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Bassam M. AbuAl-Foul

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Bassam M. AbuAl-Foul
American University of Sharjah

P.O. Box 26666
Sharjah, United Arab Emirates
E-mail: sbawps@aus.edu

The Causal Relation between Savings and Economic Growth:

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Bassam M. AbuAl-Foul
Economics Department
School of Business Administration
American University of Sharjah
P.O. Box 26666
babufoul@aus.edu
babufoul2@gmail.com

Abstract

This paper examines the causal relation between savings and economic growth for Morocco and Tunisia using Autoregressive Distributed Lag (ARDL) approach to cointegration. The results support bidirectional causality between economic growth and savings growth for Morocco. However, for Tunisia, the results suggest a unidirectional causality from saving growth to economic growth.

*Keywords***:** Cointegration: ARDL approach; Savings and Economic Growth; Causality, MENA region.

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Author's Email: babufoul@aus.edu
babufoul2@gmail.com

I. 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, 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, 2010), among others provide support for the hypothesis that savings growth promotes economic growth. Other theoretical models suggested that saving leads to positive impact on economic growth in the long run through investment and the accumulation of capital. This view is supported by (Romer, 1986 & 1987); (Lucas, 1988); and (Mankiw et al 1992). Second, economic growth stimulates savings. This view is supported with the empirical findings of (Sinha and Sinha, 1998), (Saltz, 1999), (Agrawal, 2001), (Anoruo and Ahmad, 2001), and (Narayan and Narayan, 2006), among others. Third, savings growth and economic growth reinforce each other. This view is supported by the empirical findings of, among others, (Agrawal and Sahoo, 2009), and (Odhiambo, N. M. 2009).

Morocco and Tunisia, as classified by the World Bank according to the 2012 GNI per capita, are, respectively, among the lower-middle-income and upper middle income economies in the world.

The purpose of this study is to examine the causal relationship between saving and economic growth in both Morocco and Tunisia using an Autoregressive Distributed Lag (ARDL) approach to cointegration as proposed by (Pesaran *et al.*, 2001)[1].

[1] See Payne (2010) for a survey of various methodologies used in the literature for studying the causal relationship.

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

II. The Data, Model, and Empirical Methodology

Data

We use annual data on real gross domestic product (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.

The model

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

$$S = a_0 + b1Y + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where Y is log (real GDP) and S is log (real GDS).

Empirical methodology

Cointegration test: the ARDL approach. The study uses the Autoregressive Distributed Lag (ARDL) approach to cointegration 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:

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

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

The ARDL approach was used by, among others, (Yildirim and Sezgin, 2003), (Bahmani-Oskooee and Kara, 2005), (Feeny, 2005), (Morley, 2006, 2007), (Liang and Cao, 2007), (Narayan and Narayan, 2005, 2006), (Squalli, 2007), (Katircioglu and Feridun 2011), and (Alkhathlan, 2013).

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:

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

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

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: $\delta_{2S} = \lambda_2 = 0$).

III. Empirical Results

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[2] involved has been investigated by calculating the F-statistics. When estimating equation 3 for Morocco, the computed F-statistics (with trend) $F_S(S/Y)$ 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 ΔS is the dependent variable and that there is a long run relationship between the variables involved (see Table 1 in the appendix). However, when using equation 2, where ΔY is the dependent variable, the null hypothesis of no cointegration cannot be rejected since the computed F-statistics $F_Y(Y/S)$ is 4.61 (with no trend) and 3.84 (with trend), 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 1 in the appendix).

When estimating equation 2 for Tunisia, 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 in the appendix). However, when using equation 3, where ΔS is the dependent variable, the null hypothesis of no cointegration cannot be rejected since the computed F-statistics $F_S(S/Y)$ are 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

[2] Although unit root test is not required for testing for cointegration using the ARDL approach, the ADF and 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.

level provided by Pesaran et al. (2001) (see Table 1 in the appendix). 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, Granger causality exists in at least one direction. For 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 2 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 economic growth and saving growth in Morocco.

As the bounds test results show no long-run relationship between real GDP and real GDS, in the case of Tunisia, we use the VAR model to examine the Granger causality between the variables. 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 3).

IV. Conclusion

This study examines empirically the relationship between saving and economic growth in the case of Morocco (1965-2007) and Tunisia (1961-2007) using the Autoregressive Distributed Lag (ARDL) approach. The results show long-run relationship between savings and economic growth exists in the case of Morocco but not for Tunisia over the period examined. When testing for Granger causality, the results show bidirectional causality exists between savings and economic

growth for Morocco. The results of bidirectional causality suggest that Morocco should improve its savings rate as it is important for enhancing the rate of economic growth in the economy. While for Tunisia, the results reveal a unidirectional Granger causality runs from saving to economic growth. Thus, Tunisia should promote policies that focus on enhancing savings to enhance 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.

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Appendix

Table 1. Bounds F-Test Results for Cointegration

Country	Dependent Variable	F-Statistics (no trend)	F-Statistics (with trend)	ECT (-1)
Morocco:	ΔY	4.61	3.84	-0.2104**
	ΔS	4.21	11.11	-0.3783*
Tunisia:	ΔY	0.84	1.17	
	ΔS	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. Δ 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.

Table 2. Morocco: Granger Causality Tests

Causality Type	F-statistic (p-value)
Short-run Granger causality:	
ΔS → ΔY (H0: $\delta_{2Y} = 0$)	4.4625 (0.0188)
ΔY → ΔS (H0: $\delta_{2S} = 0$)	8.2418 (0.0012)
Long-run Granger causality:	
ΔS → ΔY (H0: $\lambda_1 = 0$)	6.4012 (0.0161)
ΔY → ΔS (H0: $\lambda_2 = 0$)	8.5401 (0.0061)
Strong Granger causality:	
ΔS, ECT → ΔY (H0: $\delta_{2Y} = \lambda_1 = 0$)	6.0547 (0.0020)
ΔY, ECT → ΔS (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. Δ is the first difference operator.

Table 3. 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)