Growth-Savings Nexus in the Arab Region: Empirical Evidence from Panel Data

Dr. Jamel JOUINI

Dr. Mohamed Ismail

Arab Monetary Fund

July 2020

These economic studies are the product of the staff of the Economic Department at the Arab Monetary Fund (AMF). The Fund publishes these studies which survey issues pertinent to monetary, fiscal, banking, trade and capital market policies and their impact on Arab economies.

All correspondences should be addressed to:

Economic Department
Arab Monetary Fund
P.O. Box 2818
United Arab Emirates
Telephone No.: +9712-6171552
Fax No: +9712-6326454
Email: economic@amfad.org.ae
Website: www.amf.org.ae

Contents

Tables

Figures

Executive summary

The economic development literature has devoted increased attention to the linkages between output and savings over the last decades. In this context, attention is particularly paid to the direction, sign and magnitude of the causality between economic growth and savings, thus helping policymakers handle well the output-savings nexus. The rapid economic growth recorded in some Arab countries and the scarcity of related works on the Arab region incentivize us to investigate empirically the relationship between economic growth and savings for a set of ten Arab economies over the 1981-2018 period. The study is accurately conducted in a robust framework based on panel data techniques to obtain pertinent outcomes, thus allowing policymakers to advocate appropriate policies to achieve the desired levels of both economic growth and savings.

The results of the study are in line with expectations and show evidence of cointegrating relationships between economic growth and savings when controlling for auxiliary determinants in the model. They reveal a positive bidirectional output-savings nexus over both the long-run and short-run, with the responses of savings to economic growth being more important than the responses of economic growth to savings and the long-run effects being almost three times greater than the short-run effects. Indeed, over the long-run, an increase of 1% in output leads to an increase of 1.590% in savings; however, an increase of 1% in savings leads to an increase of 0.096% in output.

On the other hand, over the short-run, an increase of 1% in output generates an increase of 0.573% in savings; however, an increase of 1% in savings generates an increase of 0.034% in output. It is also found that the effects of investment, financial development, trade openness and inflation are higher in terms of magnitude for savings than for output, thus suggesting that such auxiliary variables contribute more to savings than to economic growth.

Important economic implications of the results are provided not only to policymakers of the set of Arab countries under study but also for other Arab economies that are economically linked and share similar development strategies with the considered economies. These implications aim to enhance both output and savings over both the long-run and short-run, depending on the development level and the intrinsic features of each economy. Indeed, authorities should create a favorable economic climate, devote more resources to high added value sectors, human capital and high technology, and encourage start-ups. It is also important to develop capital markets that play a crucial role in the process of economic development through mobilizing necessary savings to finance investment projects. Arab oil-exporting countries should effectively diversify their economies to hedge against the sharp declines of oil prices in the international markets. Additionally, Arab central banks should maintain macroeconomic stability by opting for a monetary policy that alleviates the negative effects of inflation, thus boosting both economic growth and savings.

Introduction

The growth-savings nexus has received increased attention over the last decades in the literature (see Anoruo and Ahmad, 2001; Alguacil et al., 2004; Narayan and Narayan, 2006; Sinha and Sinha, 2008; Odhiambo, 2009; Alomar, 2013; Kudaisi, 2013; and Jouini, 2016). The outcomes of these empirical works are mixed since they reveal that economic growth engenders savings (Keynesian theory) and/or savings boosts economic growth (classical school). The direction of causality between economic growth and savings as well as its sign and magnitude are of great interest for decision-makers to establish appropriate policies to enhance economic growth and savings.

The empirical analysis of the growth-savings nexus in the Arab region is an attractive issue given that some Arab countries have recorded rapid economic growth due to oil wealth and the development of services sector, thus boosting economic growth and savings. It is also worth noting that only few empirical studies in the literature have addressed the issue of the links between economic growth and savings for the Arab region, in addition to the shortcomings related to the methodologies used in some works. Therefore, it is important to examine the growth-savings nexus for the Arab region in a reliable framework to achieve the desired objectives of the study.

We continue in the same momentum of empirical studies related to the relationship between economic growth and savings using panel

data procedures that have not been previously used to investigate such relationship for the Arab region. Indeed, we make use of the well-suited Pooled Mean Group (PMG) technique developed by Pesaran et al. (1999), which consists in estimating a dynamic heterogeneous model for a panel of ten Arab economies over the 1981-2018 period. In addition to economic growth and savings, we include investment, financial development, trade openness, and inflation into the model to consider a more generalized specification to avoid biased results and to shed light on other channels through which economic growth and savings cause each other. By doing so, we assess accurately the bidirectional causal links between economic growth and savings over both the long-run and short-run, thus providing appropriate policy implications to the Arab authorities.

The obtained findings are aligned with expectations and reveal cointegrating links between the variables and a positive bidirectional growth-savings nexus over both the long-run and short-run, thus supporting the feedback effect between economic growth and savings for the set of Arab countries under study over the considered period. Significant responses of both economic growth and savings to the fluctuations in auxiliary determinants are also found over both the long-run and short-run. Useful policy implications of the results are provided to decision-makers of the considered Arab economies to help them boost economic growth and savings. These implications can also be of great interest to other Arab countries that are

economically linked and share similar development strategies with the countries under study.

The remainder of the study is organized as follows. Section 1 presents a brief literature review on the growth-savings nexus. Section 2 introduces the model and describes the data. The econometric methodology is presented in Section 3. Section 4 discusses the empirical results of the econometric analysis. Concluding remarks and policy implications of the results are set forth at the end of the study.

1. Literature review

Several works in the economic development literature have dealt with the relationship between economic growth and savings in advanced and developing economies. Romer (1986), Lucas (1988) and Lin (1992) show that higher savings generate economic growth through capital accumulation. Husain (1995) outlines that the divergence in the growth rates of savings mainly explains the divergence of economic growth between advanced and developing countries. In this vein, Sinha and Sinha (1998) argue that decision-makers in developing economies should opt for policies in favor of savings to boost output. Carroll and Weil (1994) find that savings respond negatively to the changes in economic growth, due to the increase of households' consumption in case of an exogenous rise on aggregate growth. Carroll et al. (2000) reveal a positive income-

savings nexus when the marginal propensity to consume is smaller than one.

Andersson (1999) outlines that causality between economic growth and savings varies across three advanced countries. In a similar study, Mohan (2006) shows that the causal links between output and savings depend on the income class of the country. Odhiambo (2009) reveals that for South Africa, economic growth and savings cause each other over the short-run and that causality runs from economic growth to savings over the long-run, thus suggesting that policymakers should advocate policies to boost both economic growth and savings over the short-run and only economic growth over the long-run.

Sarantis and Stewart (2001) find that income causes savings for a panel of OECD economies with different causality magnitude across countries. By cons, Irandoust and Ericsson (2005) reveal that economic growth responds significantly to the changes in savings for a set of African economies. Kónya (2005) shows evidence of bidirectional causal links between economic growth and savings for the Austrian economy as well as unidirectional causality across economies with different income levels. Jouini (2016) finds that economic growth and savings are mutually and positively connected over both the long-run and short-run in Saudi Arabia, thus implying that authorities should establish policies to achieve higher levels of both economic growth and savings.

2. Model and data

We consider the following panel long-run relationships between economic growth, savings, and related determinants:

$$RGDP_{it} = \alpha_0 + \alpha_1 RGDS_{it} + \alpha_2 IVST_{it} + \alpha_3 FD_{it} + \alpha_4 TO_{it} + \alpha_5 INF_{it} + u_{1,it} \quad (1)$$

$$RGDS_{it} = \beta_0 + \beta_1 RGDP_{it} + \beta_2 IVST_{it} + \beta_3 FD_{it} + \beta_4 TO_{it} + \beta_5 INF_{it} + u_{2,it} \quad (2)$$

where the cross-section index i refers to the country, the time-dimension index t refers to the time period for each country, $RGDP_{it}$ is the real gross domestic product (constant 2015 US$), $RGDS_{it}$ is the real gross domestic savings,[1] $IVST_{it}$ is the investment measured by the share of gross fixed capital formation to GDP, FD_{it} is the financial development measured by the domestic credit to private sector as a percentage of GDP, TO_{it} is the trade openness measured by the ratio of trade (exports plus imports) to GDP, INF_{it} is the inflation rate based on GDP deflator (base year is 2015), and $u_{1,it}$ and $u_{2,it}$ are the error terms. All variables, except inflation that is negative for some economies over some periods, are converted into natural logarithms so that the coefficient estimates are interpreted as the

[1] The real gross domestic savings are obtained by dividing the nominal gross domestic savings by the GDP deflator (base year is 2015).

elasticities of real GDP (real savings) with respect to real savings (real GDP), investment, financial development, and trade openness.

We consider annual data over the 1981-2018 period[2] for ten Arab economies, namely Algeria, Bahrain, Egypt, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Tunisia, and the United Arab Emirates (UAE). Data on real GDP, Real GDS and inflation are gathered from the United Nations Conference on Trade and Development (UNCTAD) database, while data on investment, financial development and trade openness are collected from the World Development Indicators (WDI) database published by the World Bank.

3. Econometric methodology

We estimate a dynamic heterogeneous panel model, developed by Pesaran et al. (1999), to assess the short-run dynamics and long-run equilibrium[3] state of the growth-savings nexus by controlling for auxiliary determinants in the model. Practically, the panel error correction models are given by:

[2] The study period is selected so that data are available for all considered Arab economies. We claim that this period is long enough to examine the long-run growth-savings nexus in the panel framework.

[3] Considering long-run linkages among variables is explained by the fact that economic growth and savings may co-move over the long-run.

$$\Delta RGDP_{it} = a_i + b_i t + \theta_{1i} e_{1,i,t-1} + \sum_{l=1}^{p_1-1} \varphi'_{1,il} \Delta RGDP_{i,t-l} + \sum_{j=0}^{q_1-1} \gamma'_{1,ij} \Delta X_{i,t-j} + \delta'_{1i} X'_{it} + \varepsilon_{1,it} \quad (3)$$

$$\Delta RGDS_{it} = c_i + d_i t + \theta_{2i} e_{2,i,t-1} + \sum_{l=1}^{p_2-1} \varphi'_{2,il} \Delta RGDS_{i,t-l} + \sum_{j=0}^{q_2-1} \gamma'_{2,ij} \Delta Z_{i,t-j} + \delta'_{2i} Z'_{it} + \varepsilon_{2,it} \quad (4)$$

where Δ stands for the first difference operator, X_{it} is the vector of all variables, except real GDP, Z_{it} is the vector of all variables, except real savings, $e_{1,i,t-1}$ and $e_{2,i,t-1}$ are the deviations from the long-run equilibrium, and $\varepsilon_{1,it}$ and $\varepsilon_{2,it}$ are the disturbance terms. The coefficients a_i, b_i, c_i and d_i are country specific effects, the error correction term coefficients θ_{1i} and θ_{2i} measure the adjustment speed of the short-run deviations of real GDP and real savings towards the long-run equilibrium state, respectively, the coefficients $\varphi_{1,il}$ and $\varphi_{2,il}$ assess the short-run past own effects of real GDP and real savings, respectively, the coefficients $\gamma_{1,ij}$ and δ_{1i} ($\gamma_{2,ij}$ and δ_{2i}) measure the short-run impacts of the variables on real GDP (real savings), and the optimal lag orders p_1, q_1, p_2 and q_2 are determined by applying the Schwarz Bayesian information criterion. We employ the maximum likelihood method and the Newton-Raphson's optimization algorithm to obtain consistent and normally distributed estimators asymptotically.

The coefficients of the long-run relationships are identical across the selected Arab countries, as illustrated by Eqs. (1) and (2). This homogeneity of the long-run coefficients may be explained by the

common technologies, arbitrage conditions, and budget or solvency constraints. Under this homogeneity assumption, Pesaran et al. (1999) argue that the coefficient estimates in the long-run are consistent and efficient. However, the model coefficients are assumed to be heterogeneous in the short-run, as illustrated by Eqs. (3) and (4), thereby allowing the dynamic specification to be different across economies. Under these conditions, the short-run estimates are obtained by averaging the coefficients across countries.

4. Discussion of the results

We examine the integration properties of the considered variables by applying panel unit root tests. If the variables are integrated of order one, *I*(1), we test for long-run linkages between the variables by employing panel cointegration tests and detect the corresponding break dates. If there is cointegration between the variables, we assess the growth-savings nexus by estimating the long-run coefficients. The short-run coefficients and the adjustment speed towards the long-run equilibrium state are then estimated based on the error correction models.

4.1. Preliminary data assessment

The time-varying patterns of real GDP and real savings plotted in Figures 1 and 2 shed some light on the nature of the linkages between them across Arab countries. Indeed, they show similar trending

behavior[4] at most times of the study period for each country and across economies, thus suggesting positive links between them.

The descriptive statistics displayed in Table 1 reveal that Saudi Arabia records the highest average real GDP and real savings followed by the UAE, which may be explained by the increase of hydrocarbons exports in both countries and the development of services sector in the UAE. By cons, Bahrain records the lowest average real GDP, and Tunisia has the lowest average real savings. It is also worth noting that the average real GDP for Egypt, Saudi Arabia, and the UAE is greater than the average real GDP over the whole group of countries. In addition, the average savings for Algeria, Saudi Arabia, and the UAE exceed the average savings over the whole panel of countries.

The empirical correlations presented in Tables 2 and 3 are calculated across countries and over the whole panel. The values by country indicate that real GDP and real savings are positively and highly connected for eight out of ten countries.[5] For the whole sample, there is evidence of positive and high dependence between real GDP and

[4] Savings decrease from 2011 in Egypt and Tunisia due to the Arab Spring events that broke out in January 2011. Sudan records falls in savings from 2012, due to the South Sudan's independence on 9 July 2011, before recording an improvement in 2017.

[5] The correlation between real GDP and real savings is positive and moderate for Egypt and Tunisia, as evidenced by the coefficient values.

real savings. The results also reveal mixed (positive or negative) correlations between real GDP as well as real savings and the auxiliary determinants across countries and over the whole panel. The correlation analysis is not conclusive regarding the causal linkages between the variables. Therefore, an in-depth analysis of the growth-savings nexus based on reliable econometric techniques is required to achieve the desired objectives of the study.

4.2. Unit root and cointegration test results

We apply the panel stationarity test developed by Carrion-i-Silvestre et al. (2005) and the panel cointegration test developed by Westerlund (2006) to account for heterogeneity, cross-country dependence, and structural breaks. The heterogeneity across countries may be explained by the intrinsic features of the economic climate of the selected economies.[6] The cross-country dependence may be due to the economic links between many considered countries.[7] Considering structural breaks may be motivated by the fact that the period (1981-2018) recorded influential international economic and financial events that cause profound changes in the

[6] To check for heterogeneity of the variables across countries, we can apply the tests of Holtz–Eakin (1986) and Holtz–Eakin et al. (1989).

[7] The dependence between countries can be checked using the tests developed by Breusch and Pagan (1980) and Pesaran (2004).

evolution patterns of some economic fundamentals for many considered countries.[8]

We assume that a maximum of two break dates is enough to implement the tests, given the study period that spans from 1981 to 2018. In addition, a trimming of 0.3 is used to identify the break dates, implying that there are at least 11 observations in each regime. We consider the bootstrap versions of the above tests[9] which account for heterogeneity, cross-section dependence[10] and regime-shifts. In this vein, we reject the null hypotheses of stationarity and cointegration between the variables if the bootstrap *p*-values are less than a conventional significance level (1%, 5% or 10%). The stationarity test results presented in Table 4 show evidence of non-stationarity for level variables and stationarity for first-differenced variables for all test equations, thus suggesting that all variables are $I(1)$.[11] These outcomes allow us to test for cointegration between the

[8] To test for structural breaks in the variables, we can employ the tests proposed by Bai and Perron (1998, 2003).

[9] The number of bootstrap replications B is set at 999 and chosen so that $\alpha(B+1)$ is an integer where α is a significance level, thus removing all eventual bias when calculating the bootstrap *p*-value (see Davidson and MacKinnon, 2000).

[10] We consider the asymptotic versions of the tests if there is evidence of no cross-country dependence. In this study, we have applied the Breusch and Pagan (1980) and Pesaran (2004) tests and found evidence of dependence between countries.

[11] Similar outcomes are obtained by applying other panel unit root tests. In addition, time series unit root tests have been conducted to show that the variables are generally $I(1)$.

variables. The results depicted in Table 5 conclude in favor of long-run linkages between the variables for all test specifications, implying that the variables co-move in the long-run.[12]

4.3. Detection of breaks

The results of the break dates in linear time trend reported in Table 6 reveal evidence of at least one break for most countries, suggesting that the considered study period records influential economic events that hit the variables. The break date located in 2009 is the most detected date across countries, thus showing the repercussions of the global financial crisis on the economies and corroborating the cross-country dependence. Other break dates in different years may coincide with various domestic and international events.

4.4. Results of the growth-savings nexus

Given the evidence of cointegration between the variables, we can now estimate the above models to assess the growth-savings nexus over both the long-run and short-run. Before assessing this nexus, we check the homogeneity of the coefficients across countries over the long-run by applying the Hausman test discussed by Pesaran et al. (1996). The results reported in Table 7 conclude in favour of identical long-run coefficients across economies for both equations since the test does not reject the homogeneity null hypothesis. This outcome

[12] Other tests have been applied to show evidence of cointegration between the variables.

may be because many countries in the considered panel share strong economic links and common features in terms of economic and trade policies. Regarding the short-run dynamics across economies, the heterogeneity may be explained by the intrinsic features of the economic climate across countries in terms of domestic demand, economic high added value sectors and economy size.

For the long-run effects, the results reported in Table 7 reveal that savings are a relevant driver of economic growth for the Arab region since the coefficient is statistically significant at the 1% level. In fact, an increase of 1% in real savings leads to an increase of 0.096% in real GDP. On the other hand, savings respond significantly and positively to the fluctuations in economic growth since an increase of 1% in real GDP leads to an increase of 1.590% in real savings. Therefore, the responses of savings to economic growth are greater than the responses of economic growth to savings. These outcomes imply that economic growth and savings vary mutually in the same sense, but with different degrees, thus supporting the positive feedback effect between them for the selected Arab countries over the study period.[13]

The results also show evidence of significant and positive effects of investment, financial development and trade openness, and a significant and negative impact of inflation on economic growth, as

[13] The causality direction may help policymakers make judicious economic policies (see Deaton, 1995).

expected, over the long-run. However, only investment, trade openness and inflation exert significant and positive impacts on savings, as expected, over the long-run. It is also found that financial development does not affect savings at any conventional significance level over the long-run.[14] The impacts of the significant determinants are greater in terms of magnitude for savings than for economic growth, implying that such determinants contribute more to savings than to economic growth.

Regarding the short-run effects, the results presented in Table 8 show significant and positive bidirectional links between economic growth and savings, as evidenced by the statistically significant coefficients. Indeed, an increase of 1% in savings (economic growth) generates an increase of 0.034% (0.573%) in economic growth (savings). Therefore, authorities in the considered Arab countries can make judicious policies to stimulate economic growth and savings based on the estimated growth-savings nexus. In the same context, Kónya (2005) and Jouini (2016) find bidirectional causal links between economic growth and savings in Saudi Arabia; however, Alomar (2013) reveals that only economic growth causes savings for four Arab Gulf states. The findings also indicate that all auxiliary variables contribute significantly to economic growth and savings over the short-run. Inflation has the smallest impact on economic

[14] Kelly and Mavrotas (2008) reveal that financial development positively affects savings.

growth and savings compared to the other auxiliary determinants over both the long-run and short-run. The short-run coefficients of the auxiliary variables are smaller and have the same sign compared to the long-run.

The error correction term coefficients are statistically significant and negative, as expected, for both models, thus confirming the long-run linkages between the variables, as evidenced by the cointegration test (see Table 5), and suggesting the return to the long-run state following a shock for economic growth and savings. Additionally, they refer to the high predictability of the growth-savings nexus and the mean-reversion of the spread movement. The adjustment speed is similar for both economic growth and savings, since the error correction term coefficients take the values –0.354 and –0.360, respectively. This finding implies that the current deviations from the equilibrium state are corrected by 35.4% for economic growth and 36% for savings in the next year. Accordingly, the convergence to the long-run equilibrium state will be attained in two years and ten months for both economic growth and savings.

Our findings comply with expectations over both the long-run and short-run, and there are some plausible economic explanations for this. Indeed, the positive links between economic growth and savings may be explained by the specificity of most Arab countries as oil-exporting countries. The positive responses of economic growth and savings to the fluctuations in investment may be supported by the fact

that investment is a key driver of economic activity, which may be reflected positively on GDP and thus on savings. The positive effect of trade openness may be due to the fact that most Arab countries are exporting countries and adopt outward-oriented policies to attract high-tech international companies in order to boost their economies, which leads to increase GDP and thus savings. The positive impact of financial development on economic growth may be supported by the fact that domestic credit to private sector boosts investment, which may be reflected on GDP. However, the negative reaction of savings to the changes in financial development may be explained by the fact that domestic credit to private sector may decline savings. Inflation declines domestic demand which may be reflected negatively on the supply and thus on GDP. However, the positive response of savings to the changes in inflation may be supported by the fall of consumption that leads to an increase in savings. Overall, authorities in the selected Arab countries can thus rely on these outcomes to take necessary measures for boosting economic growth and savings.

Conclusion and policy implications

The study presents a meticulous analysis of the growth-savings nexus by controlling for auxiliary determinants in the model for a set of ten Arab countries over the 1981-2018 period. In this context, we endeavor to examine whether there is support for the traditional point of view of the classical school and/or the Keynesian point of view for

the Arab region by applying reliable econometric tools, which is of great interest for policymakers to promote both economic growth and savings.

The obtained findings are expected and reveal positive bidirectional causality between economic growth and savings over both the long-run and short-run for the selected Arab countries, which is in line with some theory-based hypotheses about the positive growth-savings nexus (see Modigliani, 1970; and Carroll et al., 2000). This result may be due in part to the high revenues generated from natural resources and hydrocarbons exports as well as services sector in some Arab economies, thus boosting economic growth and savings. It is also found that the auxiliary determinants have the power to predict economic growth and savings. Overall, all these outcomes suggest that our empirical methodology is well-suited for examining the growth-savings nexus in the Arab region.

The study provides interesting economic implications for decision-makers in the Arab countries. Indeed, policies should boost both economic growth and savings to achieve the desired levels, depending on the development level of each country and the intrinsic features of its economy:

- Given that the impact of economic growth on savings is higher than that of savings on economic growth, policymakers should work more on enhancing GDP to hasten both economic growth and savings by creating a favorable

economic climate and by devoting more resources to high technology, human capital, investment in economic high added value sectors, etc.

- Financial markets play a vital and important role in mobilizing savings and thus providing the necessary liquidity to finance investment projects to achieve sustainable economic development. Therefore, given the importance of financial markets in enhancing the economic climate and attracting foreign investments, policymakers in the Arab countries should work to develop the financial sector.
- Some Arab oil-dependent countries should establish effective policies to diversify their economies and boost exports in non-oil sectors to hedge against the fluctuations of oil prices in the international markets, thus maintaining sustainable economic growth. Additionally, the Arab governments should invest in importing new production technologies to strengthen economic activity.
- Central banks and monetary authorities in the Arab region should make a balanced monetary policy to alleviate the negative effects of inflation to achieve macroeconomic stability, thus leading to boost economic growth.

References

Alguacil, M., Cuadros, A. and Orts, V. (2004). Does saving really matter for growth? Mexico (1970–2000). *Journal of International Development*, 16, 281–290.

Alomar, I. (2013). Economic growth and savings in GCC: A cointegration and causal relationship analysis. *International Journal of Humanities and Social Science*, 3, 213–218.

Andersson, B. (1999). On the causality between saving and growth: long- and short-run dynamics and country heterogeneity. Department of Economics, Uppsala University, Sweden.

Anoruo, E. and Ahmad, Y. (2001). Causal relationship between domestic savings and economic growth: evidence from seven African countries. *African Development Bank*, 13, 238–249.

Bai, J. and Perron, P. (1998). Estimating and testing linear models with multiple structural changes. *Econometrica*, 66, 47–78.

Bai, J. and Perron, P. (2003). Computation and analysis of multiple structural change models. *Journal of Applied Econometrics*, 18, 1–22.

Breusch, T. and Pagan, A.R. (1980). The Lagrange multiplier test and its application to model specifications in econometrics. *Reviews of Economics Studies*, 47, 239–253.

Carrion-i-Silvestre, J.L., Castro, T.D.B. and Bazo, E.L. (2005). Breaking the panels: An application to the GDP per capita. *Econometrics Journal*, 8, 159–175.

Carroll, C.D., Overland, J. and Weil, D.N. (2000). Saving and growth with habit formation. *American Economic Review*, 90, 341–355.

Carroll, C.D. and Weil, D.N. (1994). Saving and growth: a reinterpretation. *Carnegie–Rochester Conference Series on Public Policy*, 40, 133–192.

Davidson, R. and MacKinnon, J. (2000). Bootstrap tests: how many bootstraps? *Econometric Reviews*, 19, 55–68.

Deaton, A. (1995). Growth and saving: What do we know, what do we need to know, and what might we learn? Manuscript, Princeton University.

Hall, A. (1994). Testing for a unit root in time series with pretest data–based model selection. *Journal of Business and Economic Statistics*, 12, 461–470.

Holtz-Eakin, D. (1986). Testing for individual effects in dynamic models using panel data. NBER Technical Working Paper No. 57.

Holtz-Eakin, D., Newey, W.K. and Rosen, H.S. (1989). Implementing causality tests with panel data, with an example from local public finance. NBER Technical Working Paper No. 48.

Husain, A.M. (1995). Long–run determinants of private saving behaviour in Pakistan. *The Pakistan Development Review*, 34, 1057–1066.

Irandoust, M. and Ericsson, J. (2005). Foreign aid, domestic savings, and growth in LDCs: an application of likelihood–based panel cointegration. *Economic Modelling*, 22, 616–627.

Jouini, J. (2016). Economic growth and savings in Saudi Arabia: Empirical evidence from cointegration and causality analysis. *Asia-Pacific Journal of Accounting and Economics*, 23, 478–495.

Kelly, R. and Mavrotas, G. (2008). Savings and financial sector development: Panel cointegration evidence from Africa. *The European Journal of Finance*, 14, 563–581.

Kónya, L. (2005). Saving and growth: Granger causality analysis with bootstrapping on panels of countries. *Journal of Economic Research*, 10, 231–260.

Kudaisi, B.V. (2013). Savings and its determinants in West Africa countries. *Journal of Economics and Sustainable Development*, 4, 107–119.

Lin, S.Y. (1992). Malaysia: saving–investment gap, financing needs and capital market development. *Malaysia Management Review*, 27, 26–53.

Lucas, R.E. (1988). On the mechanics of economic Development. *Journal of Monetary Economics*, 22, 3–42.

Modigliani, F. (1970). The life cycle hypothesis of saving and intercountry differences in the saving ratio. In: Eltis, W.A., Scott, M.F. and Wolfe, J.N. (Eds.), Induction, Growth and Trade: Essays in honour of Sir Roy Harrod. Oxford University Press, Oxford, pp. 197–225.

Mohan, R. (2006). Causal relationship between savings and economic growth in countries with different income levels. *Economics Bulletin*, 5, 1–12.

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, 468–481.

Odhiambo, N.M. (2009). Savings and economic growth in South Africa: a multivariate causality test. *Journal of Policy Modeling*, 31, 708–718.

Pesaran, M.H. (2004). General diagnostic tests for cross section dependence in panels. University of Cambridge. Working Paper No. 435.

Pesaran, M.H., Shin, Y. and Smith, R. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, 94, 621–634.

Pesaran, M.H., Smith, R.P. and Im, K.S. (1996). Dynamic linear models for heterogeneous panels. Chap.5 in Matyas and Sevestre.

Romer, P. (1986). Increasing returns and long–run growth. *Journal of Political Economy*, 94, 1002–1037.

Sarantis, N. and Stewart, C. (2001). Saving behaviour in OECD countries: evidence from panel cointegration tests. *Manchester School*, 69, 22–41.

Sinha, D. and Sinha, T. (1998). Cart before horse? The saving–growth nexus in Mexico. *Economics Letter*, 61, 43–47.

Sinha, D. and Sinha, T. (2008). Relationships among household saving, public saving, corporate saving and economic growth in India. *Journal of International Development*, 20, 181–186.

Westerlund, J. (2006). Testing for panel cointegration with multiple structural breaks. *Oxford Bulletin of Economics and Statistics*, 68, 101–132.

Table 1. Summary statistics of the variables

Country	RGDP	RGDS	INVT	FD	TO	INF
Algeria						
Mean	1.08E+11	4.37E+11	30.019	26.768	57.053	1.588
Std. Dev.	3.50E+10	2.13E+10	6.114	23.926	10.412	11.264
Bahrain						
Mean	1.75E+10	6.84E+9	24.472	49.974	163.250	3.101
Std. Dev.	8.46E+9	4.47E+9	7.369	13.221	30.075	7.856
Egypt						
Mean	1.83E+11	2.19E+10	21.838	34.842	49.545	2.314
Std. Dev.	9.03E+10	9.27E+9	6.042	11.059	10.744	11.689
Morocco						
Mean	5.76E+10	1.33E+10	27.322	45.564	63.106	0.860
Std. Dev.	2.61E+10	5.78E+9	3.263	28.083	13.437	8.568
Oman						
Mean	3.74E+10	1.52E+10	22.760	35.239	90.946	2.949
Std. Dev.	1.60E+10	7.45E+9	6.216	16.161	13.857	12.272
Qatar						
Mean	6.19E+10	3.84E+10	27.822	40.910	87.865	3.117
Std. Dev.	5.59E+10	3.86E+10	9.716	15.504	8.728	13.369
Saudi Arabia						
Mean	4.04E+11	1.51E+11	21.558	28.855	74.026	2.885
Std. Dev.	1.42E+11	8.71E+10	3.075	13.461	10.946	10.254
Sudan						
Mean	4.93E+10	6.63E+9	15.663	7.799	25.474	3.452
Std. Dev.	2.54E+10	5.96E+9	4.993	4.082	10.266	19.002
Tunisia						
Mean	2.69E+10	4.71E+9	24.208	64.264	89.926	0.332
Std. Dev.	1.13E+10	1.86E+9	3.641	8.816	11.187	6.629
UAE						
Mean	2.01E+11	9.32E+10	23.894	43.348	106.517	2.926
Std. Dev.	9.73E+10	5.14E+10	4.043	21.232	41.112	7.338
Whole panel						
Mean	1.15E+11	3.94E+10	23.956	37.756	80.771	2.352
Std. Dev.	1.31E+11	5.69E+10	6.871	22.112	40.276	11.276

Table 2. Empirical correlations between RGDP and the other variables

Country	RGDS	INVT	FD	TO	INF
Algeria	0.908	0.523	-0.427	0.555	0.067
Bahrain	0.965	0.098	0.900	-0.433	-0.013
Egypt	0.441	-0.869	0.137	-0.306	0.044
Morocco	0.982	0.577	0.952	0.895	-0.017
Oman	0.887	0.202	0.910	0.621	0.168
Qatar	0.986	0.694	0.641	0.498	0.028
Saudi Arabia	0.886	0.402	0.914	0.188	0.148
Sudan	0.823	0.671	0.318	0.424	0.019
Tunisia	0.601	-0.685	0.634	0.734	-0.115
UAE	0.959	-0.588	0.923	0.977	0.108
Whole panel	0.889	-0.070	0.027	-0.043	0.043

Table 3. Empirical correlations between RGDS and the other variables

Country	RGDP	INVT	FD	TO	INF
Algeria	0.908	0.325	-0.445	0.791	0.287
Bahrain	0.965	0.193	0.866	-0.421	0.093
Egypt	0.441	-0.427	0.559	0.210	0.381
Morocco	0.982	0.553	0.907	0.874	0.037
Oman	0.887	0.252	0.702	0.679	0.369
Qatar	0.986	0.665	0.535	0.568	0.103
Saudi Arabia	0.886	0.275	0.732	0.499	0.397
Sudan	0.823	0.625	0.375	0.482	0.061
Tunisia	0.601	-0.302	-0.001	0.473	0.124
UAE	0.959	-0.473	0.881	0.948	0.023
Whole panel	0.889	0.066	0.082	0.132	0.106

Table 4. Panel stationarity test results

Variable	Intercept	Trend	Breaks in intercept	Breaks in trend
RGDP	0.000	0.001	0.000	0.000
	0.198	0.140	0.141	0.111
RGDS	0.000	0.052	0.001	0.000
	0.320	0.119	0.371	0.133
INVT	0.001	0.002	0.052	0.017
	0.922	0.730	0.898	0.700
FD	0.000	0.044	0.000	0.000
	0.865	0.471	0.876	0.532
TO	0.002	0.045	0.015	0.007
	0.601	0.112	0.483	0.186
INF	0.017	0.049	0.078	0.009
	0.651	0.406	0.655	0.408

Notes: The Carrion-i-Silvestre et al. (2005) test is constructed under the null hypothesis of stationarity; and considers a model with intercept, a model with linear time trend, a model with a maximum of two break dates in level and a model with a maximum of two break dates in linear time trend. The top value is for level series, and the bottom value is for first-differenced series for each variable. For each variable, the values refer to the bootstrap *p*-value. We reject the null hypothesis of stationarity if the *p*-value is less than a conventional significance level (1%, 5% or 10%).

Table 5. Panel cointegration test results

Dep. variable	Intercept	Trend	Breaks in intercept	Breaks in trend
RGDP	0.767	0.117	0.933	0.739
RGDS	0.907	0.113	0.560	0.116

Notes: The Westerlund (2006) test is constructed under the null hypothesis of cointegration; and considers a model with intercept, a model with linear time trend, a model with a maximum of two break dates in level and a model with a maximum of two break dates in linear time trend. For each dependent variable, the values refer to the bootstrap *p*-values. We reject the null hypothesis of cointegration if the *p*-value is less than a conventional significance level (1%, 5% or 10%).

Table 6. Estimated break dates

Dep. variable	**Country**	Date 1	Date 2
RGDP	Algeria	-	-
	Bahrain	1996	-
	Egypt	1996	2008
	Morocco	1993	2007
	Oman	-	-
	Qatar	1989	-
	Saudi Arabia	1993	2009
	Sudan	2000	2009
	Tunisia	1989	2009
	UAE	1997	2009
RGDS	Algeria	1990	-
	Bahrain	1996	-
	Egypt	1995	2009
	Morocco	2009	-
	Oman	-	-
	Qatar	1992	2005
	Saudi Arabia	1993	2009
	Sudan	1998	-
	Tunisia	1989	2009
	UAE	1997	2008

Note: For each dependent variable, the values refer to the detected break dates in linear time trend based on the panel cointegration test of Westerlund (2006).

Table 7. Long-run estimates

Dep. variable	**Exp. variable**	Coefficient	Std. Error
RGDP	RGDS	0.096***	0.011
		(0.19)	-
	INVT	0.037***	0.014
		(0.62)	-
	FD	0.033***	0.005
		(0.28)	-
	TO	0.178***	0.022
		(0.19)	-
	INF	-0.003***	0.001
		(0.92)	-
RGDS	RGDP	1.590***	0.247
		(0.24)	-
	INVT	0.175*	0.091
		(0.18)	-
	FD	-0.128	0.080
		(0.93)	-
	TO	0.239*	0.144
		(0.41)	-
	INF	0.037***	0.004
		(0.11)	-

Notes: For each variable, the value in parentheses is the p-value associated to the Hausman test statistic for identical coefficients over the long-run. *** and * denote significance at the 1% and 10% levels, respectively.

Table 8. Short-run estimates

	Dep. variable			
	RGDP		RGDS	
Exp. variable	Coefficient	Std. Error	Coefficient	Std. Error
RGDP	-	-	0.573***	0.163
RGDS	0.034***	0.011	-	-
INVT	0.013***	0.004	0.063***	0.018
FD	0.013***	0.004	-0.046***	0.013
TO	0.063***	0.020	0.086***	0.025
INF	-0.001***	3.0E-4	0.013***	0.004
DRGDP	-	-	0.863*	0.503
DRGDP(-1)	0.062	0.070	-0.763	0.491
DRGDP(-2)	0.042	0.037	-0.025	0.067
DRGDS	0.093**	0.043	-	-
DRGDS(-1)	0.008	0.015	0.077	0.076
DRGDS(-2)	0.003	0.004	-0.027	0.027
DINVT	0.023	0.023	-0.049	0.058
DINVT(-1)	0.001	0.007	-0.014	0.110
DINVT(-2)	-0.015	0.015	0.069	0.090
DFD	0.007	0.006	-0.205	0.187
DFD(-1)	0.014	0.010	0.183	0.155
DFD(-2)	0.021	0.021	-0.187	0.150
DTO	-0.044*	0.023	0.100	0.086
DTO(-1)	-0.004	0.013	0.073	0.068
DTO(-2)	-0.011	0.011	0.102	0.102
DINF	0.001	0.001	-0.006**	0.003
DINF(-1)	-0.001	0.001	-0.001	0.001
DINF(-2)	-0.001	0.001	-0.002	0.002
Adj. speed	-0.354***	0.111	-0.360***	0.103
Trend	0.012***	0.004	-0.008**	0.004
Intercept	7.420***	2.244	-6.171***	1.789

Notes: 'D' stands for first difference. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Figure 1. Time-variations of real GDP

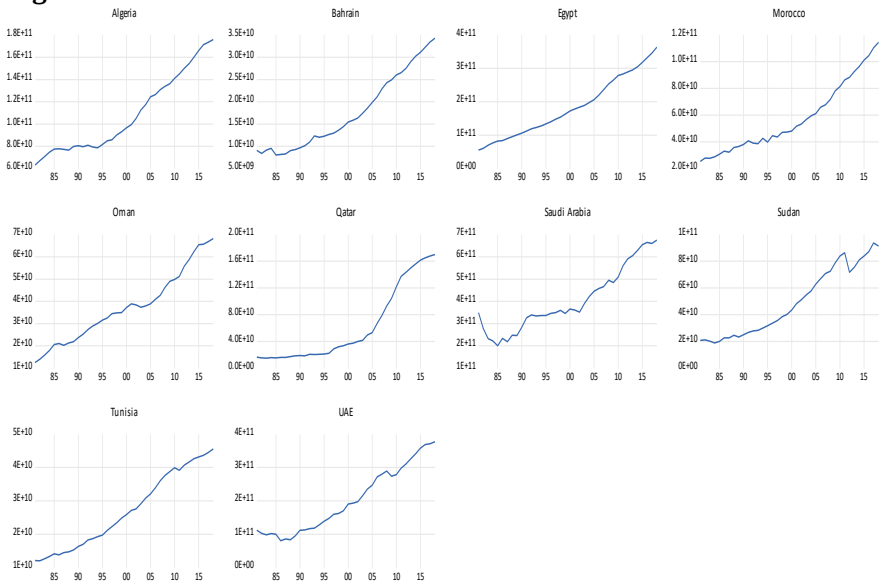

Figure 2. Time-variations of real savings