

## **The Causal Relation between Savings and Economic Growth: Some Evidence from MENA Countries**

Bassam AbuAl-Foul ([babufoul@aus.edu](mailto:babufoul@aus.edu))

### **Abstract**

This paper examines empirically the long-run relationship between real gross domestic product (GDP) and real gross domestic saving (GDS) for Morocco (1965-2007) and Tunisia (1961-2007) using a newly developed approach to cointegration by Pesaran et al. (2001) that performs well with small samples and regardless of the orders of the respective time series (i.e., whether time series are  $I(0)$ ,  $I(1)$ , or  $I(0)/I(1)$ ). The empirical results reveal that in the case of Morocco a long-run relationship exists between the variables, while no evidence of long-run relationship to exist in the case of Tunisia. The Granger causality test supports bidirectional causality between economic growth and saving growth in Morocco. However, in the case of Tunisia, the results suggest that there is a unidirectional Granger causality between real GDP and real GDS and runs from saving growth to economic growth.

**JEL Classification:** E6, E2, O2

### **1. Introduction**

The review of the literature shows that there is a positive relationship between savings and economic growth. This positive relationship can be explained by one of the following hypotheses. First, that growth in savings can stimulate economic growth through investment.

This view is supported by the Harrod (1939), Domer (1946), Solow (1956) models of growth. Empirical works by Alguacil et al. (2004) and Singh (2009), among others provide support for the hypothesis that savings growth promotes economic growth. Second, that economic growth stimulates savings. This view is supported with the empirical findings of Sinha and Sinha (1998), Saltz (1999), Agrawal (2001), and Anoruo and Ahmad (2001), and Narayan and Narayan (2006), among others.

Morocco and Tunisia, as classified by the World Bank according to the 2004 GNI per capita, are among the lower-middle-income economies in the world. In addition, Morocco is classified by the World Bank as less indebted country while Tunisia is classified as moderately indebted. This research will focus on examining the causal relationship between savings and economic growth in both Morocco and Tunisia in order to provide the policymakers in these countries with a planning tool that can help them in formulating their policies to promote economic growth. Thus the major question that this research needs to answer is whether or not the traditional view of growth that savings growth promotes economic growth is valid for those countries.

The purpose of this study is to examine the impact of saving on economic growth in both Morocco and Tunisia. Using annual data from 1965 to 2007 for Morocco and from 1961 to 2007 for Tunisia and an Autoregressive Distributed Lag (ARDL) approach to cointegration as proposed by Pesaran *et al.* (2001), the findings of this study reveal that there is a long-run relationship, over the sample periods, between saving and real GDP growth in the case of Morocco while in the case of Tunisia such variables appear to have no long-run relationship between them. When examining the Granger causality between saving and real GDP, the test results support bidirectional Granger causality in the case of Morocco. However, in the case of

Tunisia, the results show support of Granger causality between saving and GDP and that causality runs from saving to economic growth.

The rest of the paper is organized as follows. Section 2 presents the model, data, and the empirical methodology used in the study. Section 3 discusses the empirical results while section 4 concludes the study.

## 2. The Model, Data, and Empirical Methodology

In light of the existing literature, the theoretical model used to examine the relationship between saving and economic growth is:

$$S = a_0 + b_1Y + \varepsilon \dots \dots \dots (1)$$

where  $Y$  is log (real GDP) and  $S$  is log (real GDS). Data on these variables are annual and obtained from the World Bank's World Development Reports (online) and covers the periods 1965-2007 and 1961-2007 for Morocco and Tunisia, respectively. All the variables are in constant local currency units.

### *Cointegration Test: The ARDL approach*

The study uses the Autoregressive Distributed Lag (ARDL) approach to cointegration that was proposed by Pesaran *et al.* (2001) which estimates the conditional ARDL model for real GDS and real GDP given in equation 1 (considering each variable as a dependent variable) as follows:

$$\Delta Y_t = \alpha_{0Y} + \sum_{i=1}^k \delta_{1Y} \Delta Y_{t-i} + \sum_{i=0}^k \delta_{2Y} \Delta S_{t-i} + \gamma_{1Y} Y_{t-1} + \gamma_{2Y} S_{t-1} + \varepsilon \dots \dots \dots (2)$$

$$\Delta S_t = \alpha_{0S} + \sum_{i=1}^k \delta_{1S} \Delta S_{t-i} + \sum_{i=0}^k \delta_{2S} \Delta Y_{t-i} + \gamma_{1S} Y_{t-1} + \gamma_{2S} S_{t-1} + \varepsilon \dots \dots \dots (3)$$

The ARDL approach was used by, among others, Yildirim and Sezgin (2003), Bahmani-Oskooee and Kara (2005), Narayan (2005), Narayan and Narayan (2006), Morley (2006), Nieh and Wang (2005), and Feeny (2005), Liang and Cao (2007). Narayan (2006) argued that the ARDL method proposed by Pesaran *et al.* (2001) can perform well in small samples and irrespective of whether the variables are I(0), I(1), or mutually cointegrated, and it is unbiased and efficient. The ARDL approach uses two steps to estimate the long run relationship. First step is to determine whether a long run relationship exist between the variables in equations 2 and 3 by considering each of the variables as a dependent variable. Then we use the F-test for testing the existence of the long-run relationship in equations 2 and 3. That is, the null hypothesis of no cointegration among variables in equation 2 is tested (i.e.,  $H_0: \gamma_{1Y} = \gamma_{2Y} = 0$ ) against the alternative hypothesis (i.e.,  $H_1: \gamma_{1Y} \neq \gamma_{2Y} \neq 0$ ) using the F-test for the joint significance of the lagged levels coefficient in equation 2. In equation 3, when the gross domestic saving is the dependent variable, the null hypothesis of no cointegration among variables is tested (i.e.,  $H_0: \gamma_{1S} = \gamma_{2S} = 0$ ) against the alternative hypothesis (i.e.,  $H_1: \gamma_{1S} \neq \gamma_{2S} \neq 0$ ) using the F-test for the joint significance of the lagged levels coefficient in equation 3. If the estimated F-statistics is greater than the upper bound critical value, we conclude that the variables in question are cointegrated. Also, if the estimated F-statistics falls between the lower and the upper bound critical values, the decision about cointegration among the variables involved is inconclusive. And if the estimated F-statistics is less than the lower critical value, the null hypothesis of no

cointegration cannot be rejected. Second step, if the long-run relationship is established between the variables, the long-run and the short-run coefficients are estimated using the ARDL approach. The optimal lag is determined using Akaike Information Criterion (AIC). In addition, because of the possibility of trend existence in both series, estimations, equations 2 and 3 are estimated taking into consideration case III: unrestricted intercept and no trend and case IV: unrestricted intercept and restricted trend as explained in Pesaran et al. (2001).

We use annual data on real GDP and real gross domestic savings (GDS) for Morocco (1965-2007) and Tunisia (1961-2007). All the data are extracted from the World Bank, World Development Indicators online. Both variables were transformed into natural logarithms where  $Y$  is  $\log$  (real GDP) and  $S$  is  $\log$  (real GDS).

*Granger Causality*

If the cointegration test results reveal that the variables are cointegrated, we use the Vector Error Correction (VEC) model estimation as in equations 4 and 5. However, if the variables are not cointegrated we use Vector Autoregressive (VAR) model in the first difference in the estimation given that both variables are I (1). Thus, we use the following VER model to examine the Granger causality between real GDP and real GDS:

$$\Delta Y_t = \alpha_{0Y} + \sum_{i=1}^k \delta_{1Y} \Delta Y_{t-i} + \sum_{i=1}^k \delta_{2Y} \Delta S_{t-i} + \lambda_1 EC_{t-1} + \varepsilon \dots \dots \dots (4)$$

$$\Delta S_t = \alpha_{0S} + \sum_{i=1}^k \delta_{1S} \Delta S_{t-i} + \sum_{i=1}^k \delta_{2S} \Delta Y_{t-i} + \lambda_2 EC_{t-1} + \varepsilon \dots \dots \dots (5)$$

where  $EC_{t-1}$  is the lagged error correction term. As equations 4 and 5 show, Granger causality between real GDP and real GDS can be revealed by testing the following null hypotheses:

- a) For short-run Granger causality: ( $H_0: \delta_{2Y} = 0$  and  $H_0: \delta_{2S} = 0$ ),
- b) For long-run Granger causality: ( $H_0: \lambda_1 = 0$  and  $H_0: \lambda_2 = 0$ ),
- c) For strong Granger causality: ( $H_0: \delta_{2Y} = \lambda_1 = 0$ , and  $H_0: \delta_{2S} = \lambda_2 = 0$ ).

### 3. Empirical Results

#### *Unit Root Test*

Although unit root test is not required for testing for cointegration using the ARDL approach, it is necessary for verifying that both series are not cointegrated or order higher than one, and also for conducting Granger causality test. We use the Augmented Dickey-Fuller (ADF) test for conducting the unit root test. The ADF tests the null hypothesis of nonstationarity. Table 1 shows the ADF test results for both  $S$  and  $Y$  series as defined above. The ADF test results show that both variables  $S$  and  $Y$  are nonstationary in their levels and stationary in their first difference in both countries. In addition, the Phillips-Perron test results (not reported here but available upon request) confirm the results that both variables  $S$  and  $Y$  are nonstationary in their levels and stationary in their first difference in both countries.

#### *Cointegration Test: The ARDL approach*

Before estimating equation 1 in the case of each country, the existence of the long-run relationship between the variables involved have been investigated by calculating the F-statistics.

Table 1

The ADF Unit Root Test Results

Country	Variable	Augmented Dickey-Fuller (ADF) Test Statistic:			
		ADF ( <i>L</i> ) (no trend)	CV	ADF ( <i>L</i> ) (with trend)	CV
Morocco: (1965-2007)	<i>S</i>	- 1.2384 (1)	-2.9350	- 3.2500 (0)	-3.5208
	<i>Y</i>	- 2.2995 (1)	-2.9350	- 2.9083 (1)	-3.5236
	$\Delta S$	-8.7783 (0)	-2.9350	-8.6887 (0)	-3.5236
	$\Delta Y$	-9.9331 (0)	-2.9350	-10.423 (0)	-3.5236
Tunisia: (1961-2007)	<i>S</i>	- 0.9048 (1)	-2.9281	- 3.3194 (0)	-3.5107
	<i>Y</i>	-1.3105 (0)	-2.9266	- 1.8628 (0)	-3.5107
	$\Delta S$	-8.9170 (0)	-2.9281	-8.8119 (0)	-3.5131
	$\Delta Y$	-7.3392 (0)	-2.9281	-7.5219 (0)	-3.5131

**Notes:** Variables *Y* and *S* are, respectively, the log of real GDP and real GDS. *L* denotes the lag length selected using SIC, and CV denotes critical values at 5% significance level.

In the case of Morocco, when estimating equation 3, the computed F-statistics (with trend)  $F_Y(Y/S)$  is 11.11 which is higher than the upper bound critical values of 6.73 at the 1% significance level that is provided by Pesaran et al. (2001). This means that the null hypothesis of no cointegration is rejected when  $\Delta S$  is the dependent variable and that there is a long run relationship between the variables involved (see Table 2). However, when using equation 2, where  $\Delta Y$  is the dependent variable, the null hypothesis of no cointegration cannot be rejected since the computed F-statistics  $F_X(X/Y)$  is 4.61 and 3.84 with no trend and with trend, respectively, which is less than the lower bound critical values of 4.94 (with no trend) and 4.68 (with trend) at the 5% significance level as provided by Pesaran et al. (2001) (see Table 2).

Table 2

Bounds F-Test Results for Cointegration

Country	Dependent Variable	F-Statistics (no trend)	F-Statistics (with trend)	ECT (-1)
Morocco:	$\Delta Y$	4.61	3.84	-0.2104**
	$\Delta S$	4.21	11.11	-0.3783*
Tunisia:	$\Delta Y$	0.84	1.17	
	$\Delta S$	2.08	3.09	

  

	Case III:		Case IV:	
	$I(0)$	$I(1)$	$I(0)$	$I(1)$
Critical values at 1%	6.84	7.84	6.10	6.73
Critical values at 5%	4.94	5.73	4.68	5.15
Critical values at 10%	4.04	4.78	4.05	4.49

Notes:

$Y$  is the log of real GDP and  $S$  is the log of real GDS.  $\Delta$  is the first difference operator. The critical values for the lower  $I(0)$  and upper  $I(1)$  bounds are taken from Pesaran et al. (2001), Appendix: Table CI (iii) Case III: (unrestricted intercept and no trend) and Table CI(iv) Case IV: (unrestricted intercept and restricted trend). \*, \*\* Significant at 1% and 5% significance levels, respectively.

In the case of Tunisia, when estimating equation 2, the computed F-statistics  $F_Y(Y/S)$  are 0.84 (with no trend) and 1.17 (with trend) which are less than the lower bound critical values of 4.94 (with no trend) and 4.68 (with trend) at the 5% significance level provided by Pesaran et al. (2001) (see Table 2). However, when using equation 3, where  $S$  is the dependent variable, the null hypothesis of no cointegration cannot be rejected since the computed F-statistics  $F_S(S/Y)$  is 2.08 (without trend) and 3.09 (with trend) which are also less than the lower bound critical

values of 4.94 (with no trend) and 4.68 (with trend) at the 5% significance level provided by Pesaran et al. (2001) (see Table 2). This means that the null hypothesis of no cointegration cannot be rejected when variable  $Y$  or  $S$  is the dependent variable.

### *Granger Causality*

When two variables are cointegrated then Granger causality exists in at least one direction. In the case of Morocco, the cointegration test results of the ARDL model reveal that real GDP and real GDS are cointegrated, thus Granger causality will exist at least in one direction between the variables. However, the ARDL cointegration results do not reveal the direction of the causality between real GDP and real GDS. The results in Table 3 suggest that there is a statistical evidence of bidirectional Granger causality in its three kinds (i.e., short-run, long-run, and strong Granger causality) between real GDP and real GDS. Thus the results in Table 3 suggest that there is bidirectional causality between economic growth and saving growth in Morocco.

Since the bounds test results show no long run relationship between real GDP and real GDS, in the case of Tunisia, thus we cannot use VER model to examine the Granger causality between the variables. Instead, we use estimate the VAR model. The results of VAR model (as in equations 4 and 5 excluding error correction terms) suggest that there is a unidirectional Granger causality between real GDP and real GDS and runs from saving growth to economic growth (see Table 4).

Table 3

Morocco: Granger Causality Tests

Causality Type	F-statistic (p-value)
<u>Short-run Granger causality:</u>	
$\Delta S \rightarrow \Delta Y$ (H0: $\delta_{2Y} = 0$ )	4.4625 (0.0188)
$\Delta Y \rightarrow \Delta S$ (H0: $\delta_{2S} = 0$ )	8.2418 (0.0012)
<u>Long-run Granger causality:</u>	
$\Delta S \rightarrow \Delta Y$ (H0: $\lambda_1 = 0$ )	6.4012 (0.0161)
$\Delta Y \rightarrow \Delta S$ (H0: $\lambda_2 = 0$ )	8.5401 (0.0061)
<u>Strong Granger causality:</u>	
$\Delta S, ECT \rightarrow \Delta Y$ (H0: $\delta_{2Y} = \lambda_1 = 0$ )	6.0547 (0.0020)
$\Delta Y, ECT \rightarrow \Delta S$ (H0: $\delta_{2S} = \lambda_2 = 0$ )	7.7533 (0.0004)

Notes:

$Y$  is the log of real GDP and  $S$  is the log of real GDS. ECT is the error correction term.  $\Delta$  is the first difference operator.

Table 4

Tunisia: Granger Causality Test VAR model:

Null Hypothesis	F-Statistic (p-value)
D(S) does not Granger Cause D(Y)	3.4041 (0.0434)
D(Y) does not Granger Cause D(S)	1.7712 (0.1835)

#### 4. Conclusion

This study examines empirically the relationship between saving and the GDP growth in the case of Morocco (1965-2007) and Tunisia (1961-2007) using the newly developed ARDL approach. The results reveal that there is long-run relationship between saving and GDP in the

case of Morocco. However, in the case of Tunisia, the empirical results reveal that no long-run relationship exists between saving and GDP growth over the period examined. When testing for Granger causality, the results show that a bidirectional causality exist between saving and GDP growth in Morocco. While for Tunisia, the results reveal that there is a unidirectional Granger causality between real GDP and real GDS and that causality runs from saving growth to economic growth. However, these results should be interpreted with cautious since they may be effected if we could have a large data set and it may be useful to disaggregate saving and add other policy variables and see how this affects the economy.

## References

- Agrawal, P., (2001), "The Relation between Savings and Growth: Cointegration and Causality Evidence from Asia," *Applied Economics*, 33, pp. 499-513.
- Agrawal, P. and Sahoo, P. (2009) "Saving and Growth in Bangladesh," *The Journal of Developing Areas*, 42, Iss. 2, 89-110
- Alguacil, M., Cuadros, A., and Orts, V. (2004) "Does saving really matter for growth? Mexico (1970-2000)," *Journal of International Development*. 16, Iss. 2, 281-290.
- Anoruo, E. and Ahmad, Y. (2001) "Causal Relationship between Domestic Savings and Economic Growth: Evidence from Seven African Countries," *African Development Bank*, 13, Issue 2, 238-249.
- Domer, E.D. (1946) "Capital Expansion, Rate of Growth, and Employment," *Econometric*, 14, 137-147.
- Harrod, R. (1939) "An Essay in Dynamic Theory," *Economic Journal*, 49, 14-33.

- Narayan, P. K. and Narayan, S. (2006) "Savings behaviour in Fiji: an empirical assessment using the ARDL approach to cointegration," *International Journal of Social Economics*, 33, No. 7, 468-480.
- Pesaran, M. H., Shin, Y., and Smith, R. (2001) "Bound Testing Approaches to the Analysis of Level Relationships," *Journal of Applied Econometrics*, 16, 289-326.
- Saltz, I.S. (1999) "An Examination of the Causal Relationship between Savings and Growth in the Third World," *Journal of Economics and Finance*, 23, 90-98.
- Singh, T. (2009) "Does domestic saving cause economic growth? A time-series evidence from India," *Journal of Policy Modeling*, doi:10.1016/j.jpolmod.2009.08.008,
- Sinha, D. and Sinha, T. (1998) "Cart before the Horse? The Saving-Growth Nexus in Mexico," *Economics Letters*, 61,43-47.
- Solow, R.M. (1956) "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics*, 70, 65-94.
- World Bank, World Development Report (Online).