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EMPIRICAL ANALYSIS OF THE SAVINGS-GROWTH NEXUS IN TURKEY

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KEYWORDS

Savings, economic growth, Toda-Yamamoto causality test, bootstrapping, Turkey.

ABSTRACT

This paper investigates the causality relationship between savings and economic growth in Turkey from 1961 to 2012 using the bootstrap, process-based, Toda-Yamamoto, linear Granger causality test. According to empirical analyses, a bidirectional causality exists between savings and economic growth in Turkey. Thus we can say that the feedback hypothesis is valid. That is, both the Keynes and the Solow model are relevant for Turkey.

1. INTRODUCTION

The analysis of the causal relation between savings and economic growth is of high importance for the government and related authorities to reach intended macro economic targets. If savings occur before economic growth and result in economic growth, policy makers can apply policies that increase the mobilization of savings to provide a higher level of economic growth. On the other hand, if economic growth occurs before and results in savings, the acceleration of economic growth is necessary to eliminate the obstacles to expansion to increase the level of savings. On certain occasions, there may not be a causal relation between economic growth and the level of savings. This result cannot be obtained especially in countries in which the per capita income level is very low. In these countries, people earn enough income only to survive. The entire income, therefore, is spent to fulfill their basic needs. Governments in these countries should pay attention to social policies and give priority to increasing developmental levels before economic growth.

Economic growth requires physical and human investments. Even though savings in other countries support these kinds of investments, these investments are generally funded by domestic savings. It would be very challenging to realize economic growth without productive investments and their components. Besides, savings are not solely required and sufficient to accelerate economic growth. However, savings are certainly expected to enhance economic growth.

This study investigates whether there is a causal relation between savings and economic growth in Turkey between 1961 and 2010. This study is a causality analysis. Studies in this area in the literature mainly used the standard Granger causality test. The standard Granger causality test is highly responsive to the order of the stationarity of variables. Furthermore, the standard Granger causality test is implemented in different ways depending on whether the variables are co-integrated, and it requires that the variables are stationary. In the Toda-Yamamoto causality test based on bootstrap distribution used in the study developed by Hacker and Hatemi-J (2006), the series are not required to be stationary or co-integrated. This paper is organized as follows: In the following section, a theoretical backgroundis presented**.** The literature review is presented in section 3. In section 4, the econometric methodology is explained. Section 5 presents the data and empirical findings, and, in the last section, the conclusion is presented.

2. THEORETICAL BACKGROUND

Although a causal relation between the rate of savings and economic growth is highly important for policy makers, there are ongoing discussions on the direction of this causal relation. Empirical applications on the relation between savings and economic growth are based on the model by Keynes (1936) and Solow (1956).

According to the Keynes model, savings (S) are the function of growth (Y) and explained by the following model:

$$S = \alpha_0 + \alpha_1 Y + U_1 \qquad (1)$$

where S represents savings, Y economic growth, α_0 constant, α_1 the coefficient that indicates the sensitivity of savings to economic growth, and U_1 error term.

On the other hand, savings are a determinant of economic growth according to the hypothesis by Solow. In this respect, economic growth as a function of savings can be indicated as follows:

$$Y = \beta_0 + \beta_1 S + U_2 \qquad (2)$$

where S represents savings, Y economic growth, α_0 constant, α_1 the coefficient that indicates the sensitivity of economic growth to savings, and U_1 error term (Mistzal, 2011: 19).

The Keynes model emphasizes that output growth is the reason for the growth of savings. According to this model, an increase in the output causes the income level to increase. This increase in income causes the national savings level to increase (Abu, 2010: 94).

In the Solow model, the rate of savings is a key determinant of the stationary state capital stock. In other words, if the rate of savings is high, the economy will have higher levels of capital and output per employee. It is the contrary when the rate of savings is low. Thus, it can be concluded for the Solow model that increases in the rates of savings result in rapid growth. However, this is only valid in the short term. Increases in the saving rates increase the short-term growth rate, and this process lasts until it has reached the new stationary state. Therefore, increases in the saving rates do not affect long-term growth rates. Increases in the saving rates increase the levels of capital per employee and output per employee. This causes the economy to become richer compared to the previous state (Berber, 2006: 157–158).

Increases in the saving rates increase the level of output per employee and the growth rates during transition periods. While the level of output per employee maintains its condition in time, the growth rate decreases and reaches the long-term growth rate again. Increases in savings result in increases in the capital stock per employee and output per employee (Konya, 2005: 232). However, increases in the growth level realized in the short term due to increases in investments are not continuous. Because the diminishing returns on capital are legally applicable, the economic growth rate diminishes in the long term to the labor force increase rate again. Therefore, increases in savings do not affect growth in the long term (Berber, 2006: 157-158).

3. LITERATURE

Saltz (1999) studied the causal relationship between savings and growth rates of real outputs for a group of 18 Latin American and newly industrialized countries from1960 to 1991 using the Granger causality test. He found that higher growth rates of real output cause higher growth rates of savings.

Sinha (1996) investigated a cointegration relationship between savings and growth in India for the period of 1960 to 1995. He found that the variables were cointegrated by using the Johansen and Juselius (1990) cointegration test, but a Granger causality test indicated that savings and economic growth are neutral according to the results of empirical analyses by Sinha (1998).

Tang and Chua (2009) examined the savings-growth nexus in Malaysia with quarterly data from March 1991 to September 2006. They found that the variables were cointegrated by the Bierens (1997) nonparametric cointegration test and a bilateral causality existed between savings and economic growth by the multiple rank F-test.

K´onya (2005) investigated the causality between savings and growth in 84 countries from 1961 to 2000. He used the Granger causality analysis with bootstrapping on panels of countries. He found a two-way Granger causality between the savings ratio and the growth rate in Austria, a one-way causality from growth to savings in Finland, France, Japan, Sweden, Switzerland and Niger, and a one-way causality from savings to growth in Ireland, Trinidad & Tobago, and the Central African Republic; but in all other cases, there was no empirical evidence of Granger causality in either direction.

Al-Foul (2010) examined the causal relation between savings and economic growth for Morocco (1965–2007) and Tunisia (1961–2007) with the cointegration approach by Pesaran et al. (2001). His empirical results showed that no evidence of a long-run relationship existed for Tunisia while a long-run relationship existed between the variables for Morocco. Also, the Granger causality test supports that there is a unidirectional Granger causality from savings growth to economic growth in the case of Tunisia and a bidirectional causality between economic growth and savings growth in Morocco.

Abu (2010) studied the savıngs-economıc growth nexus in Nigeria from 1970 to 2007 using Granger causality and co-integration analyses. He concluded that the variables are co-integrated and a long-run equilibrium existed between them. Furthermore, the Granger causality test revealed that a one-way causality runs from economic growth to savings.

Lean and Song (2009) examined the relationship between the growth of domestic savings and economic growth in China for the period of 1955–2004. They detected a co-integrated relationship between economic growth and household savings, enterprise savings. Also, they found that in the long-run, a unidirectional causality existed running from the domestic savings growth to the economic growth and that bilateral causality existed between domestic savings growth and economic growth in the short-run

Mohan (2006) studied the relationship between domestic savings and economic growth for various economies with different income levels using the Granger causality test. He used time series annual data from 1960 to 2001. His emprical results showed that there was a unidirectional Granger causality from economic growth rate to growth rate of savings in 13 countries, and there is a unidirectional Granger causality from growth rate of savings to economic growth rate in two countries. Also a bi-directional causation was found in five countries.

Anoruo and Ahmad(2001) explored the causal relationship between economic growth and the growth rates of domestic savings for the Congo, Coˆted'Ivoire, Ghana, Kenya, South Africa, and Zambia for the period 1960–1997. They used Johansen and Juselius's (1990) co-integration test and the Granger causality test. They found a long-run relationship between economic growth and the growth rates of domestic savings and that economic growth causes growth rate of domestic savings for most of the countries under consideration.

Ciftcioglu and Begovic (2010) investigated the effects of higher saving rates on economic growth for a sample of Central and Eastern European countries over the period of 1995–2003 by panel data analysis. They concluded that domestic savings rates had exerted a statistically significant effect on growth rates of the GDP over the sample period.

Misztal (2011) studied the cause and effect relationship between economic growth and savings in advanced economies and in emerging and developing countries from 1980 to 2009. His results showed the existence of a one-way causal relationship from gross domestic savings to GDP in the case of developed countries as well as in developing and transition countries.

4. ECONOMETRIC METHODOLOGY

In this study, we will use the Toda-Yamamoto (1995) causality test with a leveraged bootstrap distribution introduced by Hacker and Hatemi-J (2006).

Hacker and Hatemi-J (2006) investigated the size properties of the Toda–Yamamoto modified Wald (MWALD) test. They show that particularly in small samples, the asymptotic distribution of this test is a poor approximation. They demonstrated that, especially when this distribution has the characteristics of the error term autoregressive conditional heteroscedasticity (ARCH) and non-normality, MWALD-test statistics generate biased results that reject the null hypothesis. To improve on the size properties of the modified Wald test, they suggested a leveraged bootstrap distribution that is not sensitive to non-normality and the existence of ARCH.

Toda and Yamamoto's MWALD test is attractive due to the advantage of implementing, regardless of whether the processes are integrated or even cointegrated. Toda and Yamamoto (1995) suggested following an augmented VAR(*p*+*d*) model.

$$y_t = v + A_1 y_{t-1} + \ldots\ldots A_p y_{t-p} + \ldots\ldots A_{p+d} y_{t-(p+d)} + \mu_t \quad (1)$$

Where y_t is the number of variables in the VAR model, v is an vector of intercepts, μ_t is a vector of error terms, r A_p is a matrix of parameters for lag p, which is assumed to be known, and d, which is equal to the integration order of the variables.

The k th element of y_t does not Granger-cause the j th element of y_t if the null hypothesis that is defined following is not rejected.

$H_0:$ the row j, column k element in A_r equals zero for $r = 1,\ldots,p$

The following denotations for a sample size T are suggested to describe the Toda-Yamamoto test statistic in a compact way:

$Y := (y_1,\ldots,y_T)$ $\quad (n \times T)$ matrix,

$\hat{D} := \left(\hat{v}, \hat{A}_1, ..., \hat{A}_p, ..., \hat{A}_{p+d}\right) \qquad \left(n \times \left(1 + n\left(p + d\right)\right)\right)$ matrix,

$$Z_t := \begin{bmatrix} 1 \\ y_t \\ y_{t-1} \\ \vdots \\ y_{t-p-d+1} \end{bmatrix} \qquad \left(\left(1 + n\left(p + d\right)\right) \times 1\right)$$

matrix for $t = 1, ..., T$

$Z := \left(Z_0, ..., Z_{T-1}\right) \qquad \left(\left(1 + n\left(p + d\right)\right) \times T\right)$ matrix

and

$\hat{\delta} := \left(\hat{\varepsilon}_1, ..., \hat{\varepsilon}_T\right) \qquad \left(n \times T\right)$ matrix

Thus, the augmented $VAR(p+d)$ model is in a simple form as follows:

$Y = \hat{D}Z + \hat{\delta}$ (2)

Toda and Yamamoto (1995) suggested the MWALD test statistic for testing non-Granger causality as follows:

$MWALD = \left(C\hat{\beta}\right)' \left[C\left(\left(Z'Z\right)^{-1} \otimes S_U\right)C'\right]^{-1} \left(C\hat{\beta}\right)$ (3)

where S_U is the variance-covariance matrix of residuals from the unrestricted regression(3), $\hat{\beta} = vec\left(\hat{D}\right)$ [vec denotes the column-stacking operator], $\otimes$ is the Kronecker product, and C is a $p \times n\left(1 + n\left(p + d\right)\right)$ indicator matrix. Using these notations, the null hypothesis of the no-Granger causality is defined as the following.

$H_0 : C\beta = 0$

The MWALD test statistic is asymptotic χ^2 distributed with the number of degrees of freedom equal to *p*, which is the number of restrictions to be tested.

The bootstrap simulation procedure is conducted following the procedure that was introduced by Hacker and Hatemi-J (2006). We first estimated regression (4) through OLS with the null hypothesis of no-Granger causality imposed. For each bootstrap simulation, we created the simulated data, $y_t^*,\ t = 1, ..., T$ based on the coefficient estimates from this regression $\widetilde{A}_1, ..., \widetilde{A}_p$, the original $y_{t-1}, ..., y_{t-p}$ data, and $\widetilde{\mu}_t^*$ as the bootstrapped residuals. The bootstrap residuals are based on T random draws with replacement from the regression's modified residuals, each with an equal probability of $1/T$.

We are generated the empirical distribution for the MWALD based on conducting the bootstrap simulation 10,000 times and calculating the MWALD-test statistics for each time. Then we calculated the MWALD statistic using the original data. If the MWALD-test statistic was higher than bootstrap critical values, then the null hypothesis of non-Granger causality would be rejected; otherwise, we did not reject the null hypothesis.

5. DATA AND EMPIRICAL RESULTS

We investigated the savings and economic growth causality relationship in Turkey over the years 1961–2012. We used the proportion of gross domestic savings in the GDP (hereafter GDS) and the annual percentage change of real per capita GDP (the growth). These data were extracted from the World Development Indicator (WDI).

To examine the savings-growth reletionship for Turkey, we used the Hacker and Hatemi-J (2006) bootstrap, process-based, Toda-Yamamoto (1995), linear Granger causality. Toda-Yamamoto-test statistics for Granger causality are used when the data generate process is characterized for both variables by integration of the same order (degree zero, one, or two) or when it is characterized by different integration orders for the two variables.

First, we studied the integration order or the variables with the Phillips-Perron unit root test. The results are presented in Table 1.

Table 1: Phillips-Perron Unit Root Test

Variables	$H_0 : I(1)$		$H_0 : I(2)$	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
GDS	0.2501	0.6027	0.0000	0.0000
GDP	0.0000	0.0000		

Notes: p-values are presented.

As indicated in Table 1, GDS is I(1) and GDP is I(0). The results of the Toda-Yamamoto (1995) linear Granger causality based on the Hacker and Hatemi-J (2006) bootstrap process is given in Table 2.

Table 2: Toda- Yamamoto (1995) Linear Granger Causality Based on Hacker and Hatemi-J's (2006) Bootstrap Process

Null Hypothesis	*Estimated test Value*	*1% bootstrap critical value*	*5% bootstrap critical value*	*10% bootstrap critical value*
GDS $\nRightarrow$ GDP	4.361*	9.896	4.185	2.785
GDP $\nRightarrow$ GDS	2.943**	7.213	3.474	2.803

The null hypothesis (A$\nRightarrow$B) implies that A does not Granger-cause B. "*" and "**" are significant respectively at the 5% and 10%. We obtained bootstrap critical values from 10,000 replications.

We discovered that bidirectional causality exists between savings and growth for Turkey according to the results in Table 2.

According to these results, the feedback hypothesis is valid in Turkey. Theoretically, it is understood that both the Keynes and the Solow models are applicable for Turkey. Turkey is a developing country. Although the current deficit and the investment-savings deficit are generally met by foreign savings in developing countries, the domestic savings rate can be used to find the current deficit and investment-savings deficit, which can affect economic growth. However, uncertainty in developing countries encourages people and investors to act with caution. Therefore, people and investors prefer to make savings rather than making investments and consumption in an uncertain environment. Accordingly, while savings affect economic growth in developing countries, people rather tend to favor savings because they frequently encounter the atmosphere of uncertainty. Instability in economic growth causes uncertainty. This uncertainty results in increases in savings. Turkey's position as a developing country plays a significant role in the interaction between savings and economic growth.

6. CONCLUSION

According to these results, savings in Turkey both get affected by economic growth and have an effect on it. Thus, policy makers, especially in developing countries, are required to implement policies to increase savings. In developing countries, although foreign savings are generally preferred for funding macroeconomic actions such as balance of payments disequilibrium and sustainable growth, the source of financing obtained in this manner poses a great risk. There are many factors that affect the direction of savings of foreign countries to any country, such factors include interest, exchange rate, profitability, and other factors highly important in attracting this source of financing. Foreign investment inflow is available in a country as long as interest, exchange rates and profitability rates are suitable. On the contrary, foreign capital tends towards other countries. Therefore, foreign capital can immediately enter and leave a country. For this reason, we should be encouraged to increase domestic savings and to turn them into investment. Accordingly, stability should be ensured in economic and political arenas. Policy makers should create an environment of trust in this respect.

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