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Does Higher Inflation Mean Lower Fertility Rate: The Case of Turkey*

Daha Yüksek Enflasyon Daha Düşük Doğurganlık Oranı Anlamına Mı Gelir? Türkiye Örneği

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ÖZ

Bu çalışma, 1960-2019 dönemleri için Türkiye'de doğurganlık oranı ile enflasyon arasındaki uzun dönem ilişkiyi iki farklı enflasyon ölçüsü kullanarak incelemektedir. Bu anlamda hipotezimiz, yüksek enflasyon oranının Türkiye'de doğurganlık oranını düşürdüğünü ileri sürmektedir. KPSS durağanlık testinin bulgularına göre serilerimiz sıfır veya bir şeklinde tümleşik sıralıdır ve bu nedenle eş bütünleşme analizleri için ARDL sınır testi yaklaşımı kullanılmıştır. Eş bütünleşme testi sonuçlarına göre Türkiye'de doğurganlık oranı. tüketici fiyat endeksi ve GSYİH deflatörü ile eş bütünleşik olup, uzun dönemde birlikte hareket etmektedir. Enflasyon ve doğurganlık oranı arasında negatif istatistiksel olarak anlamlı uzun vadeli bir ilişki bulunmaktadır. Daha açık bir ifadeyle, Türkiye'de uzun dönemde tüketici fiyat endeksi %1 artarsa doğurganlık oranı %0.035673 azalır ve GSYİH deflatörü %1 artarsa doğurganlık oranı %0.034813 düşer. Bu arada, otokorelasyon problemi dışında, her iki model de değişen varyans ve normal olmama problemlerinden mustarip değildir ve birkaç tanısal teste dayalı olarak kararlıdır.

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ABSTRACT

This study examines the long-term relationship between inflation on fertility rate in Turkey for the periods of 1960-2019 by employing two different measures of inflation. In that sense our hypothesis asserts that higher inflation rate lowers fertility rate in Turkey. Based on the findings of KPSS stationarity test, our series are integrated order either zero or one, and thus we used ARDL boundary test approach for cointegration analyses. According to cointegration test results, fertility rate is co-integrated with consumer price index and GDP deflator, and thus they move together in the long-run in Turkey. We found a negative statistically significant long-run relationship between inflation and fertility rate. More explicitly, if consumer price index goes up by %1 then fertility rate goes down by %0.035673 and if GDP deflator increases by %1 then fertility rate drops by %0.034813 in the long-run in Turkey. Meantime, except autocorrelation problem, the both models do not suffer from heteroskedasticity and non-normality problems and are stable based on several diagnostic tests.

1. Introduction

The fertility rate, which is the main factor of population growth, is expressed as the ratio of births in a country or region to the number of women of childbearing age within a certain period of time. Inflation, on the other hand, means that the prices of goods and services increase continuously and perceptibly, and the purchasing power decreases in parallel with this. The effects of population structures created by fertility on inflation are a matter of curiosity in academic studies.

Recent demographic change movements in the world cause changes in birth and death rates. According to this, firstly, there was a decrease in death rates, and then, with the developing urbanization and industrialization, a decrease in birth rates was observed. These changes cause the population to increase first and then change the proportions of the increasing population in age groups. As the average life expectancy of people increases this causes a decrease in the fertility rate, the proportion of the elderly population in the total population also increases. This change in the ratio of the old and young population also changes consumption patterns and general consumption needs. For example, while the elderly population spends their revenue more on public services and health, the young population spends their revenue on sectors such as communication, technology, education and transportation. In addition, as the elderly population increases, labor force participation rates decrease. It is seen that these changing patterns also affect inflation by revealing different economic effects.

The mobility in the population affects the economic factors such as saving, consumption and investment on supply-demand. Therefore, it is predicted that inflation will also be affected. Therefore, fertility may be one of the most important determinants of future economic development or inflation. The result of this effect may differ depending on the economic structures of the countries.

One of the most important factors to be considered in order to prevent inflation is population growth. While economic welfare is in question, population growth and planning become an important issue for countries. This case is especially in II. It gained global importance after World War II. Because with the increase in population, more and more natural resources were needed. With the increase in Consumption Demand, more labor was needed, which also increased the supply rates. As a result, the extent to which the supply can respond to the increasing demand becomes an important issue for the struggle against inflation. Therefore, population increases are generally associated with economic growth in studies.

The aim of this study is to investigate how inflation experienced between 1960 and 2019 affects fertility in Turkey with ARDL bounds test. In other words, it is trying to explain how fertility affects inflation. With the variable used; female fertility rate, female labor force participation rate and inflation rate. The long-term relationship of these variables is discussed. From this perspective, it is stated that high inflation rate reduces the fertility rate in Turkey.

2. Literature

Barro (2001) states that economic growth is significantly negatively related to the total fertility rate. Thus, the choice to have more children per capita (and therefore higher population growth rate in the long run) means that growth in per capita productivity is in return. In a similar study, Orsal and Goldstain (2010) investigated whether fertility is in harmony with the economic conjuncture, whether it tends to decrease in high income periods and the effects of economic variables on total fertility over time. According to their findings, they reach the conclusion that fertility changes with the conjuncture, that is, when income increases, fertility also increases and when income decreases, fertility also decreases.

According to Weller (1977), the relationship between fertility and female labor force participation rates reflects the incompatibility between caring for children and working in economically productive jobs. Reflecting similar views, Semyonov (1980) concluded in his study that women's labor force participation is lower in countries with high fertility rates. Although fertility affects women's labor force participation negatively, it is known that female labor force participation will first increase productivity and then decrease fertility, respectively.

According to Anderson (2014) stated that population aging will also have an impact on inflation through different channels. It is stated that aging will reduce the labor supply, and therefore may lead to deflationary pressures due to slowing growth. Similarly, in the study of Katagiri (2012), which focuses on the aging population; When the effect of population decline on the economy is analyzed separately in terms of total demand and supply, it is seen that this situation can have two opposite effects on inflation. From a aggregate demand perspective, a declining and aging population can lead to deflationary pressures on the economy due to lower aggregate demand, a negative wealth effect from falling asset prices, and changes in relative prices reflecting different consumption preferences. According to Yoon (2015) when looking at the situation from the supply side, it will decrease the effective supply of labor in the economy, decrease the labor force participation rate and decrease the potential increase in output. It is stated that this situation may create inflation pressure. According to Konishi and Ueda (2013) If aging is caused by the decrease in the birth rate, it causes inflation by shrinking the tax base and increasing fiscal expenditures.

Başkaya and Özkılıç (2017) examined the changes in fertility between provinces and regions in Turkey and the social, cultural and economic variables that affect them. They observed that the fertility rate in Turkey decreased significantly until the 1980s, but after these dates, the decline slowed down and there were significant fertility differences between provinces, and that fertility increased as one went from west to east. They also conclude that factors such as income level, industrialization, urbanization, internal migration, labor force participation, unemployment, education and population policies affect fertility in Turkey. Berber and Artan (2004) They tested the inflation-economic growth relationship in Turkey for the period. According to the findings obtained from the study; Inflation negatively affects economic growth. Namely, a 10% increase in the inflation rate affects economic growth negatively. In addition, as a result of the Granger causality analysis, a one-way causality relationship from inflation to economic growth was determined.

According to the study of Demirtaş and Yayla (2017) Factors determining female employment are fertility, dependency rate, male unemployment rate, inflation, and economic growth. According to the studies of Kaygısız and Ezanoğlu (2021) Population growth also has an impact on inflation. As a result of the analysis, it is determined that inflation decreases as the ratio of the young population in the total population increases.

It is important for Turkey's future policies to realistically determine the effects of women's labor force participation rate and education level, which are key factors affecting fertility, through population growth. In this study, which was carried out in order to contribute to the literature; The effects of inflation experienced in Turkey on fertility have been discussed and the direction of the relationship between the variables has been tried to be explained. According to the study; It was concluded that there is a reciprocal causality between GDP per capita and female labor force participation in Turkey.

3. Data and Metodology

Countries, during the periods of high inflation, may experience low fertility rates for two reasons: i.) the cost of caring and rising baby/child is higher in that periods relative to low inflation periods and ii.) married women may have to work in order contribute their family budgets as result of sharp drops in purchasing power of a family's nominal income in high inflation periods. Therefore, families may postpone their intentions of having child for the aforementioned reasons. In the light of this discussion, we analyze the long-term effect of inflation on fertility in Turkey for an annual data sample of 1960-2019. Our hypothesis asserts that higher inflation rate leads to lower fertility rate in Turkey. We conducted our analyses by using two different measures of inflation. These are consumer price index (2010 = 100) (INF1) and GDP deflator (INF2). Fertility rate (FERT) is measured as total fertility rate (births per woman). All data are from World Development Indicators of the World Bank and their logarithmic forms were utilized in the analyses.

We used ARDL boundary test for cointegration analysis and hence estimated the following model:

$$\Delta \mathrm{FERT}_t = \gamma_0 + \sum_{i=1}^{p} \alpha_i \Delta \mathrm{FERT}_{t-i} + \sum_{i=0}^{r} \beta_i \Delta \mathrm{INF}_{t-i} + \theta_1 \mathrm{FERT}_{t-1} + \theta_2 \mathrm{INF}_{t-1} + \varepsilon_t \quad (1)$$

The explanations of notations in Equation 1 above are as follows: θ_1 and θ_2 notations are long-run coefficients; α_i and β_i notations are short-run coefficients; Δ notation is first degree difference operator; γ_0 is constant term, and ε_t notation is white noise error term of the regression model.

The null hypothesis of cointegration test claims that there is no co-integrating relationship (i.e., $H_0 : \theta_1 = \theta_2 = 0$) whereas the alternative hypothesis of cointegration test claims that there is co-integrating relationship (i.e., $H_1 : \theta_1 \neq \theta_2 \neq 0$). If the F-statistic value of the test is higher than the critical value of the upper bound then the alternative hypothesis is accepted while if the F-statistic value of the test is lower than the critical value of the lower bound then the null hypothesis is accepted. Meantime we cannot make decision when F-statistic value stays between the critical values of lower and upper bounds.

The short-run and long-run coefficients are gathered by estimating the following error correction model:

$$\mathrm{FERT}_t = \alpha_0 + \sum_{i=1}^{p} \delta_i \Delta \mathrm{FERT}_{t-i} + \sum_{i=0}^{q} \vartheta_i \Delta INF_{t-i} + \pi ECM_{t-1} + \varepsilon_t \quad (2)$$

The explanations of notations in Equation 2 above are as follows: δ_i and ϑ_i notations are the dynamic coefficients of short-run; ECM is error correction term; π notation the speed of adjustment term. The speed of adjustment term must get a statistically significant negative sign.

4. Empirical Results

Firstly, we implemented Kwiatkowski-Phillips-Schmidt-Shin (KPSS) stationarity tests to identify the integration Level of each series for two models (i.e., model with just constant and model with constant and linear trend) and the findings are given in Table 1, 2, and 3 below. Table 1 shows that INF1 variable is stationary at level for the model containing both constant and linear trend and hence it is integrated order zero (i.e., I(0)). For the model containing only constant, INF1 variable is stationary at first difference and hence it is integrated order one (i.e., I(1)).

Table 1. KPSS Test Findings for INF1 Variable

Null Hypothesis: INF1 is stationary		
Exogenous: Constant		
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel		
		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.947147
Asymptotic critical values:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000
Null Hypothesis: ΔINF1 is stationary		
Exogenous: Constant		
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel		
		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.206624
Asymptotic critical values:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

Null Hypothesis: INF1 is stationary		
Exogenous: Constant, Linear Trend		
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel		
		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.126544
Asymptotic critical values:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

Table 2 indicates that FERT variable is stationary at level for the model containing both constant and linear trend and thus it is integrated order zero (i.e., I(0)). For the model containing only constant, FERT variable is stationary at first difference and thus it is integrated order one (i.e., I(1)).

Table 2. KPSS Test Findings for FERT Variable

Null Hypothesis: FERT is stationary		
Exogenous: Constant		
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel		
		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.943258
Asymptotic critical values:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000
Null Hypothesis: ΔFERT is stationary		
Exogenous: Constant		
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel		
		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.320213
Asymptotic critical values:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000
Null Hypothesis: FERT is stationary		
Exogenous: Constant, Linear Trend		
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel		
		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.172795
Asymptotic critical values:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

Table 3 implies that INF2 variable is stationary at level for the model containing both constant and linear trend and so it is integrated order zero (i.e., I(0)). For the model containing only constant, INF2 variable is stationary at first difference and so it is integrated order one (i.e., I(1)).

Table 3. KPSS Test Findings for INF2 Variable

Null Hypothesis: INF2 is stationary		
Exogenous: Constant		
Bandwidth: : 6 (Newey-West automatic) using Bartlett kernel		
		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.946047
Asymptotic critical values:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000
Null Hypothesis: ΔINF2 is stationary		
Exogenous: Constant		
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel		
		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.204265
Asymptotic critical values:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000
Null Hypothesis: INF2 is stationary		
Exogenous: Constant, Linear Trend		
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel		

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.126311
Asymptotic critical values:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

As hinted by the results in Table 1, 2, and 3, INF1, FERT, and INF2 variables are integrated order zero for the model possessing both constant and linear trend while INF1, FERT, and INF2 variables are integrated order one for the model possessing just constant. Since INF1, FERT, and INF2 variables satisfy the requirement of ARDL boundary test of being integrated order no more than two, ARDL boundary test can be used to find out if INF1, FERT, and INF2 variables are co-integrated.

After checking the integration order of each series, we identify the optimal lag lengths of ARDL model by using Schwarz information criterion (SIC). Out of six different ARDL models evaluated, ARDL(2,0) model with the lowest SIC score was chosen for two models utilizing INF1 and INF2 separately as dynamic regressors. Therefore all analyses are implemented via ARDL(2,0) model. Table 4 and 5 report SIC scores for six distinct specifications of ARDL model.

Table 4. Lag Selection for ARDL Model with INF1 Variable

Model	LogL	AIC	SIC*	HQ	Adj. R-sq	Specification
3	321.286828	-10.906442	-10.728818	-10.837254	0.999994	ARDL(2, 0)
2	322.327274	-10.907837	-10.694688	-10.824811	0.999994	ARDL(2, 1)
1	323.173833	-10.902546	-10.653872	-10.805682	0.999994	ARDL(2, 2)
4	221.552193	-7.432834	-7.219685	-7.349808	0.999794	ARDL(1, 2)
5	219.126675	-7.383678	-7.206054	-7.314490	0.999780	ARDL(1, 1)
6	215.220295	-7.283458	-7.141359	-7.228108	0.999753	ARDL(1, 0)

Table 5. Lag Selection for ARDL Model with INF2 Variable

	LogL	AIC	SIC*	HQ	Adj. R-sq	Specification
3	321.712751	-10.921129	-10.743505	-10.851941	0.999994	ARDL(2, 0)
2	323.703963	-10.955309	-10.742160	-10.872283	0.999994	ARDL(2, 1)
1	324.311354	-10.941771	-10.693097	-10.844907	0.999994	ARDL(2, 2)
4	220.753154	-7.405281	-7.192132	-7.322255	0.999788	ARDL(1, 2)
5	218.243605	-7.353228	-7.175603	-7.284039	0.999773	ARDL(1, 1)
6	214.310281	-7.252079	-7.109979	-7.196728	0.999745	ARDL(1, 0)

Table 6 below displays cointegration test result for ARDL model using INF1 variable as dynamic regressor. As can be deducted from Table 6, F-statistic value gathered from ARDL boundary test of 31.97368 is greater than the upper bound critical values at all significance levels and hence INF1 and FERT variables are co-integrated.

Table 6. Co-integration Test for ARDL Model with INF1 Variable

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	31.97368	10%	4.05	4.49
k	1	5%	4.68	5.15
		2.5%	5.3	5.83
		1%	6.1	6.73

In Table 7 below, cointegration test result for ARDL model using INF2 variable as dynamic regressor is given. As implied by Table 7, F-statistic value gathered from ARDL boundary test of 32.70813 is higher than the upper bound critical values at all significance levels and thus INF2 and FERT variables are co-integrated.

Table 7. Co-integration Test for ARDL Model with INF2 Variable

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	32.70813	10%	4.05	4.49
k	1	5%	4.68	5.15
		2.5%	5.3	5.83
		1%	6.1	6.73

In sum, the cointegration test findings in Table 6 and 7 point out FERT variable move together with INF1 and INF2 variables in the long-run in Turkey during the period of 1960-2019.

Table 8 provides the results of long-run coefficient estimation for ARDL model having INF1 variable as dynamic regressor. The findings disclose that INF1 variable has a statistically significant negative influence on FERT variable. More explicitly, if consumer price index goes up by %1 then fertility rate goes down by %0.035673 in Turkey.

Table 8. Long-run Coefficient Estimations for ARDL Model with INF1 Variable

Dependent Variable: FERT			
Variable	*Coefficient*	*t-statistic*	*Prob.*
TREND	-0.010607	-10.19965	0.0000
INF1	-0.035673	-10.82420	0.0000

Table 9 provides the results of short-run coefficient estimation for ARDL model having INF1 variable as dynamic regressor. As indicated by the table, first short-run lag of FERT variable is positive and statistically significant. As expected, the coefficient of ECM term is negative and statistically significant. As to the results of diagnostic test reported in Table 9, except autocorrelation, the model does not have heteroskedasticity and non-normality problems.

Table 9. Error Correction Estimation for ARDL Model with INF1 Variable

	Dependent Variable:FERT		
	Coefficient	*t-Statistic*	*Prob.*
$\Delta FERT_{t-1}$	1.103452	64.85481	0.0000
CONSTANT	0.061487	9.952754	0.0000
ECM_{t-1}	-0.040567	-9.977009	0.0000
ECM = FERT- (-0.0357*INF1 - 0.0106*TREND)			
Diagnostic Tests			
Tests			Test Value (Prob.)
Jarque-Bera Normality Test			1.250885 (0.535025)
Breusch-Godfrey Serial Correlation LM Test			33.96221 (0.0000)
Harvey Heteroskedasticity Test			1.422190 (0.2394)

As seen from Figure 1, the parameters of ARDL model having INF1 variable as dynamic regressor are stable.

Figure 1. CUSUM-Square Test for ARDL Model with INF1 Variable

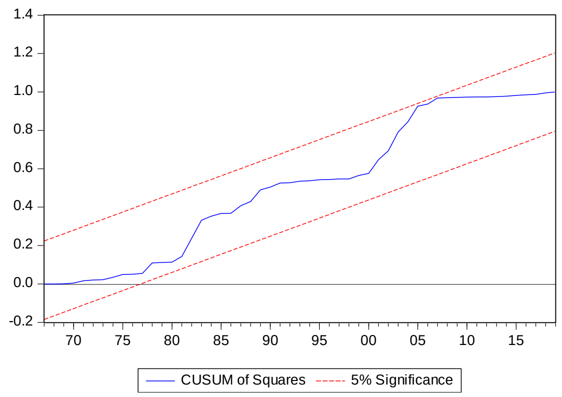


Table 10. Long-run Coefficient Estimations for ARDL Model with INF2 Variable

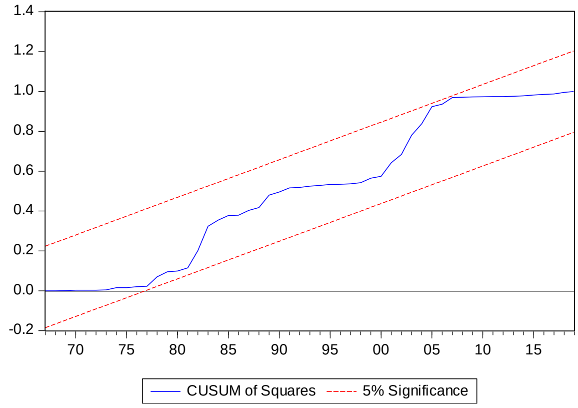
Dependent Variable: FERT			
Variable	*Coefficient*	*t-statistic*	*Prob.*
TREND	-0.010832	-10.68427	0.0000
INF2	-0.034813	-10.91433	0.0000

Table 10 displays the findings of long-run coefficient estimation for ARDL model having INF2 variable as dynamic regressor. The findings hint that INF2 variable has a statistically significant negative effect on FERT variable. In other words, if GDP deflator increases by %1 then fertility rate drops by %0.034813 in Turkey. In Table 11, short-run coefficient estimations for ARDL model containing INF2 variable as dynamic regressor are obtained. As seen from Table 11, first short-run lag of FERT variable is positive and statistically significant. In parallel to our prior expectation, the coefficient of ECM term is negative and statistically significant. As can be seen from diagnostic tests provided in Table 11, except autocorrelation, the model does not suffer from heteroskedasticity and non-normality problems.

Table 11. Error Correction Estimation for ARDL Model with INF2 Variable

	Dependent Variable:FERT		
	Coefficient	*t-Statistic*	*Prob.*
$\Delta FERT_{t-1}$	1.102259	65.67130	0.0000
CONSTANT	0.061324	10.06624	0.0000
ECM_{t-1}	-0.040205	-10.09095	0.0000
ECM = FERT- (-0.0348*INF2 - 0.0108*TREND)			
Diagnostic Tests			
Tests			Test Value (Prob.)
Jarque-Bera Normality Test			1.581548 *(*0.453494*)*
Breusch-Godfrey Serial Correlation LM Test			35.77129 *(*0.0000*)*
Harvey Heteroskedasticity Test			1.922722 *(*0.1202*)*

Figure 2. CUSUM-Square Test for ARDL Model with INF2 Variable



As can be concluded from Figure 2, the ARDL model having INF2 variable as dynamic regressor is stable.

5. Conclusion

This study investigates the long-term impact of inflation on fertility rate in Turkey for the years between 1960 and 2019 by using two different measures of inflation. For that reason, we test the hypothesis claiming that higher inflation rate lowers fertility rate in Turkey. Based on scores of SIC criterion, we picked up ARDL (2,0) model as the optimal model and we conducted our all analyses via ARDL (2,0) model. According to the results of stationarity test, our series are integrated order either zero or one, and thus ARDL boundary test approach for cointegration analyses are employed. Cointegration test findings reveal that fertility rate is co-integrated with consumer price index and GDP deflator, and hence they move together in the long-run in Turkey. A negative statistically significant long-run association between inflation and fertility rate was identified. More specifically, if consumer price index jumps by %1 then fertility rate decreases by %0.035673 and if GDP deflator rises by %1 then fertility rate falls by %0.034813 in the long-run in Turkey. Meanwhile, except autocorrelation problem, none of the models possesses heteroskedasticity and non-normality problems and each one of the models is stable based on several diagnostic tests.

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