Cointegrating and Causal Relationships between Saving and Growth:The Case of Iran

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ABSTRACT

This paper examines the long-run causal relationship between saving and economic growth for Iran for the period 1967-2010. Applying the multivariate cointegration techniques and Toda and Yamamoto causality test, it is found that the stability of savings-led growth hypothesis in the long run is not applied for this country. On the other hand, it is found that there is a unidirectional causality running from economic growth to saving for Iran. Evidently, the empirical results cast further doubt on the relevance of the domestic saving used as a target variable for economic development.

Keywords: *Saving, economic growth, Toda-Yamamoto Causality, Iran*

Introduction

Neo-classical models of economic growth such as Solow-Swan model and the Ramsey model infer the importance of domestic saving in promoting economic growth, resulting in growing interest in this topic. Lewis (1955) economic development theory centrally revolves around the idea of higher saving leads to higher growth. Domar-Harrod model specifies that investment is the driving force behind long-run economic growth, which could be financed primarily from domestic saving, where this is supported by the many empirical studies such as by World Bank (1993). Nevertheless, growth would not occur if the saving is used for unproductive investment. Furthermore, the significant absence or presence of saving to stifle or promote growth depends on many factors, such as the quality of the financial system and public institutions and the total factor productivity (Hevia, Ikeda & Loayza, 2010).

On the other hand, Keynesian theory indicates that growth causes saving, thus it is necessary to emphasize on the demand side to achieve economic prosperity. Carroll-Weil hypothesis (1994) postulates that higher economic growth is necessary for higher rate of saving, and one of the most powerful determinants of saving is economic growth. Studies in Ghana (Olajide 2009), Tunisia (Bassam Abu al-Foul, 2010), India (Verma, 2007), Pakistan (Sajid & Sarfaz, 2008) and Kenya (Waithima, 2008) have found that there is a unidirectional causality that runs from economic growth to saving, and no evidence on reverse causality occurred. A study by Saltz (1999) on the saving-growth causality for 18 Latin American and newly industrialised countries (NIC)found that growth rate of real GDP granger cause saving. Mohan (2006) studies the direction of causality between saving and growth for economies with different levels of income using Granger causality. His main results lend more support for the hypothesis of growth precedes saving, where growth granger causes saving in 13 low-income countries, saving granger cause growth in Indonesia and and Singapore, and bi-directional causality in 5 high-income countries. Nevertheless, he finds that there is no causality relationship in Egypt. Employing Granger causality, Kónya (2005) finds that there exist bidirectional causality between saving and growth in Austria, one-way causality from saving to growth in Ireland, Trinidad & Tobago and the Central African Republic, and unidirectional causality runs from growth to saving in Finland, France, Japan, Sweden, Switzerland and Nigeria. These vast empirical literature have shown mixed findings, generate debates on the role of saving as a target variable for economic progress.

The main objective of this paper is to examine the cointegrating and causal relationships between domestic saving and economic growth in Iran. This country has experienced a remarkable increase in its rates of saving as percentage of GDP for period 1960-2010, between 28% and 43%. Thus, this paper will contribute significantly to the literature by providing new evidence on saving-growth causality in Iran, as to the best of our knowledge, there are only a few studies and none of these studies employ Toda and Yamamoto (1995) Granger causality test which is an innovative, more robust and more efficient methodology in small sample and non-stationary data. The structure of this paper is as followed: section 2 describes the data and discusses the empirical results and section 3 concludes.

Data and empirical results

Data

We use the annual time series data covered for the period 1967-2010, and are obtained from World Bank Database. In keeping up with the literature, growth is proxied by the variable real Gross Domestic Product (GDP), whereas domestic saving is proxied by variable real Gross Domestic Saving (Saving), where the current Gross Domestic Saving is deflated by GDP Deflator. All data are calculated in local currency unit and are expressed in logarithm, thus their first difference is equivalent to the growth rates.

Unit root test

Many macroeconomic time series contain unit roots, thus, it is imperative to test the stationarity of a time series as the non-stationarity regressors invalidate the empirical results and analysis. Even though Toda-Yamamoto (T-Y) test does not require the pre-testing of unit root test and cointegration test, the unit root tests is, however, significant in order to determine the maximum order of integration of series (d max) to be employed in the T-Y test. Therefore, the Augmented Dickey-Fuller (ADF) test is performed using E-view software. Table 1 presents the results of the unit root tests for all variables. It is clear that the ADF unit root tests cannot reject the null hypothesis of a unit root at levels of all variables at 5%, but reject the null at first-difference at 1%, implying that all variables are integrated of order one or I(1). Subsequently, the maximum order of integration of series (d max) in the system is 1.

Table 1: The results of ADF test

	At level		At first difference	
Country/ Variable	**ADF Statistic (only constant)**	**ADF Statistic (constant and Trend)**	**ADF Statistic (only constant**	**ADF Statistic (constant and Trend)**
GDP	-1.1173 (3)	-2.9011 (1)	-3.6189 (2)*	-3.5282 (2)**
Saving	-1.3274 (0)	-2.0723 (0)	-7.0443 (0)*	-6.9557 (0)*

(i).The number of optimum lags is in the parentheses according to AIC.
(ii).(*), (**) and (***) significant at 1%, 5% and 10% respectively.

Cointegration Tests

Proven that all variables are I(1), Johansen and Juselius cointegration tests are then used to determine whether these non-stationary variables are cointegrated or not. Table 2 below reveals the results of both trace and maximum Eigen value tests, where these tests are constructed with a one lag as determined by the Akaike Information Criterion (AIC) criteria. The empirical results evidently show that the null hypothesis of no cointegration is accepted, implying that the domestic saving and economic growth do not have a long run relationship between themselves over the relevant time span in the case of Iran.

Table 2: Testing for cointegration using the Johansen and Juselius method

Tests		Iran	Critical value at 95%
H0	**HA**		
Trace			
$r=0$	$r=1$	11.8555	15.4947
$r<=1$	$r=2$	1.7578	3.8414
λ-max			
$r=0$	$r=1$	10.0977	14.2646
$r<=1$	$r=2$	1.7578	3.8414

Toda-Yamamoto Causality Test

One can presume that there is an existence of causal relationship in at least one direction once the cointegration relationship has been established. Causality relationship is then investigated using T-Y approach (1995), as this technique is more appropriate for non-stationary data. The procedure T-Y encompasses of an augmented Vector Auto Regression (VAR) where the following equations (Eq. 1 and Eq. 2) for bivariate case are estimated:

$$GDP_t = \alpha_1 + \sum_{i=1}^{k-d\,max} \alpha_{1i} GDP_{t-i} + \sum_{j=1}^{k-d\,max} \beta_{1j} Saving_{t-j} + \varepsilon_{1t} \qquad (Eq.1)$$

$$Saving_t = \alpha_2 + \sum_{i=1}^{k-d\,max} \alpha_{2i} Saving_{t-i} + \sum_{j=1}^{k-d\,max} \beta_{2j} GDP_{t-j} + \varepsilon_{2t} \qquad (Eq.2)$$

where k is the optimal lag-length of VAR model at level and it is determined through Akaike Information Criterion (AIC). The optimal lag determined for Iran is 4, thus the augmented VAR ($k + d$ max) (VAR 5) model for both Eq. 1 and Eq. 2 are estimated using the Seemingly Unrelated Regressions (SUR) method. Causality between growth and saving is then tested using modified WALD test, where null hypothesis of $\beta_{1j} = 0$ ($Saving_t$ does not cause GDP_t) and null hypothesis of $\beta_{2j} = 0$ (GDP_t does not cause $Saving_t$) are rejected if the p-values are less than the significance level. The results of T-Y causality test are depicted in Table 3 below.

Table 3: Toda-Yamamoto Causality (modified WALD) Test Results

Hypothesis	Chi-sq	p-Value
GDP does not Granger Cause Saving	24.6436*	0.0001
Saving does not Granger Cause GDP	5.20344	0.2671

(*), (**) and (***) significant at 1%, 5% and 10% respectively.

From Table 3, without a doubt, the null of GDP does not Granger cause Saving is rejected at 1%, while the null of saving does not Granger Cause GDP is accepted. The results confirm that there is a presence of unidirectional causality from economic growth to domestic saving and no reverse causality. This implies that causal relationships exist between domestic saving and economic growth for this country and economic growth stimulates domestic saving.

Concluding remarks

In this paper, we attempt to examine the cointegrating and causal relationships between saving and growth for Iran using Johansen cointegration tests and Toda and Yamamoto causality test. The empirical results show that there is no long run equilibrium relationship between saving and economic growth for Iran. Nevertheless, it is found that there is uni-directional causality runs form growth to saving, which is in line with conclusions of many previous empirical studies discussed previously. This indicates that the stability of savings-led growth hypothesis in the long run is not applied for Iran; that lead to the conclusion that this country's economic growths are driven by other factors. The findings also support the Keynesian viewpoint where saving depends on growth, thus this raises two important policy implication. First, the empirical results casts further doubt on the relevance of the domestic saving used as a target variable for economic development. Second, there is a strong need to accelerate the economic growth in order to increase the saving rate, which can be achieved through many means, for examples, establishing macroeconomic stability and achieving a greater financial liberation.

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