



Savings Rates in Turkey: The Prospects for a Sustainable Growth

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ABSTRACT

The main objective of this study is to reveal the development process of Turkey's savings rates and investigate the causal relationship between domestic savings and sustainable economic growth by employing Hatemi (2012) asymmetric causality test under the time series analysis for the period of 1980-2016. Results of the study indicate that the problem of the inadequate level of domestic savings has not been solved yet in Turkey. It is seen that domestic savings in Turkey have remarkably declined mainly from the 1990s and remain considerably low level at 14% over the past few years. It is also seen that Turkey's domestic savings remain considerably below that of the world average and most of the different income group countries. Besides, Hatemi (2012) asymmetric causality test results indicate that there is an existence of causality running from positive shocks on real gross domestic product (RGDP) to positive shocks on gross domestic savings (GDS) at 1% significance level while positive shocks on GDS cause positive shocks on RGDP at 5% significance level. This study, however, could not find evidence of any causal relationship between negative shocks on GDS (RGDP) and negative shocks on RGDP (GDS) at an appropriate significance level.

Keywords: Sustainable Growth, Domestic Savings, Hatemi-J Asymmetric Causality Test

JEL Classifications: C22, E21, O40

1. INTRODUCTION

The concept of savings can be defined simply as a portion of income not spent for consumption expenditures, and economic growth is mostly described as real increases in the production capacity within 1 year. The fundamental role of savings is to finance investments which are the most important driving force of economic growth. That is today's savings increase the new capital building capacity of a country to produce goods and services in the future; thereby one can claim that savings can feature in long-run economic growth.

From this aspect, most of the developing countries, as well as Turkey experiencing macroeconomic instability, attach importance to long-run or sustainable economic growth rather than rapid growth because sustainable economic growth is useful for whole parts of the economy by encouraging full employment, human development, and the nature at the same time Yıldırım (1997). The necessity of sustainable economic growth applies to Turkey substantially because of Turkish economy is more fluctuating and vulnerable to external shocks, even if the economy is growing more than most of the developed countries. One of the main

reasons behind this fact can be considered as lack of adequate domestic savings in the country. The resultant saving-investment gap is usually tried to be offset by foreign savings and, therefore, current account deficit is widening in Turkey. Furthermore, foreign savings can quickly leave the country in the course of adverse economic shocks and this situation results with that the fluctuations can be more secular in Turkey.

Since the importance of domestic savings on sustainable economic growth, Turkish authorities have intended to increase domestic savings from the first 5-year development plan to present day. However, the actual domestic savings rates have stayed mostly under its planned levels in Turkey. The stated reasons for low level of domestic savings by authorities in the development plans are the low level of income, and the saving creator entrepreneur groups have not reached the sufficient power and extensity. Unfortunately, this chronic problem has not been solved, and domestic savings remarkably declined mainly from the 1990s and remain considerably low level at 14% on average within the period 2010-2015. Therefore, the unending saving-investment gap and hence current account deficit have become unavoidable problems in the country for a long time.

Moreover, by comparing with the world and different income groups, Turkey's savings rates have remained below remarkably that of World average for the periods from 1991 to 2015. The same result is valid for comparison of Turkey's savings rates with that of lower middle countries (LMC), upper middle countries (UMC) and high-income countries (HIC). The opposite result is seen only in the comparison of Turkey's savings rates with low-income countries (LIC).

The subject of the relationship between savings and economic growth has been discussed for a long time. Classics have attached importance to savings concerning explanation of economic growth. They argued that an increase in profits would rise to capital accumulation and hence economic growth through an increase in savings and investments. The theoretical studies known as Harrod-Domar growth model (Domar, 1946; Harrod, 1939) and Solow (neoclassical) growth model (Solow, 1956) are apparently attracting importance to savings on economic growth. The Harrod-Domar growth model indicates that economic growth is based on saving and capital-output ratio whereas the Solow model implies that increase in savings rates positively affects output per worker but the effect of savings on economic growth would be temporary. The endogenous growth theory that attracted attention after the 1980s emphasized that the increase in savings rate would help to realize the economic growth through the capital accumulation and investment (Singh, 2010). Further, Romer model which is an alternative view of long-run prospects for economic growth mentioned that saving rates can affect the economic growth in the long-term since the rates of return on capital and investment can increase with increases in the capital stock (Romer, 1986).

In general, while exogenous growth theory implies that saving has a temporary effect on economic growth, the endogenous growth theory claims that the saving is having a permanent impact not only on the level of per capita income but also on the rate of economic growth (Buiter, 1991).

The subject was also handled in the theoretical framework by Ramsey (1928). He aimed to find mathematically how much a nation should save and suggested that today's saving can contribute to more future consumption. Keynesian view, however, implies that saving does not cause the economic growth since the amounts of saving and investment are the result of the common behaviors of individual consumers and entrepreneurs, these amounts are the exceeding part of the income from consumption and equal to each other as an accounting equation (Keynes, 1936). However, it must be taken into account that productivity growth may not be independent of capital accumulation when technical progress comes into existence on new capital equipment (Snowdon and Wane, 2005).

In this context, it can be argued that the concept of the relationship between savings and economic growth remains an unsolved problem in economic theory. Many studies on this subject have mostly used Granger, Toda-Yamamoto and VECM-based causality approach to investigate the causal relation between savings and growth. In this study, asymmetric causality approach, which differentiates this study from others, developed by Hatemi (2012) will be used for the same purpose.

2. DEVELOPMENT PROCESS OF SAVINGS RATES IN TURKEY

Inadequate domestic savings and unsteady economic growth problems were addressed in all development plans, but these issues have not yet been solved for a long time in Turkey. The country still has one of the lowest levels of domestic savings among the most of the developing and some of the developed countries.

When examined the development process of savings rates from the historical perspective of Turkey, domestic savings rates increased to 12.8% of gross domestic product (GDP) from 8.4% in 1960-1970 within the framework of first and second 5-year development plans (Republic of Turkey Ministry of Development, 2017). In the second half of the 1970s, the Turkish economy had strong difficulty due to external payment difficulties and high price increases. From 1975 to 1979 the domestic savings rates stayed roughly comparable at 12%.

However, after a sharp increase between 1980 and 1988 due to high inflation and policy-making uncertainties, domestic savings dramatically declined from 1988 to 2015. From 1988 to 2001, the main reason behind the decline in the domestic savings can be considered as excessive fall in public savings as it is shown in Figure 1. Also, by contrast, the reason behind the decline in the domestic savings seems that the reduction in private saving rates because of increased consumption, reduced inflation and interest rates over the period between 2001 and 2010 (World Bank, 2011).

According to International Monetary Fund's (IMF's) country report (2016), after the 1999-2001 economic crises, Turkey continued a prospering policy of macroeconomic stabilization, thereby, public debt reduced to 33% from 90% of GDP in 2015 and inflation reduced to single digits from about 70%. The economy grew fast and the growth rate measured as nearly 5% on average during the period 2001 and 2015. Besides, domestic savings rates remained about 14% while the country grew about at 6% among the period from 2010 to 2013. That strong growth was driven mostly by an increase in domestic demand or by policy supportive of domestic consumption. However, the country experienced high inflation and massive current account deficit among the period in question (IMF, 2014). The savings rates in Turkey remained considerably low level at 14% on average per year in the period 2010-2015; therefore, the saving-investment gap is tired to be compensated with capital inflows. Although the Turkish economy attracts the considerable level of foreign capital in the post period due to applied successful stabilization policies and attractive returns, it is clear that this growth strategy is not sustainable.

Figure 1 shows that domestic savings rates sharply increased to 26.2% of GDP in 1988 from 12.1% in 1984. However, it dropped to 13.8% in 2009 and had stayed below 16% since 2008. Also, domestic savings move in the same direction with private sector savings; therefore, it can be argued that total domestic savings have mostly been determined by private sector savings in Turkey.

Another point of interest is that domestic savings rates in Turkey are mostly staying below the investment rates. Figure 2 covering

the period between 1968 and 2015 indicates that the domestic savings rates usually remain under the investment rates in Turkey except for 2001 and 2003.

Özlele and Karakurt (2012) mentioned that the saving-investment gap has not resulted in the higher level of investments but resulted in the lower level of private savings. This condition sorts out the formation of Turkey's never-ended current account deficit (Inal, 2013). Namely, since the national savings remains incapable of providing economic growth, increasing usage of foreign savings caused current account deficit in Turkey for a long time Karanfil (2014).

As it is shown in Figure 3, saving-investment gap and current account deficit lines move in a similar direction. One can assert that there is an existence of a strong relationship between the saving-investment gap and current account deficit in Turkey.

In addition, it is important to mention that Turkey's domestic savings have diminished in comparison with that of selected developing countries.

Table 1 indicates that during the period between 1996 and 2000, the average of gross domestic savings (GDS) in Turkey remained at 19.58% reduced about 2 points on average during the period 2001-2005. Also, during the periods between 2006-2010 and

2011-2015, the average of domestic savings in Turkey decreased modestly and respectively remained at 15.64 and 14.99% of GDP. This comparison indicates that Turkey's domestic savings were better off with that of Argentina and Brazil during the period 1996-2000, however, remained below that all of the selected countries over the period from 2001 to 2005.

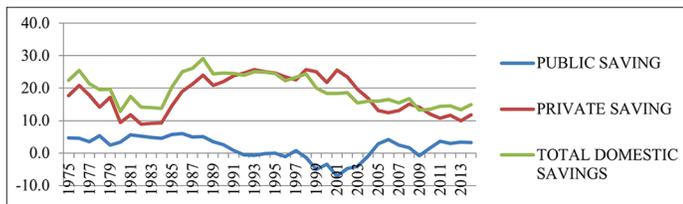
Besides, during the period between 2006 and 2010, Turkey's savings rates reduced to 17.65% from 19.58% while savings rates in Brazil and Argentina increased substantially. Although domestic savings in most of the selected countries decreased over the period between 2011 and 2015, Turkey's savings rates have collapsed more and more over that time of period and remain far below that of all of the selected countries.

The comparison among Turkey and different income groups indicated in Figure 4 show that Turkey's savings rates remained far below that of, upper-middle-income countries (UMC) and modestly below that of lower-middle-income countries (LMC), HIC and the world. Whereas savings rates in LMC, UMC, and LIC increased, Turkey's savings rates decreased over the period between 1991 and 2015. This condition indicates that lack of adequate level of domestic savings is the underlying reason for Turkey's unsustainable economic growth.

Furthermore, as it is shown in Figure 5, GDP growth rates in Turkey are more fluctuating than UMC, LMC, HIC, and LIC groups' and world's growth rates during the period between 1990 and 2016. This situation reflects the fact that countries with high savings rates can achieve more sustainable economic growth.

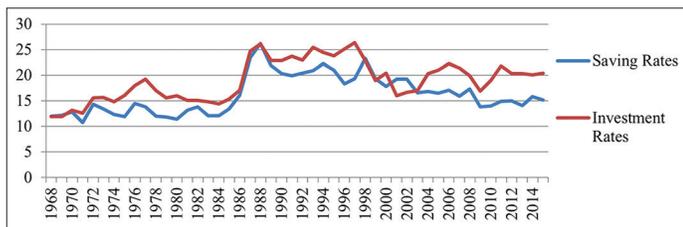
Determining the reasons for the decline in domestic savings in Turkey is another critical question to be resolved. As it was shown before in Figure 2, Turkey's total domestic savings move in the

Figure 1: Total, private and public savings in Turkey



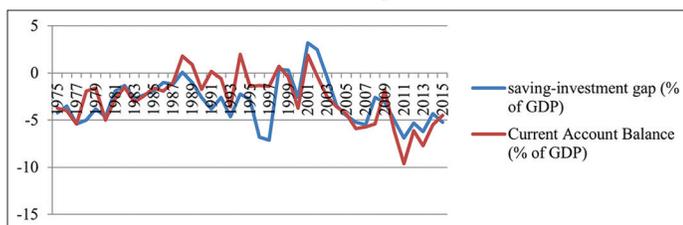
Source: Republic of Turkey Ministry of Development (2017)

Figure 2: Savings and investments (% of gross domestic product)



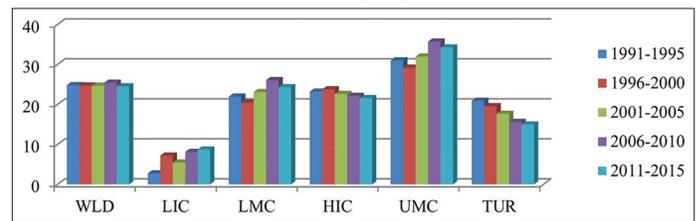
Source: World Bank (2017)

Figure 3: Saving-investment gap and current account balance (% of gross domestic product)



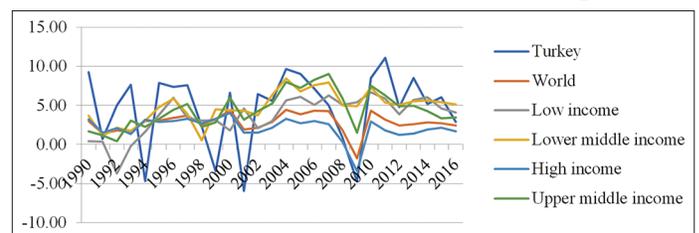
Source: World Bank (2017) (the gap is calculated by self- authorship)

Figure 4: Comparison of Turkey's savings rates with that of different income groups



Source: World Bank (2017). (Averages are calculated by self- authorship)

Figure 5: Comparison of Turkey's gross domestic product growth rates with that of world and different income groups



Source: World Bank (2017)

Table 1: GDS rates in the selected countries

Countries	1996-2000	2001-2015	2006-2010	2011-2015
	GDS (% of GDP)	GDS (% of GDP)	GDS (% of GDP)	GDS (% of GDP)
Argentina	16.77	23.63	23.31	18.75
Brazil	15.64	19.17	20.46	19.02
Chile	24.31	25.59	30.32	24.21
China	39.35	43.27	50.53	49.71
Indonesia	28.06	29.88	31.44	34.35
R .Of. Korea	33.57	34.02	33.71	34.46
Malaysia	45.79	42.82	41.80	35.36
Russia	28.86	32.92	31.70	28.89
Turkey	19.58	17.65	15.64	14.99
India	22.85	27.28	35.06	31.44

Source: World Bank (2017) (Average rates of domestic savings are calculated by self-authorship). GDS: Gross domestic savings, GDP: Gross domestic product

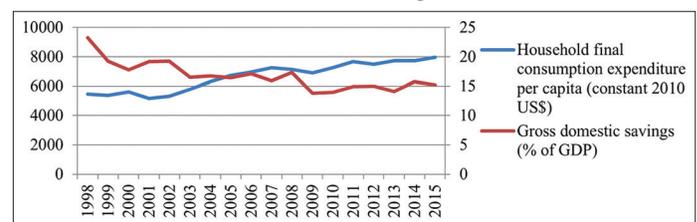
same direction with private savings. This condition implies that the primary determinant of total domestic savings is the private savings in Turkey and it can be argued that the reasons for decline domestic savings include mostly the reasons for the decline in private savings such as rapid increase in private consumption expenditures in Turkey. According to Organization for Economic Co-operation and Development (OECD, 2016) report, although Turkey has a strong growth pattern over the past 15 years, this rapid growth helped capital flows to Turkey; however, it leads to increase private consumption expenditures which caused to decrease in domestic savings in the country.

According to World Bank data (2017), household final consumption expenditures increased from 66.5% of GDP in 1998 to 69.1% in 2015. Figure 6 confirming the suggestions of Karagöl and Özcan (2014) shows that Turkey has ever-growing consumption expenditures and digressive domestic savings over the time. One of the reasons for the sharp increase in consumption expenditure is the increase in credit card usage (Karagöl and Özcan, 2014). According to Interbank Card Center data, domestic transactions with domestic and international cards increased over the time (Interbank Card Center [BKM], 2017).

Moreover, the reasons behind the decline in private saving rates in Turkey expressed by World Bank report (2011), are the increase in income, the decrease in real interest rates, the young age dependency ratio, the substantial decline in the inflation rate, the steady precautionary motive for saving, and the low level of female labor force.

3. EMPIRICAL STUDIES ON THE RELATIONSHIP BETWEEN SAVINGS AND ECONOMIC GROWTH

The phenomenon of economic growth is one of the most important social and economic issues for both developed and developing countries in every period. Therefore, factors or causes of economic growth are undoubtedly one of the most interesting issues in economic literature. Since the saving is the main source of financing investments, economic literature has consequently become the scene of many debates over the relationship between economic growth and savings. When the conducted literature

Figure 6: Household final consumption expenditures and gross domestic savings

Source: World Bank (2017)

survey is evaluated, most of the studies imply that the relationship between savings and economic growth has a positive direction. However, the long-lasting debate about the direction of causality between these variables could not be concluded with a typical result. Many studies, in this context, hold the idea that there is unilateral causality running from savings to economic growth while others claimed that there is bilateral causality or no causal relationship among them. Additionally, studies conducted in Turkey have found varied results. Namely, the causal relationship between savings and economic growth vary from study to study because they were applied to different countries, periods and econometric techniques.

In this section, we will reveal empirical studies about the causal relation between savings and economic growth by using tables divided into two parts to illustrate national and international studies separately (Tables 2-4).

4. DATA AND METHODOLOGY

In this study, we used annual data obtained from World Development Indicators for Turkey from 1980 to 2016. The time series data covers the GDS and real GDP (RGDP). The dataset of each macroeconomic variables, descriptions, and sources are illustrated in Table 5.

To research for whether there is a causal relationship between domestic savings and economic growth we firstly conduct a model as follows.

$$\text{Model: } \ln \text{RGDP}_t = \beta_0 + \beta_1 \ln \text{GDS}_t + u_t$$

Here t indicates time; β_0 indicates constant term; β_1 indicates the coefficient of the independent variable, and u shows the error term.

Since the time series can be affected by trend and the stochastic feature of variables, the first stage of this section covers the Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) unit root testing procedures to determine whether the variables are stationary or not. The conditions of the stationary stochastic process are defined by Gujarati and Porter (2009) as follows.

$$E(Y_t) = \mu \text{ (Condition of constant mean).}$$

$$\text{Var}(Y_t) = E(Y_t - \mu) = \sigma^2 \text{ (Condition of constant variance).}$$

$$Y_t = [(Y_t - \mu)(Y_{t+k} - \mu)] \text{ (Condition of dependence of covariance on two time periods).}$$

Here k represents the lag level.

Whether these conditions are satisfied or not is mostly tested by using ADF and PP tests. Since these two approaches are similar in many cases, we reveal only ADF test which can be illustrated by an equation as follows.

$$\Delta y_t = \alpha + \delta y_{t-1} + \sum_{i=1}^k \gamma_i \Delta y_{t-i} + \varepsilon_t \tag{4.1}$$

The null and alternative hypothesis for both ADF and PP tests can be conducted as:

$$H_0: \delta = 0$$

$$H_1: \delta < 0$$

The null hypothesis (H_0) indicates the presence of a unit root and the alternative hypothesis (H_1) indicates the stationary of the series.

Table 2: Domestic transactions with domestic and international cards

Years	Volume of transaction (million TL)		
	Purchase	Cash	Total
2012	23.765,08	2.386,12	26.151,19
2013	29.466,66	3.110,30	32.576,96
2014	34.572,83	3.596,79	38.169,62
2015	37.091,93	4.439,60	41.531,53
2016	40.536,65	5.053,12	45.589,77

Source: Interbank Card Center [BKM] (2017)

Table 3: National studies on the causal relation between savings and growth

Author	Sample	Methodology	Result
Özcan et al. (2003)	Turkey (1964-1998)	OLS	G→S
Ekinci and Gül (2007)	Turkey (1960-2004)	Granger causality	G→S
Gülmez and Yardımcıoğlu (2013)	BRICS and Turkey (1994-2011)	VECM and FMOLS	S→G (LR), S↔G (SR)
Genç et al. (2014)	Turkey (1975-2012)	Bound testing	S→G
Çetinkaya and Türk (2014)	Turkey (1975-2012)	Co-integration and VECM	S→G (SR)
Bariş and Uzay (2015)	Turkey (1960-2012)	Toda-Yamamoto	No Causality
Ganioglu and Yalçın (2015)	East Asian Countries (1993-2010)	Panel data analysis	S→G
Kaya and Efe (2015)	Twenty Largest Countries (1980-2012)	Panel data analysis	S→G
Sümer (2016)	Turkey (1980-2013)	Toda-Yamamoto	G→S
Kaygısız et al. (2016)	Turkey (1980-2014)	Toda-Yamamoto	No Causality
Yalçinkaya and Kaya (2017)	Turkey (1985-2014)	VECM	S→G

When the calculated statistics of ADF or PP for the variable exceed the critical value at the conventional significance level (5%), the null hypothesis can be rejected.

When time series have the same order of integration and a stationary linear combination of these time series exist, it is admitted that these time series are co-integrated, even if these time series are non-stationary themselves (Engle and Granger, 1987). The existence of co-integration between the variables can be tested by using VAR approach developed by Johansen and Juselius (1990). In this way, it can be determined how much long-term equilibrium relations exist between the variables with the same degree of integration. The relationship between the rank of a matrix and its characteristic roots or eigenvalues is determined by this method (Gilmore and McManus, 2002). Supposing that X_t is a vector of variables which is integrated of order one of dimension $px1$. VAR order k can be represented by an equation as:

$$X_t = \mu + \Pi_1 X_{t-1} + \dots + \Pi_k X_{t-k} + \varepsilon_t \tag{4.2}$$

Here $\Pi_1 \dots \Pi_k$ indicates (pxp) lag coefficient matrixes, ε_t indicates a $(px1)$ dimensional error term with zero mean and non-singular variance-covariance matrix, and μ indicates a vector of constants. The equation 4.2 can be written for error correction term since X_t is non-stationary.

$$\Delta X_t = \mu + \Gamma_1 \Delta X_{t-1} + \dots + \Gamma_k \Delta X_{t-k} + \Pi X_{t-k} + \varepsilon_t \tag{4.3}$$

$$\text{Here } \Gamma_i = -1 + \Pi_1 + \dots + \Pi_i (i=1, \dots, k-1, \Pi = -(1 - \Pi_1 - \dots - \Pi_k)).$$

Information about the long-run relationships among the variables in data vector is included in the coefficient matrix Π (Love and Chandra, 2005). Also, if a variable integrated order one $I(1)$ and another variable integrated order zero $I(0)$, the relationship between these variables is not possible.

There are three cases to determine if there is a presence of co-integration between X variables through the rank of Π matrix (r):

In case of the rank of $\Pi = p$, all series are stationary at their level, or they have not unit root. In case of the rank of $\Pi = 0$, unrestricted VAR model can be used to estimate the short-term relations since none of the linear combinations of series are stationary. In case of the rank of $\Pi = r$ and $0 < r < p$, there are r co-integrating vectors or r stationary linear combinations. The co-integrating rank matrix Π

Table 4: International studies on the causal relation between savings and growth

Author	Sample	Methodology	Result
Carroll and Weil (1994)	64 Countries (1958-1987)	Granger Causality	G→S
Cardenas and Escobar (1998)	Colombia (1925-1994)	ECM and Granger Causality	S→G
Sinha and Sinha (1998)	Mexico (1960-1996)	Granger Causality	G→S
Andersson (1999)	US (1950-1997)	Granger Causality	No causality (LR), S↔G (SR)
	UK (1952-1996)	Granger Causality	S↔G (LR), S→G (SR)
	SWEDEN (1950-1996)	Granger Causality	S↔G (LR), No causality (SR)
Saltz (1999)	Seventeen Third World Countries (1960-1991)	Granger Causality	G→S (Mostly)
Agrawal (2001)	Seven Asian Countries (1960-1994)	Granger Causality, VECM, and VAR	G→S (Mostly)
Kriekhaus (2002)	32 Countries (1960-1980)	Panel Data Analysis	S→G
Alguacil et al. (2003)	Spain (1970-1999)	Granger Causality	S→G
Alguacil et al. (2004)	Mexico (1970-2000)	Granger Causality	S↔G
Irandoost and Ericson (2005)	Five American Countries (1965-2000)	Panel Data Analysis	S→G
Katircioglu and Naraliyeva (2006)	Kazakhstan (1993-2002)	Granger Causality	S→G
Mohan (2006)	Different Income Countries (1960-2001)	Granger Causality	G→S (Mostly)
Verma (2007)	India (1950-2003)	ARDL	No causality
Sajid and Sarfraz (2008)	Pakistan (1973-2003)	VECM	S→G
Lean and Song (2009)	China (1955-2004)	Granger Causality	S→G (LR), S↔G (SR)
Odhiambo (2009)	South Africa (1950-2005)	Granger Causality	G→S
Chaturvedi et al. (2009)	Asia (1989-2003)	Two-stage (LS) and Panel Data Analysis	S↔G
Tang and Chua (2009)	Malaysia (1991-2006)	Nonparametric Causality	S↔G
Agrawal and Sahoo (2009)	Bangladesh (1975-2004)	ARDL, FVDL and Granger Causality	S↔G
Abu (2010)	Nigeria (1970-2007)	Granger Causality	G→S
Oladipo (2010)	Nigeria (1970-2006)	Granger Causality	S→G
Mphuka (2010)	Zambia (1960-2000)	Granger Causality	G→S
Jangili (2011)	India (1950-2007)	Granger Causality	S→G (Indirect)
Misztal (2011)	Advanced, Emerging and Developing Countries (1980-2010)	Granger Causality	S→G
Tang and Chua (2012)	Malaysia (1970-2010)	Toda-Yamamoto	S↔G
Tang and Ch'ng (2012)	ASEAN Economies (1970-2010)	Co-integration and MWALD Causality	S↔G
Alomar (2013)	Arab Gulf Cooperation Council (1980-2010)	Granger Causality	G→S (Mostly)
Sothan (2014)	Cambodia (1989-2012)	Granger Causality	No Causality
Sekantsi and Kalebe (2015)	Lesotho (1970-2012)	ARDL and VECM	S→G (LR), G→S (SR)

can be decomposed into matrices α and β so that $\Pi = \alpha \beta'$. Here α includes the speed of adjustments and β indicates the coefficients of co-integration relations. In this case, X_t is stationary at first difference $I(1)$, but the combination $\beta'X_{t-1}$ is stationary at the level $I(0)$.

In Johansen procedure, there are two likelihood (LR) tests, which are trace and maximum Eigen value tests, to detect whether there is a presence of co-integration vectors (Ozer and Yeldan, 2016). The LR statistics for both tests are shown in the following equations.

$$\lambda_{trace} = -T \sum_{i=r+1}^p T \ln(1 - \hat{\lambda}_i) \quad (4.4)$$

$$\lambda_{max} = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (4.5)$$

Here $\hat{\lambda}_i$ is the value of eigenvalues obtained from the estimated Π matrix and T represents the number of convenient observations after lag adjustments, and r indicates the number of cointegration vectors. Also, the Eigen maximum test is conducted for the null

Table 5: Macroeconomic variables

Variable	Description	Source
LNRGDP	RGDP (\$, 2010)	World development indicator
LNGDS	GDS (\$)	World development indicator

LN represents the natural logarithm. RGDP: Real gross domestic product, GDS: Gross domestic savings

of r co-integrating vectors against the alternative of $r+1$. Both test statistics are distributed asymptotically as χ^2 with $p-r$ degrees of freedom (Ozer and Yeldan, 2016. p. 469).

Before examining whether there is a presence of co-integration between the variables or not, it is necessary to determine optimal lag length for each of the variables in war approach by using Akaike information criterion, Schwartz information criterion (SIC), Hannan-Quinn information criterion (HQ), and final prediction error (FPE).

After detecting co-integration between series, it is necessary to know which methodology should be used for estimation of the

coefficients of co-integration equation. In this study, we will use dynamic ordinary least square (DOLS) and fully modified ordinary least square (FMOLS) methodologies which allow the coefficients in the co-integration equation to be estimated as unbiased and consistent in line with the expectations. In this way, it is stated that FMOLS method can correct deviations stemming from autocorrelation and heteroscedasticity when DOLS method can remedy deviations particularly stemming from endogeneity by adding dynamic patterns into the model (Kök et al., 2010).

There are lots of common causality testing methodologies in literature. They, however, make any distinction between positive or negative shocks even if there are many cases potentially include asymmetric structure which regards the causal impacts (Hatemi, 2012). Hatemi (2012) revealed the following equations to illustrate how the asymmetric causality model runs by assuming two integrated series as:

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^t \varepsilon_{1i} \tag{4.6}$$

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^t \varepsilon_{2i} \tag{4.7}$$

Given $t=1,2,\dots,N$, $y_{1,0}$ and $y_{2,0}$ indicate the initial values of the constants. ε_{1t} and ε_{2t} show the white noise disturbance terms. When the negative and positive shocks are written as $\varepsilon_{1i}^- = \min(\varepsilon_{1i}, 0)$, $\varepsilon_{1i}^+ = \max(\varepsilon_{1i}, 0)$ and $\varepsilon_{2i}^- = \min(\varepsilon_{2i}, 0)$, $\varepsilon_{2i}^+ = \max(\varepsilon_{2i}, 0)$. It can be rewritten as $\varepsilon_{1i} = \varepsilon_{1i}^- + \varepsilon_{1i}^+$, $\varepsilon_{2i} = \varepsilon_{2i}^- + \varepsilon_{2i}^+$

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^t \varepsilon_{1i}^+ + \sum_{i=1}^t \varepsilon_{1i}^- \tag{4.8}$$

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^t \varepsilon_{2i}^+ + \sum_{i=1}^t \varepsilon_{2i}^- \tag{4.9}$$

When the negative and positive shocks are written in a cumulative form as follows:

$$y_{1t}^+ = \sum_{i=1}^t \varepsilon_{1i}^+, y_{1t}^- = \sum_{i=1}^t \varepsilon_{1i}^-, y_{2t}^+ = \sum_{i=1}^t \varepsilon_{2i}^+, y_{2t}^- = \sum_{i=1}^t \varepsilon_{2i}^- \tag{4.10}$$

By assuming that $y_t^+ = (y_{1t}^+, y_{2t}^+)$, causality test can be applied through employing VAR model of order p (VAR(p)) as follows:

$$y_t^+ = v + A_1 y_{t-1}^+ + \dots + A_p y_{t-p}^+ + u_t^+ \tag{4.11}$$

Here only the positive cumulative shocks are considered for testing the causal relationship. y_t^+ is a 2×1 vector of the variables, v and u_t^+ are the 2×1 vector intercepts and error terms, and A_p is the 2×2 matrix of parameters for lag order p which is selected as optimal lag through the information criteria. To test the null hypothesis referring that there is no Granger-Causality among the

variables, the VAR model indicated in equation 4.11 can be rewritten compactly as:

$$Y = DZ + \delta \tag{4.12}$$

Here Y is a $n \times T$ matrix, D is a $n \times (1+np)$ matrix, Z is a $T \times (1+np)$ matrix, and δ is a $n \times T$ matrix. The open forms of Y, D, Z and δ can be written as:

$$Y := (y_1^+, \dots, y_T^+), D := (v, A_1, \dots, A_p),$$

$$Z := (Z_0, \dots, Z_{T-1}), \delta := (u_1^+, \dots, u_T^+)$$

Also, Z_t is a $1 \times (1+np)$ matrix ($t=1, \dots, T$).

$$Z_t := \begin{bmatrix} 1 \\ y_t^+ \\ y_{t-1}^+ \\ \cdot \\ \cdot \\ \cdot \\ y_{t-p+1}^+ \end{bmatrix}$$

The null hypothesis ($H_0: C\beta=0$) referring that there is no Granger causality can be tested by Wald statistics as follows.

$$Wald = (C\beta)' \left[C((Z'Z)^{-1} \otimes S_U)C' \right]^{-1} (C\beta) \tag{4.13}$$

$$S_U = \frac{\hat{\delta}_U' \hat{\delta}_U}{T - q}$$

Here \otimes is the Kronecker product, C is the $p \times n(1+np)$ indicator matrix for restricted parameters, and $\beta = \text{vec}(D)$ which is the column-stacking operator. In addition, $S_U = \frac{\hat{\delta}_U' \hat{\delta}_U}{T - q}$ is the variance covariance matrix of unrestricted VAR model, where q is the number of parameters for each equation.

$$Y^* = \hat{D}Z + \delta^*$$

By employing estimated coefficients from the regression equation 4.12, the regression can be generated as $Y^* = \hat{D}Z + \delta^*$ in order to remedy for non-normal distribution and the presence of heteroscedasticity problem. Here Y^* is bootstrap data, δ^* is bootstrapped residuals produced through T random draws, and the bootstrap simulations are reproduced 10.000 times with estimation of Wald test in each time. Through taking (α) th upper quantile of the distribution of the bootstrapped Wald test α -level of significance bootstrap critical value as (c_α^*) is obtained.

The next step requires calculation of Wald test statistic, which is using the original data, and comparison to the critical value of bootstrap. When the Wald test statistic is higher than the bootstrap

critical value, the null hypothesis of non-Granger causality can be rejected at α level of significance (Hatemi, 2012).

5. EMPIRICAL RESULTS

In this section, the results of the tests techniques highlighted above will be interpreted and discussed their implications.

5.1. Unit Root Test Results

Table 6 shows the unit root test results of ADF and PP procedures. ADF and PP unit root testing procedures indicated that both series have unit root in their levels [I(0)] at 5% significance levels. For the first differences of the series, the ADF and PP unit root tests showed that both series are stationary in their first differences [I(1)] at 1% significance level since the critical test values for both tests are lower than t statistics. Therefore, one can conclude that both series are non-stationary at their levels but stationary at their first differences and integrated of order one at the 1% significance level.

5.2. Johansen's Co-integration Test Results

Table 7 indicates the result of the determination of optimal lags for LNRGDP and LNGDS. All of the information criteria determined the optimal lag length as 1.

Table 8 indicates that there is one co-integration relation between LNRGDP and LNGDS under the trace and Max-Eigen value statistics at 1% significance level.

5.3. Estimation Results of FMOLS and DOLS Models

Results of the cointegrated regression models (FMOLS and DOLS) shown in Table 9 indicate that an increase in the domestic savings (explanatory variable) can enhance the GDP (dependent variable) in Turkey for the research period. Also, values of estimated coefficients and t-statistics are quite similar in both estimation results of FMOLS and DOLS model. Therefore, one can conclude that the estimations of cointegrating regression gave consistent results.

5.4. Hatemi-J Asymmetric Causality Test Results

Table 10 indicates there is an existence of causality running from positive shocks on RGDP to positive shocks on GDS at 1% significance level while there is causality running from positive shocks on GDS to RGDP at 5% significance level. That is, there is a presence of positive bilateral causality among the variables. Furthermore, negative shocks on RGDP causes to negative shocks on GDS at 10% significance whereas there is no evidence of a negative shock on GDS causes to negative shocks on RGDP.

6. CONCLUSION AND POLICY RECOMMENDATION

Turkey's domestic savings have remarkably declined particularly from the 1990s and remained considerably low level at 14% on average within the period 2010-2015. Because of an inadequate

Table 6: Unit root test results of ADF and PP

Variable	LNRGDP			
	ADF		PP	
Test technique	Intercept	Trend and intercept	Intercept	Trend and intercept
Level/first difference				
Level	-0.0381	-2.4906	0.0161	-2.4906
First difference	-6.2326*	-6.1491*	-6.3724*	-6.2803*
Variable	LNGDS			
Test technique	ADF		PP	
Level/first difference				
Level	-0.9282	-2.5205	-0.9234	-2.6438
First difference	-5.9664*	-5.8965*	-5.9672*	-5.8971*
Critical Values	1%	-3.6267	-4.2349	-3.6267
	5%	-2.9458	-3.5403	-2.9458

*Denotes the variables are stationary at 1% significance level

Table 7: Optimal lag length for LNRGDP and LNGDS

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-9.420763	NA	0.007000	0.713798	0.805406	0.744163
1	75.26001	153.4839*	4.52e-05*	-4.328751*	-4.053925*	-4.237654*
2	76.75520	2.523138	5.31e-05	-4.172200	-3.714158	-4.020372
3	78.33122	2.462520	6.24e-05	-4.020701	-3.379442	-3.808142
4	80.78374	3.525496	6.99e-05	-3.923983	-3.099507	-3.650693
5	85.65815	6.397672	6.80e-05	-3.978634	-2.970941	-3.644613

*Denotes lag order selected by criterion

Table 8: Co-integration test results

Hypothesizes	Eigenvalue	Trace statistics	Max-Eigen statistics	P
None*	0.3993	19.1292** [12.3209]	17.8402** [11.2248]	0.0030
At most 1 ($r \leq 1$)	0.0361	1.2889 [4.1299]	1.2889 [4.1299]	0.2993

*Denotes rejection of null hypothesis at the 0.05 significance level. Values are written in box brackets indicate test critical values at 0.05 significance level. **Denotes that both test statistics indicate 1 cointegrating equation at the 0.05 significance level

Table 9: Estimation Results of FMOLS and DOLS models

Variable	FMOLS		DOLS	
	Coefficient	t-statistics	Coefficient	t-statistics
LNGDS	0.412454*	[20.26136]	0.401479*	[21.76333]
C	16.77532	[33.39141]	17.04692	[37.38238]

*Denotes that the coefficient of explanatory variable (LNGDS) is statistically significant at 1% significance level

Table 10: Hatemi (2012) asymmetric causality test results

Test statistic Wald Stat.	L	Critical values			Test statistic Wald Stat.	L	Critical values		
		1%	5%	10%			1%	5%	10%
LNRGDP ⁺ →LNGDS ⁺ 25.97*	4	15.61	10.50	8.40	LNGDS ⁺ →LNRGDP ⁺ 13.90**	3	14.55	9.27	7.06
LNRGDP ⁻ →LNGDS ⁻ 8.69***	4	15.97	10.79	8.63	LNGDS ⁻ →LNRGDP ⁻ 1.83	3	14.24	8.95	6.97

(*), (**) and (***) denote the presence of causality between series respectively at 1%, 5%, and 10% significance levels. Numbers in column L shows the optimal lag length determined by Hatemi-J (HJC) information criteria for related variables and (+) and (-) indicated the signs of positive and negative changes in the variables. Bootstrap simulations are reproduced 10,000 times with estimation of Wald test in each time and degree of maximum integration taken as 1 in VAR model

level of domestic savings, there is a presence of saving-investment gap which is usually tried to be offset by foreign savings. Since foreign savings can easily leave the country in the course of economic fluctuations, this situation results with that the fluctuations can be more secular.

The comparison of Turkey's domestic savings rates among World shows that Turkey's savings rates have remained below remarkably that of World average for all of the selected periods (1991-1995, 1996-2000, 2001-2005, 2006-2010 and 2011-2015). Additionally, in all of the selected periods, the comparison of Turkey's domestic savings rates among different income countries was indicated that Turkey's savings rates remained lower than (LMC), (UMC), and (HIC) group countries except for LIC. In addition to this, the comparison indicated that countries, which have a higher level of domestic savings, have sustained growth pattern whereas Turkey's growth pattern fluctuates most of the time.

To analyze the causal relationship between RGDP and GDS, we used annual data for the period from 1980 to 2016 in Turkey. Through employing Hatemi (2012) asymmetric causality testing method, it is investigated that there is a presence of causality relationship between RGDP and GDS. The test results indicate there is a presence of causality running from positive shocks on RGDP to positive shocks on GDS at 1% significance level while there is causality running from positive shocks on GDS to RGDP at 5% significance level. Further, negative shocks on RGDP causes negative shocks on GDS at 10% significance whereas there is no evidence of a negative shock on GDS (RGDP) causes negative shocks on RGDP (GDS). While not denying other studies related to this subject, this study reveals an existence of bilateral causality between savings and economic growth as Alguacil et al., 2004; Chturvedi et al. 2009; Tang and Chua, 2009; Agrawal and Sahoo, 2009; Tang and Chua, 2012; Tang and Ch'ng, 2012.

Since the main reason for the decline in domestic savings rates is the private savings, it may be crucial to take precautions for the decline in private savings. To do this, we will indicate some policy recommendations as follows.

As it is illustrated above in Table 2, the total volume of domestic transactions with domestic and International cards in Turkey is

about 26 million TL in January 2012 while it is about 45 million TL in January 2016. This situation reflects the reasons for the sharp increase in household consumption expenditures and the reasons for the decline in domestic savings particularly after 2002. Also, the easy credit facilities lead people to consume more than adequate. Therefore, it is necessary to control banking system and to apply policy implementations that lead people to be aware of benefits of today's savings is more than benefits of today's consumption in the long run.

The dependency ratio among the working age population in Turkey is relatively higher than the OECD countries because of low female labor force participation rate (World Bank report, 2011). Also, the unemployment rate is still higher in Turkey and reached to 13% in 2017. Therefore, promoting female labor force participation and alleviating unemployment can enhance additional income to families and hence it leads to increase in private savings.

Furthermore, a number of people keeping gold or money under the mattress but these mattress savings cannot be used for financing in investments and hence economic growth. Considerable steps should be taken for promoting financial literacy by education to increase domestic savings rates in Turkey.

Finally, it is necessary to have effective channels to transfer domestic savings to productive investments, or domestic savings should be reserved for sectors which create high added value, and public assistance programs should be controlled properly to avoid unnecessary expenses for unproductive areas. By this way, the positive effects of domestic savings on economic growth can be observed more significantly.

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