being correlated with a 0.29% decrease in the unemployment rate. This research aims to fill a gap by using the Okun coefficient to study the effect of increasing economic growth rates on unemployment rates in the Saudi economy during 1991–2017.

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### 1. Introduction

Change in the economic growth rates, according to the standard approach, leads to a decline in unemployment rates of varying proportions, usually explained by the nature of the economic growth achieved. Moreover, a high unemployment rate may affect economic growth in a manner determined by the nature and source of unemployment and its relevance to the sectors that are most influential in the growth of the economy.

The interplay between growth rates and unemployment rates is the essential factor in understanding how unemployment is affected, as economic policies are usually developed to increase growth rates and not to reduce prevailing unemployment rates, which are seen as external variables in most standard economic models.

Understanding of how to influence unemployment should be based on understanding the nature of the relationship of unemployment with other economic variables. Such as growth,

investment, the rate of wages, and inflation. As the above factors overlap and are all linked to changes in economic structure, the analysis of change is based mainly on linking unemployment to the change in the economy's ability to change, i.e., with economic growth as the most important measure of quantitative economic change.

Therefore, economic policies that support growth are the same as are those for eliminating unemployment. However, economic analysis using the standard approach shows that the relationship between unemployment and growth varies according to several factors that may be considered as specific factors in some economies.

Therefore, it appears that a link between growth and unemployment seems inaccurate if we adopt the standard analysis of each economy.

It can also be concluded that the perception that economic policies supporting growth are not the same policies to eliminate unemployment.

The first was used by [Okun\(1962\)](#) for the US economy in studying the relationship between GNP and unemployment rates during 1947–1960. He concluded that each 1% increase in GNP led to a 0.3% decrease in unemployment rates. This research aims to confirm the validity of Okun's law in the Saudi economy, whether the rate of unemployment and GDP growth are linked together or not, to find the strength of this relationship in addition to the

\* Corresponding Author.

Email Address: [bilal.louail@nbu.edu.sa](mailto:bilal.louail@nbu.edu.sa) (B. Louail)

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Corresponding author's ORCID profile:

<https://orcid.org/0000-0002-2383-4329>

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direction of correlation. According to Okun's formulation, GDP growth leads to a downward trend in the unemployment rate. GDP growth means an increase in real GDP over time; real GDP means the value of all goods and services formed in any economy adjusted for price changes.

As for the Saudi economy, a decline in unemployment rates has been observed in recent years, reaching 12.7% in 2018 (GAS, 2018), especially after the challenge that Saudi Arabia promised through Vision 2030. Among its priorities were the labour market and the reduction of unemployment rates. Thus, the research problem lies in the following question: What is the effect of changes in economic growth rates on unemployment rates in the Saudi economy during the period 1991–2017?

One of the reasons for choosing this topic is the lack of studies dealing with the topic in the Arab countries in general and Saudi Arabia in particular. Moreover, the choice is also connected with the introduction to and implementation of Vision 2030 in the Saudi economy, Vision 2030 is based mainly on diversification of the economy, raising the rates of economic growth, and reviving the labor market and investment development. Therefore, this research aims to fill a gap by using the Okun coefficient to study the effect of increasing economic growth rates on unemployment rates in the Saudi economy during the period 1991–2017.

The autoregressive distributed lag (ARDL) bounds testing technique is used to examine the existence of Okun's law in the Saudi Economy during 1991–2017.

The empirical results reveal the existence of Okun's law in the Saudi economy. Coefficients estimated by using the Gap Version and concluded that there was a negative and significant impact of the gross domestic product gap on unemployment rates, with a 1% increase in Gross Domestic Product being correlated with a 0.29% decrease in the unemployment rate, consistent with Okun (1962), Prachowny (1993), Ting and Ling (2011), and Abu (2017). This study attempts to contribute to the literature on Okun's law and is organized in five sections; section 1 is an introduction to the work, section 2 is devoted to literature review and hypotheses, section 3 introduces data and methodology, empirical results and discussion are the essential part of the study which are discussed in section 4, finally, section 5 focuses on implication, limitation and the future of research.

## 2. Literature review and hypotheses

### 2.1. Literature review

Many studies confirm that a correlation between economic growth rates and changing unemployment rates prevails in economies. Standard studies show a causal relationship in the Granger (Granger Causality) concept. However, the theoretical analysis does not always confirm this relationship because it

focuses on unemployment as an economic phenomenon resulting from an imbalance in economic policies.

The first to use the relationship between GNP and unemployment rates was Okun (1962) on the US economy, where he studied the relationship between 1947–1960 and concluded that each 1% increase in GNP led to a 0.3% the unemployment.

Subsequent studies attempted to confirm this relationship, and some of them applied the OKUN law to regional groupings, whether in the same countries (by provinces or states) or of different countries. Most studies for example, Durech et al. (2014) in the Czech Republic, Adanu (2005) in Canada, and Binet and Facchini (2013) in France—concluded that there was a discrepancy in the OKUN transactions.

However, some studies found no significant differences between OKUN in regional groupings. Such studies include Villaverde and Maza (2009) in Spain, and Apergis and Rezitis (2003) in Greece.

Maria et al. (2008) confirmed that the rate of unemployment and per capita income fluctuate over successive periods, and this is repeated over time, i.e., the dynamic analysis between the positive growth of income and unemployment rates.

Economou and Psarianos (2016) also confirmed that Okun's law is robust to alternative specifications. The effect of output changes on unemployment rates is weaker for countries with increased labor market protection expenditures, and it is more persistent for countries with low labor market protection.

Ball et al. (2015) also confirmed that the variation in the Okun coefficients in most countries is due to the specific characteristics of national employment and has nothing to do with labor protection legislation.

Guisinger et al. (2018) detailed the OKUN parameters for each state in the United States by introducing variables (e.g. educational level, housing achievement, low union rate, and non-productive sectors) that were neglected in previous studies and that were confirmed to affect the relationship.

Bartolucci et al. (2011) applied the OKUN Act to a group of countries, focusing on the financial crisis, and concluded that there were additional effects of certain types of financial crises on the unemployment rate.

However, some studies, such as Valadkhani and Smyth (2015) have shown that the Okun law is weak. Moreover, provided evidence weak law Okun both after the recession of 1981–1982 and after the global financial crisis of 2008.

At the level of the Arab countries, Ben-Salha and Mrabet (2019) studied the North African countries and estimated OKUN factors by taking into account the possible presence of structural breaks and thresholds and inconsistencies. By drawing up the policy implications of the countries under study, the researchers highlighted the existence of mixed types with regard to their importance, size, and stability in the various groups of labor forces and countries.

The labor market in the Kingdom of Saudi Arabia has been dealt with by many studies, including [Jouili and Khemissi \(2019\)](#), who investigated the impact of economic diversification in the employment of graduates and showed that successful economic diversification contributes positively to the creation of jobs. The actual economic diversification of Saudi Arabia is low in terms of creating new jobs, especially for holders of bachelor's degrees. So, the Saudi government needs to increase its economic diversity to create opportunities for graduates to get jobs.

[Alrasheedy \(2017\)](#) applied Okun's law to the Saudi economy and concluded that the real GDP loss is \$ 95 billion, whereas the loss of non-oil real GDP is \$ 52 billion, as a result of 1,687,313 Saudis being unemployed. However, this study did not cover the literature pertaining to the law. This is a research gap, especially since the Kingdom's entry into the application of Vision 2030.

## 2.2. Research hypotheses

To answer the previous problem and achieve the desired research objectives, we propose the following set of hypotheses:

**H1:** There is a negative relationship between economic growth rates and unemployment rates in Saudi Arabia.

**H2:** Economic growth rates negatively affect the unemployment rates in Saudi Arabia.

**H3:** Unemployment rates negatively affect the growth rates of the Saudi Economy.

**H4:** Policies in Saudi Arabia have a positive impact on the growth of the economy.

**H5:** Policies adopted in Saudi Arabia have a positive impact on unemployment rates.

## 3. Data and methodology

In this study, we used an empirical estimation of Okun's law in the context of the Saudi Economy during the period 1960–2017. We used the EViews software for analysis.

### 3.1. Data

Data were taken from the World Bank's database for all the variables during the study period. The variables are summarised in [Table 1](#).

**Table 1:** variables used by Okun's Law

Variable	Proxy	Data source
unemployment	$U_t$	WDI Database
Real GDP	$GDP_t$	WDI Database

### 3.2. Methodology

In this section, we present the empirical methodology used to estimate long-term trends for unemployment and output. We begin with presenting the standard model of the Okun coefficient, followed by additional models with

different interaction terms. The following different versions of Okun's law are used in this research.

#### 3.2.1. The gap version

[Okun \(1962\)](#) introduced Okun's Law, which proved a negative relationship between unemployment and output. This law refers to the empirical regularity that holds between cyclical output and cyclical unemployment. The level form of this relationship may be formulated by an equation given as:

$$(U_t - U_t^*) = \beta(Y_t - Y_t^*) + \varepsilon_t \tag{1}$$

where  $U_t$  is unemployment rate;  $Y_t$  is actual output;  $U_t^*$  is natural rate of unemployment;  $Y_t^*$  is potential output;  $\varepsilon_t$  is error term in period t;  $\beta$  is coefficient of Okun.

#### 3.2.2. The difference version

According to [Okun \(1962\)](#), the empirical relationship between real GDP and unemployment can be estimated using the first differences. The following equation expresses it:

$$(Y_t - Y_{t-1}) = \beta_0 + \beta_1(U_t - U_{t-1}) + \varepsilon_t \tag{2}$$

where,  $\Delta U_t$  is represents the changes in the unemployment rate between the current them and previous periods;  $\Delta Y_t$  is the growth rate of output (GDP) in percent between the current and the previous periods;  $\varepsilon_t$  is Error term in period t;  $\beta_1$  is Coefficient of Okun.

In the Okun's Law is hold when the coefficient  $\beta_1$  should be negative, as a growing economy, in the long run, ought to lead to declining unemployment following [Knotek \(2007\)](#).

#### 3.2.3. The dynamic version

The first difference model has been extended to take account of a time-lagged variable, and the model is called dynamic that corrects for omitted effects of past output on the unemployment rate. The following expression expresses the dynamic model:

$$\Delta Y_t = \beta_0 + \beta_1 U_t + \beta_2 U_{t-1} + \beta_3 U_{t-2} + \beta_4 \Delta Y_{t-1} + \beta_5 \Delta Y_{t-2} + \varepsilon_t \tag{3}$$

where,  $U_t$  is the Unemployment rate in period t;  $Y_t$  is GDP growth in period t;  $\Delta Y_{t-1}$  is Output level at period t-1;  $U_{t-1}$  is Unemployment at period t-1;  $\Delta Y_{t-2}$  is Output level at period t-2;  $U_{t-2}$  is Unemployment at period t-2;  $\beta_1 \beta_2 \beta_3$  is Okun's coefficient;  $\beta_0$  is Intercept term;  $\varepsilon_t$  is Error term in period t.

Most of the existing literature focuses on the Okun coefficient, without studying either the adjustment nature or the linear nature of this relationship.

**4. Empirical results and discussion**

In this part, Just do the gapVersion, we use the ARDL model because the time series of Unemployment gap is nonstationary at the level I(0), and stationary in the first difference I(1), while the time series of the output gap is stationary at the level I(0). The first regression equation of this empirical study (the gap version) can be specified as:

$$Ugap_t = \beta_0 + \beta_1 OUTPUTgap_1 + \varepsilon_t \tag{4}$$

Using the ARDL model, the equation takes the following formula:

$$\Delta Ugap_t = \beta_0 + \beta_1 gap_{t-1} + \beta_2 OUTPUTgap_{t-1} + \sum_{i=1}^p \gamma_{1i} Ugap_{t-1} + \sum_{j=1}^q \gamma_{2j} \Delta OUTPUTgap_{t-1} + \varepsilon_t. \tag{5}$$

To estimate the parameters of form Eq. 4, the stability of the time series should be studied. Then, the model should be tested, obtained, and explained by following these steps:

**4.1. Unit root tests**

Table 2 shows the results of the integration tests of the study variables using the Augmented Dickey-Fuller test (ADF) and the Phillips-Perron test (PP). For the unit root, the results show that the independent variable (Ugap) is integrated into the first level I(1), whereas the independent variable (OUTPUTgap) is integrated at level I(0). As a result, the ARDL Bounds Testing procedure can be adapted to estimate our model.

**Table 2: Unit root tests results (ADF and PP)**

		Ugap	OUTPUTgap
At level	ADF test	-2.15	-5.47***
	PP test	-2.98	-7.08***
At 1st difference	ADF test	-3.77***	-
	PP test	-2.98**	-
Order of Integration		I(1)	I(0)

Note: \*, \*\*, and \*\*\* indicate rejection of the null hypothesis at 1%, 5%, and 10% levels, respectively

**4.2. Bounds tests for cointegration**

Table 3 shows the statistical results of the Bounds test attached to the model. The calculated F statistic is estimated at (9.99), which is higher than is the critical value Bounds related to the upper limit of 1% of importance, which is estimated at (7.84). Thus, the null hypothesis is rejected, indicating a long-run cointegration relationship between the two variables.

**Table 3: Computed F-statistic for cointegration tests-ARDL bounds tests**

	Model	conclusion
F-statistics	9.99***	
Lower-upper bound (10%)	4.04-4.78	Co-integration
Lower-upper bound (5%)	4.74-5.73	Co-integration
Lower-upper bound (1%)	6.84-7.84	Co-integration
K	1	

Note: \*, \*\*, and \*\*\* denote statistical significance at 1%, 5%, and 10% levels, respectively. K represents the number of regressors included in the models

**4.3. Diagnostic and stability tests**

The results of diagnosing the estimated model in the dynamic ARDL method, using residual diagnostics, are summarized in Table 4.

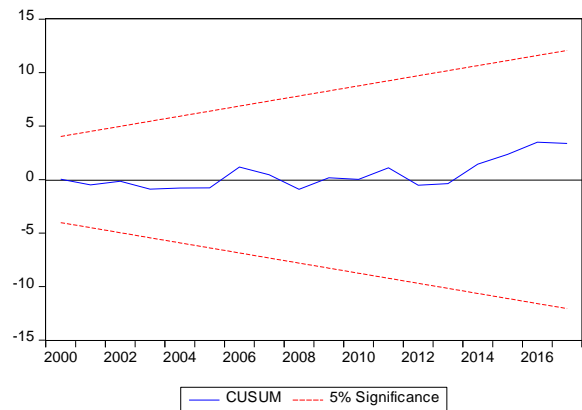
**Table 4: Results of diagnostic tests**

Diagnostic Tests	Model	
	Value	p-value
Serial Correlation LM	0.34 (3)	0.79
Heteroscedasticity ARCH	0.44 (1)	0.51
Normality Jaque-Bera	0.04(3)	0.97
Functional Form	0.10 (1)	0.75
Adj. R <sup>2</sup>	0.73	

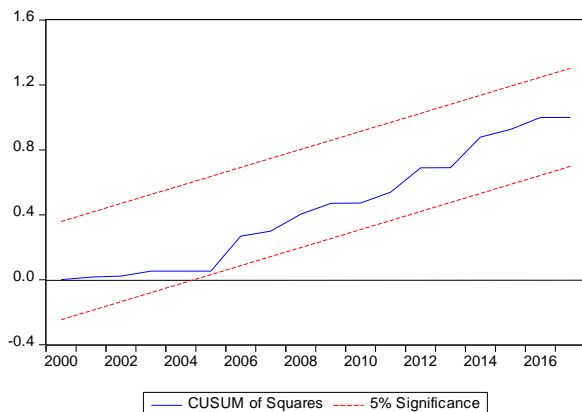
Note: ( ) is the order of diagnostic test (The lag order)

The results show that the model is free of any problem related to serial correlation and heteroscedasticity. Moreover, the functional form is confirmed by Jarque-Bera normality tests. The value of adjusted R<sup>2</sup> is approximately 73% in the model.

The stability of the estimated coefficients in the model is also proved using CUSMUS and CUSMUSQ stability tests, as shown in Fig. 1 and Fig. 2. Both figures indicate that the estimated models are within the 5% significance line, implying that the coefficients of the estimated model are stable.



**Fig. 1: Model stability: Cumulative sum of recursive residuals (CUSUM)**



**Fig. 2: Model stability: Cumulative sum of squares of recursive residuals (CUSUM of squares)**

**4.4. The long- and short-run estimation findings**

The ARDL model distinguishes between short- and long-run results, and, by estimating the model parameters, we get the following results.



**4.4.1. For the short run**

The results shown in Table 5 indicate (a) The estimated coefficient of Unemployment gap in the previous year is negatively and significantly related to Unemployment gap in the current year at the 5% significance level in the model, (b)  $OUTPUT_{gap_{t-1}}$  is negatively and significantly related to Unemployment gap at the 1% significance level, and (c) the difference of  $OUTPUT_{gap_{t-1}}$  and  $OUTPUT_{gap_{t-2}}$  is positively and significantly related to Unemployment gap at the 5% significance level. However, the difference in  $OUTPUT_{gap_t}$  appears to be insignificant in the short-run.

**Table 5:** Error correction representation of ARDL bounds test model

Variables	Model ARDL(1, 3)	
	Coeff.	p-value
Intercept	-0.035	0.43
$U_{gap_{t-1}}$	-0.033**	0.033
$OUTPUT_{gap_{t-1}}$	-0.094***	0.0024
$\Delta OUTPUT_{gap_t}$	-0.018	0.32
$\Delta OUTPUT_{gap_{t-1}}$	0.054**	0.013
$\Delta OUTPUT_{gap_{t-2}}$	0.045**	0.02
$ECT_{t-1}$	-0.033**	0.033

Note: \*, \*\*, and \*\*\* denote statistical significance at 1%, 5%, and 10% levels, respectively

**4.4.2. For the long-run**

Table 6 shows the long-run results of the Okun coefficient in Saudi Arabia during the period 1991–2017. The immediate impact of changes in output gap is negative and significant at the 10% level, which means that a 1% decrease in output gap will increase the unemployment rate by 0.082%. These results are supported by Ting and Ling (2011).

**Table 6:** Long-run coefficients' estimation with the ARDL bounds test model

Variables	Model ARDL(1, 3)	
	Coeff.	p-value
Intercept	-0.11	0.44
$OUTPUT_{gap}$	-0.28*	0.082
$U_{gap_t} = -0.1090 - 0.287 * OUTPUT_{gap_t}$		

Note: \*, \*\*, and \*\*\* denote statistical significance at 1%, 5%, and 10% levels, respectively. The dependent variable is U gap

In Table 7, which represents the results of the longitudinal methodology for the long-run relationship, we note that the statistic F-fisher calculator is the largest of all critical values at either the level I(0) or the first difference I(1). This indicates the existence of a co-integration relationship between the two variables; thus, we say that there is a long-run equilibrium relationship between the GDP and unemployment rates in the Saudi economy. This is consistent with Ting and Ling (2011) and Abu (2017).

Since there is a co-integration in the long-run, we performed ECM error correction tests. Table 8 shows the results in the short-run. The findings reveal that the speed of adjustment is negative (-0.32) and significant at 1% and does not exceed the value of

one, hence, the long-run equilibrium mechanism is valid (Pesaran et al., 1999). This implies that the annual rate of adjustment toward full equilibrium in the long-run ranges from 32% in the model.

**Table 7:** Long-run relationship: Computed F-statistic for cointegration tests–ARDL bounds tests

	Model		conclusion
	I(0)	I(1)	
Lower-upper bound (10%)	3.02	-3.51	Co-integration
Lower-upper bound (5%)	3.62	-4.16	
Lower-upper bound (1%)	4.95	-5.58	
F-statistics	6.70*		
P-value	0.0825		
K	1		

Note: \*, \*\*, and \*\*\* denote statistical significance at 1%, 5%, and 10% levels, respectively. K represents the number of regressors included in the models

Thus, Okun's law applies to the Saudi economy in both the short- and the long-run, i.e., a 1% increase in GDP reduces the unemployment rate by 0.29%, which is the case in Okun (1962).

**Table 8:** ECM Regression of ARDL; bounds test model

Variables	Model ARDL(1, 3)	
	Coeff.	p-value
$\Delta OUTPUT_{gap_t}$	-0.018	0.32
$\Delta OUTPUT_{gap_{t-1}}$	0.054**	0.013
$\Delta OUTPUT_{gap_{t-2}}$	0.045**	0.02
$ECT_{t-1}$	-0.32***	0.0002

Note: \*, \*\*, and \*\*\* denote statistical significance at 1%, 5%, and 10% levels, respectively

**5. Conclusion**

Okun's law refers to the relationship between economic growth and the rate of change in unemployment. Okun (1962) considers unemployment to be a declining proportion of the economy's potential or normal growth rate. According to this approach, it is assumed that, for the unemployment rate to fall, the growth rate of the national economy will be above either the minimum or the normal growth limit. This paper aims at estimating the Okun coefficient in the Saudi economy to ascertain its existence. The study focuses on annual time series data of Saudi Arabia collected from World Bank sources. The coefficient of Okun's law was estimated by using the Gap Version and, using the autoregressive distributed lag (ARDL) bounds testing technique.

The empirical results reveal the existence of Okun's law in the Saudi economy. Coefficients estimated by using the Gap Version and concluded that there was a negative and significant impact of the GDP gap on unemployment rates in both the short- and the long-run, whereby a 1% increase in GDP reduced the unemployment rate by 0.29%.

These results are supported by Okun (1962), Ting and Ling (2011), and Abu (2017), and they are incompatible with Akram et al. (2014) and Driouche (2013).

The results of this study can benefit several parties. The most important of these are the decision-makers in Saudi Arabia involved in reducing the unemployment rate in light of the

implementation of Vision 2030. Other parties that can benefit include economic institutions and businessmen who contribute to reducing unemployment, and decision-makers in Arab countries and developing countries—especially the oil states—who are seeking to bring their economies closer to the Saudi economy.

One of the most important shortcomings of this study is the lack of statistics on unemployment rates—we had to rely on the period 1991–2017, which is considered a small amount—in addition to our failure to issue the difference and the dynamic version.

Which was possible to get better results, and if a group of countries can be the results were better, Therefore, we can open the Future for this research through the study of the Okun law according to the third publications, even if the group of countries will be better as the Arab countries, the GCC countries or the countries of the Middle East and North Africa.

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### Compliance with ethical standards

### Conflict of interest

The authors declare that they have no conflict of interest.

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