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TESTING THE VALIDITY OF OKUN'S RULE OF THUMB ACROSS PALESTINE AND ISRAEL

Ibrahim Awad, Arne Hallam** and Mahmoud Alialhuseen****

Abstract: This study aims at investigating the validity of Okun's law across Palestine and Israel using quarterly time series data for the period 2000: Q1 - 2014: Q1. Different econometric and statistical techniques of Ordinary Least Square, Granger causality tests, co-integration, and the Vector Error Correction Model are used to accomplish the overall objective of this study. The principal conclusion indicates that the Okun's law does not hold in both Palestine and Israel, so that policymakers are advised to constantly direct human and other resources from unproductive to sustainable and productive activities that can shift aggregate demand and real output growth upwards. Toward this end, political stability and efficient governance should be taken into account.

JEL classification: B22; B23; C32.

Keywords: GDP growth; Granger causality test; Israel, Okun's law; Palestine; Unemployment rate; Unit root tests.

1. INTRODUCTION

Palestine has suffered from high rates of unemployment over the last fifteen years. For instance, in 2000 the unemployment rate ranged from 10.9% during the first quarter to 28.4% during the fourth quarter. Accordingly, Palestinian economic activities declined and witnessed a setback; this was mainly due to the second intifada in the occupied territories. The unemployment rate also remained very high during recent times, the unemployment rate in Gaza Strip increased from 32.5% in the third quarter 2013 to 38.5% in the fourth quarter of 2013 while it decreased in the West bank from 19.1% to 18.2% in the same period (Palestinian Central Bureau of Statistics "PCBS", 2014). Consequently, the problem of unemployment still lingers on the Palestinian Territories (Arshad and Erixon, 2012). Conversely, the unemployment rate in Israel was 8.8% during 2000, but it was reduced to 6.1% during in 2008 (Melnick and Mealem, 2009).

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Gross Domestic Product (GDP) in Palestine was estimated by US$6.80 billion in 2012, and averaged US$4.41 Billion from 1994 until 2012, reaching an all-time high of US$ 6.80 Billion in 2012 and a record low of US$3.04 Billion in 1994 (PCBS, 2014). In Israel, GDP was estimated by US$291.36 billion in 2013 with GDP per capita US$23,414.98 compared with US$ GDP per capita US$1,036.00 in Palestine (The World Bank Group, 2013), which shows a big difference between Palestine and Israel regarding both, unemployment rate and GDP.

Over the last decade, several studies were conducted to investigate unemployment versus output, the so called "Okun's rule of thumb". This economic term is an empirical observation rather than a result derived from theory. These studies have different results, and sometimes conflicted in their findings and conclusions about validity of Okun's law. These differences are represented through the coefficient value, stability over the business cycle, causality existence, and the direction of relationship (Owyang and Sekhposyan, 2102; Sánchez and Liborio, 2012; Faquiryan, 2010; and Lal et al. 2010). High rates of unemployment become alarming in many different countries, especially in developing ones. High unemployment plays a vital role in reducing GDP growth rates, which is likely to delay development at various levels. To the best of our knowledge, empirical studies of Okun's law for Palestine and Israel are non-existent.

Hussain and Siddiqi (2012) reveal that the importance of Okun's law is not limited to economists' interests, but also it applies for both structural policies and macroeconomic stabilization. Empirical studies that can provide information on Okun's law applied on MENA region is advised to be taken into account, this may help policymakers to realize how unemployment rates affect projected GDP growth. Revoredo-Giha (2012) shows that accurate estimates for the effect of unemployment on GDP are of importance value for policy analysis.

The focus of this paper is to investigate the validity of Okun's law in Palestine and Israel. A formal statement of the law is that a one percentage increase in the unemployment rate causes a three percent decrease in output (GNP) (Okun, 1962). Other version of Okun's rule of thumb has postulated that a percentage increase in the unemployment rate causes a 2% fall in GDP (Daly *et al.,* 2014; and Mankiw, 2012).

The rest of the paper is structured as follows. The next section presents some of the most important and related previous literature. Section 3 discusses the methods employed for analyzing the obtained data. Sections 4 and 5 show the empirical findings and discussion of the empirical findings. Finally, section 6 presents concluding remarks and policy implications.

2. POLICY AND LITERATURE REVIEW

While the Palestinian and Israeli economies are closely linked to each other and participate as partners in different ways, testing the validity of the Okun's rule for Palestine and Israel is necessary to be taken into account by the two countries. In particular, theoretical viewpoint of Okun's rule supports the existence of negative relationship between real GDP growth and unemployment rate, so that examining this economic relation across the two economies is of importance value to both Palestine and Israel, as this is the only empirical hypothesis explaining the relationship between unemployment rate and GDP growth.

The literature about the relationship between percentage change in GDP growth and percentage change in unemployment mainly focuses on causality, stability, Okun's coefficient,

and whether or not that coefficient is asymmetric over the business cycle. As aforesaid, different studies were conducted to investigate the validity of such relation, but there are no empirical and critical studies focused on Palestine and Israel. In 1962, Arthur Okun reported an empirical regularity: a negative short run relationship between changes in the unemployment rate and output growth. Many studies confirmed this result, and Okun's Law has become a fixture in macroeconomics textbooks. According to the rule of thumb many economists acknowledge that an increase in the unemployment rate of one percentage causes a two percent deviation of output (Mankiw, 2012). In Jordan, Nigeria, and seven OECD countries the rule of Okun was not validated (Kreishan, 2011; Walterskirchen, 1999; and Harries and Silverstone, 2001). In contrast, it was validated in ten eastern European countries, Spain, French, and South Africa (Maza and Villaverde, 2009; and Binet and Facchini, 2012; and Marinkov and Geldenhuys, 2007).

2.1. The Numerical Value of Okun's Law coefficient (OLC)

Okun's Law coefficient (OLC) is obtained from regression analysis to measure a change in the dependent variable (GDP growth rate) with respect to changes in the independent variable included in the model. Sögner and Stiassny (2002) used Ordinary Least Square Estimates (OLS) to investigate Okun's law for 15 OECD countries and checked structural stability. Beaton (2010) conducted a comparison study between U.S and Canada. She used OLS and **Time-Varying Parameter** Regression **Models** (TVP) to assess stability. The author shows that there are different values for the coefficient, the coefficient values are 2.0 for U.S., and 2.6 for Canada, meaning that the coefficient is subject to structural changes over the business cycle. On the other hand, Cuaresma (2003) utilizes the Hodrick–Prescott filter and a bivariate structural time series model to isolate the cyclical component of the variables of interest. He shows asymmetric OLC. The threshold regression model developed by (Hansen, 2000) found that the relationship between Okun's variables is asymmetric. Islas-Camargo and Cortez (2011), based on Clark (1989) estimated the correlation, so they concluded that OLC is different compared with previous estimates. In addition, Huang and Lin (2008) indicate that despite the fact that Okun's coefficients are changing over time, the Okun's relationship remains negative in all time periods, suggesting the validity of Okun's law.

2.2. Econometric Techniques and Okun's Law Variables

The issue of stationarity should be taken into account in considering time series data, such as GDP and unemployment, particularly if the developed model is used for forecasting. Investigating Granger causality relationship between variables, it also requires examining stationary for each variable, i.e. data is necessary to be stationary or a random walk. Nwakanma (2012) used the Augmented Dickey-Fuller (ADF) for testing stationarity of variables related to the output gap. In a study of exports and economic growth, Muhammad and Pervaz (2011) used quarterly data (1990-2008). The Ng-Perron unit root test was used to examine the stationarity for all variables included in their study on Pakistan. In addition, the Autoregressive Distributed Lag (ARDL) and Error Correction Method (ECM) for short run dynamics were utilized. They conclude that there is a positive correlation between exports and economic growth.

On the other hand, Salman (2012) applied the Granger causality test from 1993-2011 on Sweden. He concluded that GDP Granger causes unemployment but the opposite was not true. Caporale and Skare (2011) used a sample of 119 countries to examine the long and short term relation between real GDP growth and employment growth over the period 1970-2010. The Granger causality test was used to investigate causality, the authors concluded that, in the short run there is a positive Granger causality from output growth to employment, but in the long run, a negative Granger causality from an employment growth to output growth. On the other hand, Tatoglu (2011) revealed in his study, which was applied on Europe for the period 1977-2008, that there is a significant relation between unemployment and GDP growth. This conclusion is derived from using non-stationary panel techniques.

3. DATA, METHODOLOGY AND TECHNIQUES

3.1. Study Sample and Data Gathering

As aforesaid, Okun's law is typically used to inform us how much of an economy's GDP may be lost when unemployment rate is increasing (Mankiw, 2010; and Levine, 2013). The Palestinian and Israeli economies are politically, economically, and spatially linked to each other, so that modelling Okun's law in one without considering the other doesn't make statistical or economic sense. Initially, we will investigate whether Okun's law holds in Palestine and Israel respectively, and then we will consider the extent to which unemployment in Palestine affects output changes in Israel, and vice versa. Accordingly, we will examine whether or not Okun's law is applicable to the two economies (Faria *et al.,* 2010; and Lee, 2000). This is likely to be of a particular importance for Palestine when growth rate is low and unemployment rate is high. Toward this end, quarterly data was obtained from the Palestinian Central Bureau of Statistics (PCBS), the Israeli Central Bureau of Statistics (ICBS), and the The Organisation for Economic Co-operation and Development (OECD). The utilized period is limited to (2000: Quarter 1 – 2014: Quarter 1) based on data availability. The collected data focuses on unemployment and real GDP i.e., GDP at constant prices (real GDP) rather than current prices. Unemployment rates ($\%\Delta U$) were used for Palestine based on the International Labor Organization (ILO) Standards (PCBS, 2014), but for Israel, unemployment was measured as those individuals who sought work through the employment service (ICBS, 2014). Seasonally adjusted series were used for Israel and Palestine[1].

3.2. Methodology and Econometric Analysis

To accomplish the overall objective of this study, this section is to highlight the approaches adopted to investigate stationary, and to determine the presence of co-integration in the investigated time series data. It will also discuss the value of the **OLC**, which measures changes in GDP growth as a result of the changes rate in unemployment, in addition to the existence of structural changes over time. Regression analysis, the augmented Dickey Fuller test, Granger causality tests, co-integration, and vector error correction model are used.

3.2.1 Okun's Law Versions

There are a number of different ways to express Okun's law. We will discuss four alternatives/ versions and then proceed to the method used in this paper.

1. The growth rate version (Okun, 1962; Daly *et al.,* 2014). This version is more commonly used than other versions:

   Real GDP growth = $\beta_0 + \beta_1$ (Change in the unemployment rate),

   where β_0 is the average annual growth rate of full-employment output; β_1 is the factor relating changes in the unemployment rate to changes in real GDP growth.

2. The GDP gap version (Weber, 1997):

   GDP gap = $\beta_0 + \beta_1$ (Unemployment rate – Natural rate of unemployment (5% is typically used)),

   where GDP gap is the gap between potential output and actual output; β_0 is the average growth rate of full-employment output; β_1 is the factor relating the difference between the unemployment rate and the natural rate of unemployment rate to changes in the GDP gap.

3. The level version (Knotek, 2007):

   Change in the unemployment rate = $\beta_0 + \beta_1$ (Real GDP growth),

   β_0 is the average unemployment rate; β_1 is the factor relating changes in the real GDP growth to changes in the unemployment rate.

4. The difference version (Knotek, 2007):

   Unemployment rate = $\beta_0 + \beta_1$ (GDP gap between potential output and actual output),

   where β_0 is the average unemployment rate; β_1 is the factor relating changes in the GDP gap to changes in the unemployment rate.

One of the questions that arose out of Okun's law analysis is the extent to which changes in GDP growth should be measured as absolute changes from period to period versus changes in relation to a trend, or in relation to potential GDP versus actual GDP. According to the PCBS and the Palestinian Monetary Authority (PMA), in Palestine, data and/or information about both output gap and potential output is NOT available. Output gap data on Israel is not published/ available for general use. We, therefore, eliminate versions 2 and 4 shown above from consideration.

When output gap, as compared to growth rate, versions of Okun's law are used, there is often concern about whether the data should be detrended before computing the output gap (Daly, 2014 and Adanu, 2005). Given that we do not consider output models in our analysis, we don't consider data detrending.

Version 3, which takes unemployment rather than GDP growth as the dependent variable is sometimes used in the literature but has been highly criticized (Smets and Wouters, 2003; and Shimer, 2005) and so we don't consider it except in ECM estimation as discussed in the section 4.6.

To use one common unit of scale in our analysis we used the growth rate version of the first model. This formula for the variable GDP growth was adopted: $[((GDP_t - GDP_{t-1})/GDP_{t-1})*100]$ and the same to the variable unemployment rate (Daly *et al.,* 2014; Mankiw, 2012; and Faria, 2010).

3.2.2. Regression Analysis

As previously mentioned, in the context of this study we will use OLS to specifically investigate a version of Okun's Law that focuses on a relationship between changes in the unemployment rate and real GDP growth, specifically whether a percentage increase in unemployment causes a 2% fall in GDP. To examine the validity of Okun's law (Geldenhuys and Marinkov, 2007), we will use equation (1) so as to examine the OLC with the percentage growth rates as response variables and percent changes in unemployment rates (%ΔU) as control variables.

$$\text{GDP growth}_t = \alpha + \beta \ \% \ \Delta U_t + \varepsilon_t \tag{1},$$

where GDP growth is calculated as $[((GDP_t - GDP_{t-1})/GDP_{t-1})*100]$; $\%\Delta U_t$ is the percentage change in unemployment rates; $\alpha =$ is the intercept; β is Okun's coefficient showing the change in GDP growth that results from the percentage change in unemployment rate; and ε_t is the disturbance term.

Given the possibility that the time series on GDP and unemployment are non-stationary and may be cointegrated, we need to consider the possibility that the OLS estimation is not appropriate to equation (1).

3.2.3. Augmented Dickey Fuller (ADF) Test

The Augmented Dickey Fuller (ADF) and Philip Person (PP) tests are used to test stationarity of time series data. We will attempt to find whether or not data on GDP growth and %ΔU in Israel and Palestine are stationary before performing other analyses (Rigas and Theodosiou, 2011). Therefore, we will use unit root tests developed by Dickey Fuller in order to test the stationarity of time series data. Equation (2) specifies that the current change in GDP is a function of past realization, and the same is applicable for %ΔU.

$$\text{GDP growth}_t = f \ (\text{GDP growth}_{t-1}) \tag{2}$$

Dickey and Fuller (1979) actually consider three different three regression equations that can be used to test for the presence of a unit root (Enders, 2010).

$$\text{GDP growth}_t = (\alpha-1) \ \text{GDP growth}_{t-1} + \varepsilon_t \tag{3}$$

$$\text{GDP growth}_t = \alpha + (\alpha-1) \ \text{GDP growth}_{t-1} + \varepsilon_t \tag{4}$$

$$\text{GDP growth}_t = \alpha + (\alpha-1) \ \text{GDP growth}_{t-1} + \rho t + \varepsilon_t \tag{5}$$

The hypotheses regarding the time series data are:

H_O: *Time series are not stationary, $\alpha = \rho = 0$ (i.e. the data needs to be differenced to make it stationary).*

H_1: *Time series are stationary, $-2 < \rho < 0$ (i.e. the data is stationary and doesn't need to be differenced).*

A stationary process corresponds to $-2 < \rho < 0$ when equation 5 is used, and ñ is included in order to model the possibly non-zero mean of the process (Wooldridge, 2012).

3.2.4. Granger Causality Test

An alternative to an OLC regression to consider the effect of unemployment rate changes on GDP growth (*% ΔGDP*) is the Granger causality test. Granger causality analysis is an approach to measure causal association, effective connectivity, and directionality (Granger, 1969).The Granger causality test can provide an indication on the relationship between and the %ΔU i.e., does Granger cause %ΔU or vice versa. Equation (6) is used to estimate the relationship between and %ΔU:

$$\% \Delta GDP_t = \alpha_i \, \% \Delta GDP_{t-1} + \beta_1 \, \% \Delta U_{t-1} + \alpha_t \tag{6}$$

Testing for temporal causality between the two variables is centered on a VAR (vector autoregressive) model comprising two stationary series. This model is adopted in order to capture short run causality between the variable *%ΔGDP* and %ΔU. In VAR modeling (Khan et al., 2010) the value of a variable is expressed as a linear function of the past or lagged values of that variable and all other variables included in the model. Thus all variables are regarded as endogenous. The model can be written as follows:

$$\% \Delta GDP_t = \alpha_G + \sum_{i=1}^{p} \beta_i \, \% \Delta GDP_{t-i} + \sum_{j=1}^{q} \delta_j \, \% \Delta U_{t-j} + \varepsilon_t, \tag{7}$$

$$\% \Delta U_t = \alpha_U + \sum_{i=1}^{p} \theta_i \, \% \Delta U_{t-i} + \sum_{j=1}^{q} \phi_j \, \% \Delta GDP_{t-j} + e_t, \tag{8}$$

where %ΔGDP$_t$ and %ΔU are stationary variables, p and q are the lag lengths for GDP and U respectively and α and e are the stochastic error terms or shocks in the language of VAR.

3.2.4.1. Restrictions implied by the Granger Causality Test

Causality testing is utilized to investigate whether lagged information on the variable %ΔU provides any statistically significant information about GDP gowth in the presence of lagged GDP growth. If not, %ΔU doesn't Granger cause GDP growth. If in equation 7, $\delta_1 = \delta_2 \ldots \delta_n = 0$, then we say %ΔU doesn't Granger cause GDP growth. If GDP growth can predict future %ΔU over and above what lags of %ΔU itself can, then GDP growth Granger causes %ΔU. If not, GDP growth doesn't Granger cause %ΔU. In our case, the Engel-Granger two-step method will be utilized to investigate the existence or absence of co-integration between the series (Engle and Granger, 1987; and Greene, 2012), in addition to the basic tests. Granger causality is not necessarily true causality, if both %ΔU and GDP growth are driven by a common third process with different lags. The Granger test is designed to handle pairs of variables, and may produce misleading results when the true relationship involves three or more variables, so that the ECM is also used in the analysis of this study to overcome this restriction of Granger causality testing.

3.2.4.2. The Akaike Information Criterion (AIC)

We used the Akaike Information Criterion (AIC) to determine the appropriate lag length in the Granger causality test (Awe, 2012) where the number of augmenting lags (p) was determined

by minimizing the Akaike information criterion where lags are dropped until the last lag is statistically significant.

3.2.5. Error Correction Model (ECM)

Error Correction Models (ECM) can be used whenever (1) we have time series data and (2) are interested in both short and long term relationships between multiple time series. In our study we have time series models on the two economies that directly estimate the speed at which a dependent variable (GDP growth) returns to equilibrium after a change in an independent variable (%ΔU). Equation (10) below, shows how the ECM corrects for disequilibrium (Greene, 2012).

$$\text{GDP growth} = \alpha + \beta_1 \, \%\Delta U_{t-1} - \beta_2 \, EC_{t-1} + u_t, \tag{10}$$

where EC is the error correction component of the model and measures the speed at which prior deviations from equilibrium are corrected.

In this case, ECM can be used to estimate both the short and long term effects of %"U on GDP growth. The most important outcomes of the ECM are the parameters for investigating the stability of the model (returns to equilibrium) and the speed at which it adjusts. The main feature of the ECM is, its capability to correct for any disequilibrium that may shock the system from time to time. The error correction term picks up such disequilibrium and guides the variables of the system back to equilibrium. The existence of a co-integrating relationship among the variables allows us to use the ECM. If not, we will only be able to use VAR model (Greene, 2012). E-views (Econometric Views) was run for econometric analysis.

4. EMPIRICAL FINDINGS & DISCUSSION

The economic interrelationship between Palestine and Israel is frankly epitomized by the movement of the labor market from Palestine to Israel, in addition to their key economic sectors, including agriculture, industry, and services. At the beginning of the Israeli occupation of Palestine, opportunities open to Palestinians to work in Israel has been the most important single factor in the relations between the two economies. However, such deep interrelationship between the two dissimilar economies, where by Israel as a large economy can practice policies that may keep Palestine as a small economy weak and dependent. Accordingly, investigating the economic relation of Okun's rule across the two economies is of significance value to both Palestine and Israel. Empirical analysis of Okun's rule is undertaken for examining the relationship between unemployment rate and GDP growth.

4.1. Descriptive Statistics and Normality Test

In the context of this study, the data for our empirical application consists of two main variables: (1) the percentage changes in unemployment (%ΔU), and (2) GDP growth. This section is prepared to show descriptive statistics for the variables used in this study and tests normality of the data distribution. Table 1 shows that mean of Israeli GDP growth is 0.918641 compared with 2.381205 in Palestine. The normality test of Jarque-Bera test is used to determine whether or not the data is well-modeled by a normal distribution (Bera and Jarque, 1981; and Elliott and Woodward, 2007). The test outputs show that the Palestinian GDP growth and the %ΔU both are normally distributed. On the other hand, the Israeli %"U is normally distributed but the Israeli GDP growth is not

normally distributed as shown in the table below, so that the study uses non-parametric tests as compared to parametric tests. As is shown in the table below, the mean GDP growth of 2.381205% in Palestine was relatively high compared to the Israeli one of 0.918641%, this was mainly because in recent years, Palestinian National Authority's efforts to ease tensions with Israel have resulted in growth returning to Palestine. This growth is probably unsustainable without addressing security problems and high unemployment rate among young people (PCBS, 2013).

Table 1
Group Descriptive Statistics: Gross Domestic Product (GDP) growth, percentage changes in unemployment rate (%ΔU), and unemployment rate for Palestine and Israel variables

Descriptive Statistics	*Israel*			*Palestine*		
	GDP growth	*%ΔU*	*Unemployment rate*	*GDP Growth*	*% ΔU*	*Unemployment rate*
Mean	0.918641	-0.532485	8.037	2.381205	3.599918	23.902
Median	0.917161	-1.376996	7.823	1.209135	2.650366	23.900
Std. Dev.	0.914778	5.958578	1.684	10.30610	26.84497	4.538
Jarque-Bera	2.156202	164.9227	4.0544	944.6407	2970.800	38.931
P-value	0.340241	0.000000	0.132	0.000000	0.000000	0.000
# of Observations	55	55	56	55	55	56

4.2. Results of Regression Analysis

As previously explained, Okun's rule investigates the statistical relationship between unemployment rate and the real GDP growth across Palestine and Israel. In this study, we seek to know how much of Palestine's GDP growth rate may be lost as a result of increasing unemployment rate by one percent. This relation will be examined for Israel and across the two countries. It anticipated that the study results will help provide background information to policymakers in Palestine and Israel for stimulating the two economies.

An OLS regression of GDP growth on %ΔU of OLS is used to identify whether Okun's law holds (Mankiw, 2012). In this section, we carry out a regression on a sample of 55 quarterly observations to uncover the OLC for Palestine and Israel. Table 2.1 shows that %ΔU has a negative and significant impact on GDP growth in Palestine, which is consistent with economic theory. The OLC value of -0.125 (Perman and Tavera 2005; and Fouquau, 2008) is negative, but is much less the hypothesized value of two, meaning that if %ΔU increases by 1%, the GDP growth will decrease by only 0.1256. Thus, Okun's rule of thumb seems to be invalid for Palestine.

Table 2.1
Ordinary Least Squares - Palestine

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
Percentage changes in unemployment rate (%ΔU)	-0.125613	0.049877	-2.518442	0.0147
R-squared	0.054662	Mean dependent variable		2.381205
Adjusted R-squared	0.054662	S.D. dependent variable		10.30610
Dependent variable: GDP growth				

With reference to table 2.2, we can see that the %ΔU has a negative and significant impact on GDP growth in Israel, which is consistent with economic theory (Mankiw, 2012), but the OLC value of -0.058 is also much less than 2 (Perman and Tavera 2005; and Fouquau, 2008), meaning that if %ΔU increases by 1%, the GDP growth will decrease by about 0.058. Also, no evidence that Okun's rule of thumb holds in Israel.

Table 2.2
Ordinary Least Squares - Israel

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
Percentage changes in unemployment rate(% ΔU)	-0.058352	0.028278	-2.063528	0.0438
R-squared	-0.881158	Mean dependent variable		0.918641
Adjusted R-squared	-0.881158	S.D. dependent variable		0.914778

Dependent variable: GDP growth

4.3. Augmented Dickey Fuller (ADF) Results

In order to investigate whether the data is stationarity we applied the ADF test before investigating causality. If the data is nonstationary, it can be differenced to make it stationary. We utilize the optimum number of two lags based on the AIC criterion as discussed in section 3.2.5.

The unit root tests developed by Dickey Fuller are used to test the stationarity of the time series data. As is shown in tables 3.1 and 3.2, the results show that the data on GDP growth and %ΔU are stationary.

Table 3.1
Augmented Dickey-Fuller test: GDP growth – Palestine

		t-Statistic	*Prob.*
Augmented Dickey-Fuller test statistic		-6.807829	0.0000
Test critical values:	1% level	-3.555023	
	5% level	-2.915522	
	10% level	-2.595565	

Table 3.2
Augmented Dickey-Fuller test: Percentage changes in unemployment
rate (%ΔU) – Palestine

		t-Statistic	*Prob.*
Augmented Dickey-Fuller test statistic		-7.586335	0.0000
Test critical values:	1% level	-3.555023	
	5% level	-2.915522	
	10% level	-2.595565	

We have carried out the same analysis using the ADF test for Israeli GDP growth and %?U, we find that the time series of the two variables are also stationary.

Table 3.3
Augmented Dickey-Fuller test: GDP growth - Israel

		t-Statistic	*Prob.*
Augmented Dickey-Fuller test statistic		-4.463205	0.0007
Test critical values:	1% level	-3.555023	
	5% level	-2.915522	
	10% level	-2.595565	

Table 3.4
Augmented Dickey-Fuller test: Percentage changes in unemployment
rate (% ΔU) - Israel

		t-Statistic	*Prob.*
Augmented Dickey-Fuller test statistic		-5.810071	0.0000
Test critical values:	1% level	-3.555023	
	5% level	-2.915522	
	10% level	-2.595565	

Given the results of ADF tests concerning time series stationarity of data on Palestine and Israel, the Granger causality test between GDP growth and %ΔU on the two economies is applied.

4.4. Granger Causality Test Results

The estimation process of this section is developed for both directions of causality as discussed earlier, from %ΔU to GDP growth and vice versa (Loría and de Jesús, 2007). This analysis is applied to both Palestine and Israel. Granger causality tests for existence of a long-run relationship between the two variables. In Palestine we find that the %ΔU doesn't Granger cause GDP growth and the GDP growth doesn't Granger cause %ΔU as shown in table 4.1 below.

Table 4.1
Granger Causality Test: From the Palestinian Percentage changes in unemployment rate
(% ΔU) to GDP growth and vice versa

	Obs	*F-Statistic*	*Prob.*
* %ΔU does not Granger cause GDP growth	55	0.65226	0.4230
* GDP growth does not Granger cause % ΔU	0.02995	0.8633	

* Null hypothesis

Table 4.2 reveals that the Israeli % ΔU doesn't Granger cause GDP growth, but Israeli GDP growth Granger Causes % ΔU.

Table 4.2
Granger Causality Test: From the Israeli percentage changes in unemployment rate
(% ΔU) to GDP growth and vice versa

	Obs	*F-Statistic*	*Prob.*
* % ΔU does not Granger cause GDP growth	55	1.34329	0.2704
* GDP growth does not Granger cause % ΔU	4.15054	0.0216	

* Null hypothesis

As stated earlier, we will also consider the extent to which unemployment in Palestine affects output changes in Israel, and vice versa. Table 4.3 shows that Palestinian % ΔU Granger causes Israeli GDP growth. Further, Israeli GDP growth Granger causes the Palestinian % ΔU. In contrast, as is shown in table 4.3 below, Israeli % ΔU does not Granger cause Palestinian GDP growth and the Palestinian GDP growth does not Granger cause Israeli % ΔU. This result acknowledges the number of Palestinian workers from the West Bank who are employed in Israel but not vice versa.

Table 4.3
Granger Causality Test: From the Palestinian Percentage changes in unemployment rate
(% ΔU) to Israeli GDP growth and vice versa

	Obs	F-Statistic	Prob.
* Palestinian % ΔU does not Granger cause Israeli GDP growth	55	3.31357	0.0447
* Israeli GDP growth does not Granger cause Palestinian % ΔU	55	3.07363	0.0553
* Israeli % ΔU does not Granger cause Palestinian GDP growth	55	0.55649	0.5768
* Palestinian GDP growth does not Granger cause Israeli % ΔU	55	1.58053	0.2162

* Null hypothesis

A simple OLS model, equations 7 and 8, with only one lag of each variable was utilized to investigate the level of significance and direction of the relationship. Palestinian % ΔU has significant and negative impact on Israeli GDP growth (10 percent level of significance). Likewise, Israeli GDP growth has significant and negative impact on Palestinian % ΔU at the 5 percent level of significance. What is clear is that when Israeli GDP is rising, more workers from Palestine can be employed. As a result, Palestine and Israel can make use of this policy as the unemployment rate will be less in the two countries.

4.5. Co-integration Results

As discussed, in the context of time series literature, cointegration test is conducted with a view to detecting common stochastic trends in a set of variables, meaning that cointegration is important to avoid spurious regression estimates. In the light of this, cointegration approach is undertaken in this study.

Referring to tables 5.1 and 5.2 the Johansen Model of co-integration is used to summarize the results of a co-integration analysis between % ΔU and GDP growth of Palestine and Israel respectively. The results reveal that there is a long run association and stationarity of the error term for the two economies, meaning that there is an evidence of co-integration between GDP growth and % ΔU in both Palestine and Israel. Thus, the existence of co-integration indicates that a long run equilibrium association between the variables used based on the results of table 5.1 and table 5.2 regarding Palestine and Israel respectively.

Table 5.1
Co-Integration between percentage changes in unemployment rate (% ΔU) and GDP growth - Palestine

	Eigen value	Statistic	Critical Value	Prob.
None *	0.440417	54.77402	15.49471	0.0000
At most 1 *	0.351938	23.42355	3.841466	0.0000

*Denotes rejection of the null hypothesis at the 0.05 level of significance.

Table 5.2
Co-Integration between percentage changes in unemployment rate (% ΔU) and GDP growth - Israel

	Eigenvalue	*Statistic*	*Critical Value*	*Prob.*
None *	0.399366	38.29583	15.49471	0.0000
At most 1 *	0.191677	11.27803	3.841466	0.0008

* Denotes rejection of the null hypothesis at the 0.05 level of significance.

4.6. Error Correction Model Results

As a foresaid in section 3.2.5, our target in using this model is to find how and in what ways GDP growth is affected by the percentage change in unemployment rate. As discussed in section 3.2.5, the most important outcomes of the ECM are the α parameters so as to investigate whether the model is stable (returns to equilibrium) and the speed at which it adjusts. The main feature of the ECM is its capability to correct for any disequilibrium that may shock the system from time to time. The error correction term picks up such disequilibrium and guides the variables of the system back to equilibrium. The existence of a co-integrating relationship among the variables allows us to use the ECM.

While version 3 of Okun's law shown in section 3.2.1 is criticized, we found that it is useful to estimate an ECM for this version to get an idea about equilibrium behavior of % ΔU. As is shown in table 6 below regarding Palestine, the ECM estimates show that the estimated lagged error correction term of GDP growth (Lag 1) is negative and significant at 5 percent level of significance as the P-value is 0.00, which is in harmony with econometric theory (Engle and Granger, 1987). In contrast, the coefficient is -0.5556, so that the speed of adjustment toward long run equilibrium is low (55.56%) for Palestine. Estimating version 3 of Okun's law, the estimated lagged error correction term % ΔU for (lag 1) is also negative and significant, but the speed of adjustment toward long run equilibrium is low as the coefficient is -0.6343. These results support co-integration between the variables for Palestine, but the coefficients imply a sluggish adjustment process to get back to equilibrium in the long run.

Table 6 provides information on Israel. The results reveals that the estimated lagged error correction term of Israeli GDP growth (Lag 1) is negative and insignificant at 5 percent level of significance as the P-value is 0.1922, this is inconsistent with results in previous empirical

Table 6
Vector Error Correction Model Estimates

Country	*Variable*	*Coefficient (α)*	*Standard Error*	*T-Value*	*P-value*
Palestine	GDP growth (-1)*	-0.5556	0.1198	-4.6387	0.0000
	Percentage changes in unemployment rate (% ΔU) (-1)*	-0.6343	0.1312	-4.8363	0.0000
Israel	GDP growth (-1)*	-0.1858	0.1404	-1.3230	0.1922
	Percentage changes in unemployment rate (% ΔU) (-1)*	-1.0905	0.2219	-4.9138	0.000

* Reflects the percentage of the disequilibria of the earlier period's shock adjust get back to the long run equilibrium in the current.

studies (Kreishan, 2011; Bartolucci *et al.* 2011; and Villaverde and Maza, 2007). The speed of adjustment toward long run equilibrium is very low (0.18.58%). In sharp contrast, the estimated lagged error correction term % ΔU (lag 1) is negative and significant. Furthermore, the speed of adjustment toward long run equilibrium is relatively high (100.09%) as the coefficient is -1.0905.

5. EMPIRICAL RESULTS DISCUSSION

The focus in this paper is to test the validity of Okun's law across Palestine and Israel using the difference model approach. Both the long-run and short-run relationships are examined with the use of empirical data covering the period adopted in this paper. The empirical findings from OLS applied on Palestine suggest that the % ΔU has a negative and significant impact on GDP growth at 5 percent level of significance, but the OLC value is much less than the typically proposed OLC value of 2. The results are similar for Israel as % ΔU has a negative and significant impact on GDP growth at the 5 percent level of significance, but the OLC value is lower than the OLC value of Palestine. The empirical results of both Palestine and Israel seem far-away from empirical results shown in other empirical studies (Ball *et al.,* 2013).

The empirical outputs from Granger causality tests show that the relationship between GDP growth and % ΔU are similar between Palestine and Israel where % ΔU does not Granger cause GDP growth. But it varies with Palestine and Israel in terms of GDP growth as the GDP growth Granger causes % ΔU in Israel, which is likely to be contradictory with economic theory (Mankiw, 2012). In contrast, GDP growth does not Granger cause % ΔU for Palestine. If an unemployment rate increases, and doesn't have a negative and significant causal impact on real GDP growth, this may be because resources are being channeled towards unproductive activities or there are mismatches in the economic system. However, it will be an encouraging policy space to continuously direct resources from unproductive sectors to productive ones including creating an enabling environment for drastic reduction of unemployment rate; this is likely to be a significant pointer for enhanced aggregate demand and output growth in the long run, especially in Palestine.

We also consider the extent to which unemployment in Palestine affects output changes in Israel, and vice versa. Palestinian % ΔU Granger causes Israeli GDP growth. Further, Israeli GDP growth Granger causes the Palestinian % ΔU. This result is consistent with the mutual economic relations between Palestine and Israel, including that the large number of Palestinian workers from the West Bank who are still employed in Israel, including in settlements, with an estimated 100,000 Palestinian workers employed in Israel today as discussed above. As a result, the rate of unemployment among Palestinians will fall as Israeli GDP rises. Note, however, that the Israeli % ΔU does not Granger cause the Palestinian GDP growth and the Palestinian GDP growth does not Granger cause the Israeli % ΔU.

In the context of this study we have applied co-integration and VECM to Palestine and Israel to test the stability of equilibrium. The results find the existence of co-integration between GDP growth and % ΔU for each. The results also indicate that the coefficient of error correction term of all variables carry the right sign (negative) based on VECM formulation and % ΔU is significant across Palestine and Israel with coefficients value of -0.6343 and -1.0905 respectively,

meaning that in a case of disequilibrium, it will be possible to restore equilibrium in the long run, tardily for Palestine and with a resonate speed for Israel as the coefficient value was higher.

6. CONCLUDING REMARKS AND POLICY IMPLICATIONS

While the status quo of Israel and Palestine economic relations is not promising, practices continuous and practical economic policies with taking the validity of Okun's rule across the two countries into account, this can help use more efficient and effective polices for improved this relation at the macroeconomic level. The paper has estimated Okun's law coefficents using OLS and further tested the relation using the ADF test, the Granger causality test, co-integration, and VECM in order to test the validity of Okun's law type relationships with respect to both Palestine and Israel in the short and long-run. To the best of our knowledge, this empirical study is the first to examine the validity and applicability of Okun's law across the two economies.

Our principal conclusion is that Okun's Law is unlikely to be applicable and/or valid for Palestine and Israel, meaning that there is no a good policy adopted by Palestinian policymakers to direct resources continuously from unproductive sectors to productive ones that can reduce unemployment rate, and increase aggregate demand and GDP growth in the long run. In addition, the results of Okun's rule show that Israel also will not be able to create an enabling environment for drastic reduction of unemployment rate and a significant increase in real GDP growth in the long run.

With regards to the mutual economic relations between Palestine and Israel, it is clear that Palestine is an important source of workers for the Israeli economy, and the Israeli economy has a significant impact on employment opportunities in Palestine. This paper didn't discuss trade flows, but given our results on labor markets, future research might consider the effect of cross border trade on Palestinian and Israeli GDP.

As discussed above, the results of applying VECM across Palestine and Israel indicate that the coefficient of error correction term of all variables carry the correct direction of relationship in respect to both Palestine and Israel, but the coefficient of error correction term of GDP growth is statistically insignificant for Israel, while the coefficient is statistically significant with a coefficient value of 55% for Palestine. However, we conclude that the two countries are unlikely to be able to come back to the equilibrium level, so that higher rates of GDP growth and employment will not be reachable in the long run.

The empirical results provide two important implications. These are: (1) given that the Okun coefficients are far smaller than would be expected in both economies, we should look for reasons that changes in the officially reported unemployment rates seem to have such a small effect on GDP (Kreishan, 2011). In the current situation significant investment in Palestine comes from foreign aid that may or may not sustainably affect GDP or employment in the short and long term. In both countries, large expenditures on security may increase employment but have little effect on GDP in term of long run growth; and (2) we found that the Israeli and Palestinian economies are closely linked through the labor market, especially in the case of Palestine workers. The situation on the ground in Israel, Gaza, and West Bank doesn't provide a stable platform for increasing trade in goods or human capital and inhibits the natural link between the goods and labor markets.

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