Analysis of Savings and Inflation for Turkey with ARDL Model

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Abstract: In this study, short and long term possible relationships between savings (GRS) and inflation (INF) in Turkey were investigated by using a time series data covering the years of 1974-2016. Firstly, stationarity level of savings and inflation is determined by conducting unit root test. According to the unit root test, savings and inflation series are stationary in the first differences at 1% significance level. Then, whether there is a long-lasting relationship between savings and inflation was examined by the ARDL boundary test. Lastly, the Granger causality test was applied in the framework of the Toda-Yamamoto Approach. As a result of the empirical analyses, there is no neither a long-run association between savings and inflation nor any sort of causality among them.

Key Words: Savings, Inflation, ARDL model, Cointegration, Causality

Türkiye içim Tasarruf ve Enflasyonun ARDL Modeli İle Analizi

Özet: Bu çalışmada, 1974-2016 yıllarını kapsayan zaman serisi verileri kullanılarak Türkiye'de tasarruf (GRS) ve enflasyon (INF) arasındaki kısa ve uzun vadeli olası ilişkiler araştırılmıştır. İlk olarak, birim kök testi yapılarak durağanlık tasarrufu ve enflasyon seviyesi belirlenir. Birim kök testine göre, tasarruf ve enflasyon serisi ilk farklar% 1 anlam düzeyinde sabittir. Ardından, ARDL sınır testi ile tasarruf ve enflasyon arasında uzun süreli bir ilişki olup olmadığı incelenmiştir. Son olarak, Granger nedensellik testi Toda-Yamamoto Yaklaşımı çerçevesinde uygulanmıştır. Ampirik analizlerin sonucu olarak, tasarruf ve enflasyon arasında uzun zamandır devam eden bir ilişki ya da aralarında herhangi bir nedensellik bulunmamaktadır.

Anahtar Kelimeler: Tasarruflar, Enflasyon, ARDL Modeli, Eş-bütünleşme, Nedensellik.

1.Introduction

Inflation is at the top of the economic indicators that are constantly searched for daily from the past. The relation of inflation to economic growth has been the subject of many researchers. There are some studies in the literature trying to reveal the association between economic growth and inflation in the context of Turkey (see for instance Berber&Aktan,2004). The impact of inflation on economic growth has been repeatedly examined in the literature. Now the economic indicators behind economic growth are examined. Saving can be regarded as one of the major driving forces of economic growth in an economy.

In this study, it is discussed whether inflation has a long-lasting relation with savings. ARDL model was used for the analysis of long-run relationship. The literature below shows the studies using the ARDL model. A couple of the many studies related to savings existing in the literature are summarized below.

Ali and others (2017) investigated the impact of inflation on household savings in their work. In the analysis, the relationship between household income, household savings, interest rates and inflation are examined. The dataset cover 150 households. As a result of these analyzes, inflation directly affects household savings.

Richardson and Innocent (2015) conducted research on Nigeria from 1980 to 2013 by using annual data. In the study, savings, inflation and economic growth were examined using the least squares method. It is emphasized that these three macroeconomic variables constitute a conjuncture. As a result, it is seen that economic growth has increased the savings of foreign direct investment.

Göçer, Alataş and Peker (2014) studied domestic savings and domestic investments. Panel data analysis was conducted for 20 OECD countries using data from 1980-2012. The study was carried out by taking into account the Feldstein-Horioka Paradox. As a result, the Feldstein-Horioka paradox was not found to be valid.

Mangır and Ertugrul (2012), in their study covering the years of 1980-2010 for Turkey, have also addressed the FH paradox. The ARDL boundary test was used in this study. The results of the ARDL boundary test show that the

domestic saving and investment rates have a long-term relationship.

Yilmaz and Tuncay (2012) studied the effect of financial liberalization on investment and saving in their work. The analysis was performed for Turkey for the period of 1980-2010. As a result of the study it is suggested that financial liberalization applications should be managed well, otherwise the savings cannot be evaluated well.

It is obvious that there are many studies regarding to savings in the literature. Besides them, in this study, short and long term relationships between savings and inflation in Turkey were examined. Also causality relationship among them was checked as well. As a result of the empirical analyses, there is no neither a long-run association between savings and inflation nor any sort of causality.

The remaining part of the study proceeds as follows: data and methodology are given in the next section; it is followed by the discussion of empirical results; and last section provides concluding remarks.

2.Data and Metodology

This study investigates the relationship between savings (GRS) and inflation (INF) in the sense of short-run and long-run and also causality in Turkey for the period of 1974-2016.

In the study, the ARDL Boundary Test Approach is used to analyze the log-run relationship. As it is known, a possible long-term relationship between time series is tested by co-integration tests. However, as a constraint, the vast majority of co- integration test require that the series need to be integrated at the same level. On the other hand in the ARDL model, it is not necessary that the series are integrated at the same level. It is enough that the series are not integrated in order two or more. In addition to that, it has some advantages like allowing the series to have different lag-lengths and allowing to estimate simultaneously short-term and long-term parameters(Pesaran,2001).

In the analysis, one model was established using GRS series as dependent variable. In this context, the model for application of the ARDL boundary test approach as follows:

$$\Delta GRS = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta GRS_{t-i} + \sum_{i=0}^{q} \alpha_i \Delta INF_{t-i} + \delta_0 \Delta GRS_{t-1} + \delta_1 \Delta INF_{t-1} + \varepsilon_t \quad (1)$$

GRS and INF terms in the equations correspond to variables described above. While δ_0 and δ_1 terms show the coefficients of long-term relationship between the series; α_i and β_i terms show the coefficients of short-term relationship between the series. Δ is defined as first difference operator, β_0 is constant term of the model, and ε_i is white noise error term of the model.

The short and long term relationships between the series are investigated by the ARDL model in several steps. First, the model prediction is made and the possible short and long-run relationships between the series are revealed as a result of the F-test in which H0 : $\delta_0 = \delta_1 = 0$ hypothesis claiming that there is no long-term relationship (co-integration) between the series and H1 : $\delta_0 \neq \delta_1 \neq 0$ alternative hypothesis claiming that that there is a long term relationship (co-integration) between the series. In this test, F-statistic value is compared with upper and lower boundary values stated by Peseran et al. (2001). If the F-statistic value exceeds the upper limit, H1 is accepted; if it is smaller than lower limit then H0 hypothesis is accepted. However, no decision can be made if the F-statistic value remains between the upper and lower limits.

When H1 hypothesis is accepted (i.e., having co-integration), the appropriate lag-lengths for the series are determined using one of the different model selection criteria. In the models we build under the assumption that the appropriate lags of ARDL (p, q, r, m); “p” represents the lag length of GRS and “q” represents the lag length of INF series.

Finally, the error correction model is estimated by using the determined optimum lag lengths. Three error correction models that we have established in this context as follows:

$$\Delta GRS = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta GRS_{t-i} + \sum_{i=0}^{q} \alpha_i \Delta INF_{t-i} + \varphi ECM_{t-1} + \varepsilon_t \quad (2)$$

In equations above; βi and αi terms refer to the dynamic coefficients that bring the model to the balance; ECM term refers to error correction term; ϕ term refers to the speed of adjustment at which the model reverts to long-term after a

shock occurred in short-term. The ϕ coefficient in all models should be negative and statistically significant.

Besides the ARDL boundary test approach, the Granger Causality Test was applied within the context of Toda-Yamamoto approach in order to determine the existence and direction of the possible causality relationship between the series. As it is known, the TodaYamamoto approach requires first determining the maximum integration level (i.e., dmax) of series included in the model. Following this, the appropriate lag length is determined in the context of the model selection criteria by setting the unrestricted VAR model at level values of the series. VAR (P+dmax) model is estimated under the assumption that the most suitable model is VAR (P). Then, this predicted model is tested with the VAR Granger Causality/Block Exogeneity Wald Test. The existence and direction of possible causal relations between the series are identified as a result of the causality test.

3.Empirical Results

ADF stationarity test was used to determine whether the series are stationary or not. While the null hypothesis of the ADF test indicates that the series are non-stationary, the alternative hypothesis says that the series are stationary. The results of the ADF unit root test for the level and first difference values of the series are reported in Table 1.

According to the ADF test results, GRS and INF are I (1). Since none of our series are integrated at two or more levels, we can test for the existence of co-integration by applying the ARDL boundary test approach to these series.

In the model; It is observed that the most suitable model is ARDL (2,0) by using Schwarz criterion among different ARDL models.(the lowest Schwarz value are shown in Figure 1 in the Appendix.) The results of the ARDL bound test questioning the co-integration between GRS series and INF series are shown in Table 2. As seen in Table 2., the hypothesis of "H0: Long-term relationships (co-integration) does not exist" is accepted because F-stat.= 3.623543 value is lower than bottom limit critical values (i.e., I(0) Bound) at all significance levels. In other words, this result implies that there is not a long-term relationship between savings and inflation.

Also, the ECM coefficient in Table 3 takes the expected negative value and is statistically significant at 1%.

Table 1: KPSS Stationary Test Results

				Critical Value	
Variable	**Model**	**Test Statistic**	**1%**	**5%**	**10%**
	None	0,34186	-2,621185	-1,948886	-1,61193
GRS	**Constant**	-1,57548	-3,596616	-2,933158	-2,60487
	Constant,Linear Tr.	-3,102217	-4,198503	-3,523623	-3,1929
	None	-5,891617	-2,622585	-1,949097	-1,61182
ΔGRS	**Constant**	-5,89536	-3,600987	-2,935001	-2,60584
	Constant,Linear Tr.	-5,816692	-4,198503	-3,523623	-3,1929
	None	-1,16779	-2,621185	-1,948886	-1,61193
INF	**Constant**	-1,949145	-3,596616	-2,933158	-2,60487
	Constant,Linear Tr.	-2,502888	-4,192337	-3,520787	-3,19128
	None	-7,687684	-2,622585	-1,949097	-1,61182
ΔINF	**Constant**	-7,592903	-3,600987	-2,935001	-2,60584
	Constant,Linear Tr.	-7,66704	-4,198503	-3,523623	-3,1929

Table 2:ARDL Bound Test Estimation Results		
F - statistics		
3.623.543		
	Critical Values	
Sigificance	**I(0) Bound**	**I(1)Bound**
10%	4,05	4,49
5%	4,68	5,15
2,50%	5,3	5,85
1%	6,1	6,73

	Table 3: Error Correction Estimation(ECM) Results of ARDL(2,0) Model for Model 1			
		Dependent Variable:GRS		
	Coefficient	*t-Statistic*	*Prob*	
ΔGRS_{t-1}	0,282127	1,789378	0,082	
ΔINF	0,016023	0,978254	0,3345	
C	5,824333	3,412999	0,0016	
ECM_{t-1}	-0,448162	-3,326779	0,002	
	ECM=GRS -(0,0306*INF+0,2897*@TREND)			
	Diagnostic Tests Results			
Diagnostic Tests			**Test Value**	
Breusch-Godfrey Serial Correlation LM Test			0,131215(0,7172)	
Heteroskedasticity Test:Breusch -Pagan-Godfrey			0,057786(0,8100)	

Notes:*The diagnostic test results at %1 significance level indicate that there is no problem in the model in terms of autocorrelation and heteroscedasticity. The values in parentheses in the diagnostic tests part are p-values.

Table 4.VAR Granger Causality/Block Exogeneity Wald Tests

Dependent variable: INF			
Excluded	Chi-sq	df	Prob.
GRS	0.601533	2	0.7403
All	0.601533	2	0.7403
Dependent variable: GRS			
Excluded	Chi-sq	df	Prob.
INF	0.405239	2	0.8166
All	0.405239	2	0.8166

After that, Granger causality test was applied with Toda Yamamoto approach to determine the causality relation between the series. It is seen that the maximum integration level (dmax) for the series is 1 because GRS and INF series are I(1). Since Schwarz criterion =13,26065 for 1 lag and Schwarz criterion=13,61356 for 2 lags were gathered for unrestricted VAR models, the most suitable lag is 1 according to the Schwarz criterion(i.e., P=1). Then, VAR Granger Causality/Block Exogeneity Wald test results are obtained and reported below by estimating the VAR(p=1+dmax=1) model(i.e., VAR(2) model). According to the test results reported in Table 4

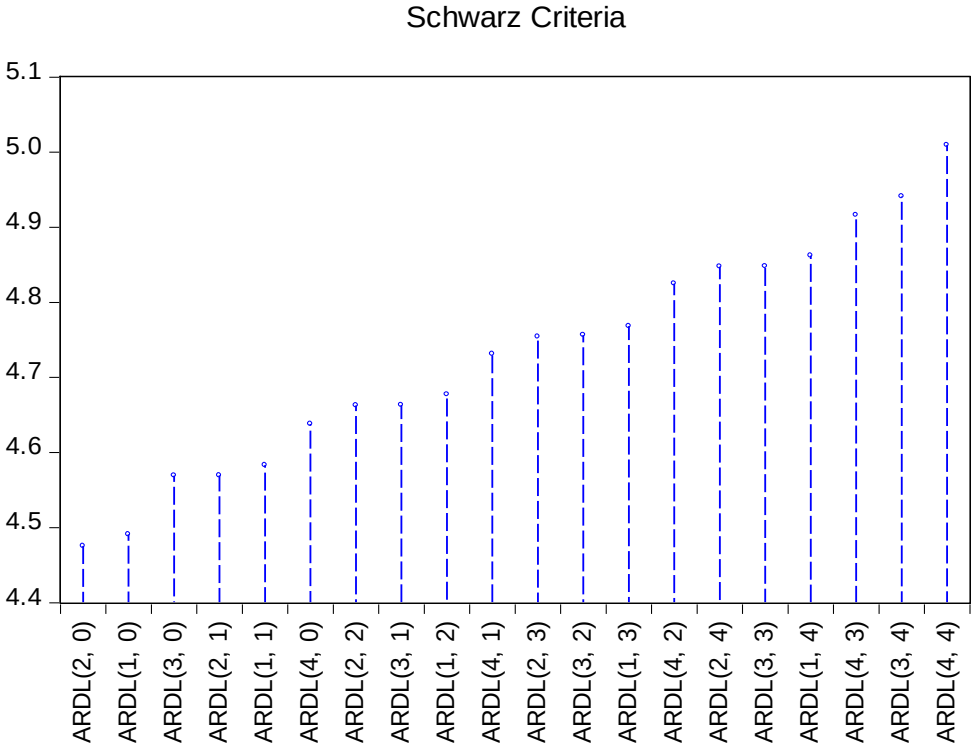
there is no causality relationship between GRS and INF in either direction.

4.Conclusion

Various aspects of the association between savings and inflation have been analyzed in the literature. In addition to them, In this study, we examined the short and long term possible relationships between saving and inflation in Turkey by utilizing ARDL bound test. Moreover, the Granger causality test was applied in the framework of the Toda-Yamamoto Approach in order to reveal the any sort of existing causality relationship between series. As a result of ARDL bound test, there is no a long lasting association between savings and inflation series. Meantime, Granger causality test results imply that there is no any sort of causality among them

Appendix

Figure 1. Schwarz Criteria(top 20 models) for Model 1



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