The impact of import on inflation: an ARDL analysis for the Turkish Economy

İthalatın enflasyon üzerindeki etkisi: Türkiye Ekonomisi için bir ARDL analizi

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Received: 26.03.2019, Accepted: 22.07.2019, Published: 15.11.2019

Abstract

Since it has complicated and prominent interrelations with another macro and microeconomic issues, determination of the causes of high level of inflation ranks almost first among the major goals of economic policy. According to the Triangle Model that was recently developed by Gordon (1997), inflation stems from three dynamics called inertia, demand and supply. On the other hand, the Monetarists and the Structuralists argue that inflation is caused by excessive money supply and cost/push factors, respectively. In this context, the aim of this study is to examine the impact of import volume on domestic inflation rate in the Turkish economy for the period 1961-2017 by utilizing a proper cointegration technique. Findings illustrated that inflation in Turkey basically stems from monetary issues and it is import driven, as well. Thus, policy makers had better take this bilateral structure into account while dealing with general price level instabilities in the Turkish economy.

Keywords: *Inflation, Import, ARDL, Turkish economy*

JEL: *E31, O24, C22*

Öz

Diğer makro ve mikroekonomik konularla karmaşık ve önemli ilişkilere sahip olduğundan, yüksek enflasyon düzeyinin sebeplerinin belirlenmesi ekonomi politikasının ana hedefleri arasında neredeyse ilk sırada yer almaktadır. Son dönemde Gordon (1997) tarafından geliştirilmiş olan Üçgen Modeline göre enflasyon atalet, talep ve arz adı verilen üç dinamikten kaynaklanmaktadır. Diğer taraftan Paracılar ve Yapısalcılar enflasyonun nedeninin sırasıyla aşırı para arzı ve maliyet arttırıcı

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http://dx.doi.org/10.25294/auiibfd.595213

faktörler olduğunu ileri sürmektedir. Bu kapsamda çalışmanın amacı, uygun bir eşbütünleşme analizi kullanarak, Türkiye ekonomisinde 1961-2017 döneminde ithalat hacminin yurtiçi enflasyon oranı üzerindeki etkisini incelemektir. Bulgular, Türkiye'de enflasyonun temelde parasal gelişmelerden kaynaklandığını ve aynı zamanda ithalat tarafından da yönlendirildiğini göstermektedir. Bu nedenle, politika yapıcıların Türkiye'de genel fiyat düzeyi istikrarsızlıkları ile ilgilenirken bu ikili yapıyı dikkate almaları yararlı olacaktır.

Anahtar Kelimeler: Enflasyon, İthalat, ARDL, Türkiye Ekonomisi

JEL Kodu: E31, O24, C22

Introduction

Inflation as one of the most important macroeconomic problems has been under investigation for many years. Since it has devastating effects especially on well-being, both political and economic policy makers are responsible for taking necessary measures and stabilizing general prices. In this regards, the triangle model that was developed by Gordon (1997) suggests that inflation depends on three determinants namely, *inertia* that represents the lagged value of inflation rate, *demand* that indicates the excess demand (i.e. the gap between nominal and potential GDP growth), and *supply* that reflects supply shocks such as the rise and fall of oil prices. As well as the triangle model, the Monetarist and Structuralist models are two other major approaches that try to explain the possible causes of higher levels of inflation.

According to the Monetarist view, inflation is caused by the proportion of money growth that exceeds income growth. They suggest that since money is capable of substituting real and financial assets, any wealth increase caused by increased money supply will conclude with consuming related assets instead of keeping them as idle money balances. This activity is going to yield a rise in the demand of those assets and their prices will follow the path. As a result, it is inevitable to face with higher levels of inflation.

On the other side, the Structuralists argue that economic activities that create demand and/or cost pressure on the prices boost inflation. Gaomab II (1998) states that "these factors operate through the supply side of the economy by increasing the unit cost of production, so that real output, or GDP contraction co-exists with resulting inflation". Besides, excessive importing activity, increased nominal wages, predatory pricing for high profits are some other factors that the Structuralists present for the causes of higher levels of inflation.

The Turkish economy has been in a challenge with inflation for a long time. Although increase in the general price level was stabilized prior to the

global financial crisis of 2008, with its double-digit structure now, it ranks first among the macroeconomic issues to be solved. Table 1 presents some statistics related to the Turkish macroeconomic outlook for the period 1961-2017. As seen, although it has been experienced substantial increase for the absolute value of GDP and GDP per capita, the Turkish economy has been suffering instable macroeconomic balances in terms of the growth rates of GDP and GDP per capita. Besides, opposite to the increased value of GDP, unemployment is seen as one of the major macroeconomic problems of the economy. On the other hand, the foreign trade volume of the Turkish economy has been substantially increased during the period in consideration. However, since import of the economy is greater than export, this has ended with the trade deficit as one other macroeconomic issue that the Turkish economy should face with. Finally, no matter how it is measured (i.e. by consumer price index (CPI) or deflator), inflation has been a serious macroeconomic priority to be solved for the Turkish economy since the middle of 1970's. However, in spite of many economic and political interventions, Turkey has failed and inflation rate has reached its double-digit level again.

Table 1. Selected statistics for the Turkish macroeconomic outlook

Years	GDP	GDP growth	GDP per capita	GDP per capita growth	Unemployment	Import	Export	Inflation (CPI)	Inflation (GDP Deflator)
1961	7.99	1.16	284	-1.27	3.40	0.54	0.41	3.17	4.37
1970	17.09	3.23	490	0.80	11.00	1.09	0.76	7.92	8.64
1980	68.79	-2.45	1564	-4.63	7.90	8.21	3.55	94.26	93.00
1990	150.68	9.27	2794	7.38	8.20	26.49	20.14	60.30	58.24
2000	272.98	6.64	4317	5.03	6.49	61.56	53.09	54.92	49.34
2010	771.90	8.49	10672	6.98	10.66	196.45	157.84	8.57	7.01
2011	832.52	11.11	11336	9.42	8.80	253.09	185.34	6.47	8.19
2012	873.98	4.79	11707	3.09	8.15	249.77	206.85	8.89	7.42
2013	950.58	8.49	12519	6.67	8.73	266.90	211.72	7.49	6.27
2014	934.19	5.17	12096	3.39	9.88	258.30	222.00	8.85	7.42
2015	859.80	6.09	10949	4.33	10.24	223.15	200.73	7.67	7.83
2016	863.72	3.18	10821	1.51	10.84	214.64	189.72	7.78	8.10
2017	851.55	7.44	10500	5.75	10.82	249.66	211.22	11.14	10.84

Source: The Turkish Statistical Institute and The World Bank, World Development Indicators Database.

*GDP, Import and Export are in billion dollars. GDP per capita is in dollars. Others are in percentages.

One of the measures recently taken for reducing high level of inflation by Turkish economic authority is to ease domestic pressure on inflation by importing some goods. However, this does not seem an appropriate policy

for reducing demand pressure on general prices when official import statistics are being observed for the Turkish economy. Even if importing activity may sometimes help inflation to fall from the demand-side, it may also boost it from the supply/cost-side, and in the light of statistics for the percentage share of components of total import, one can conclude that this is the case in the Turkish economy. According to official foreign trade statistics released by the Turkish Statistical Institute (TUIK)[4], considering ten-year periods of the last 50 years, while the minimum and maximum percentage shares of consumption goods in total import are 4% and 13%, respectively, the minimum and maximum percentage shares of capital and intermediate goods in total import are 86% and 95%, respectively. In this sense, assuming that importing activity in the Turkish economy is inevitable for the production, supply/cost side effect of import becomes stronger in terms of the import-inflation nexus. Additively, considering the intentional exchange regime followed by the Turkish economic authority for promoting export and recent abnormal depreciation of Turkish Lira against foreign currencies, it can be stated that importing for production is getting more expensive in the Turkish case and this may yield stronger supply/cost side effect of import on domestic inflation. In this context, as suggested by the Structuralist inflation model, importing policy itself may be one of the specific sources of persistent domestic inflation in Turkey via its effects especially on supply/cost structure.

This study aims at investigating the long and short-run impacts of import volume on domestic inflation in the Turkish economy for the period 1961 - 2017. Thus, it incorporates the bounds testing approach (ARDL) to cointegration of Pesaran et al. (2001) and tries to estimate an inflation function that was constructed in light of the views of Monetarist and Structuralist approaches.

The novelty of this study can be classified under three aspects. First, unlike previous studies that have utilized classical cointegration analyses such as the Johansen or Engle-Granger, this paper benefits the ARDL methodology in order to the analyze the short and long-run relationship between import and inflation. Second, the study combines the Monetarist and Structuralist inflation models and tries to hold possible inflation dynamics in order. Third, the direct impact of import on inflation has never been studied by utilizing long time series data and ARDL methodology in the Turkish economy. Thus, this paper constitutes a contribution to the empirical literature.

[4]https://biruni.tuik.gov.tr/disticaretapp/disticaret.zul?param1=1&param2=0&sitcrev=0&isicrev=0&sayac=5803 Turkish import data, Classified as the Broad Economic Categories (BEC-1).

The outline of the study is as follows: Section 1 is devoted to review of literature. Section 2 and 3 presents the empirical issues. Finally, Section 4 highlights findings.

1. Review of literature

Existing literature on the interrelations of inflation-import nexus has been generally constructed around the idea that importing activity is one of the consequences of higher level of domestic inflation (e.g. McCallum and Nelson, 2001; Kara and Nelson, 2003; Gali and Monacelli, 2005; Clausen and Kandil, 2005). However, Dexter et al. (2005) opened a new strand of literature and suggested that there are two ways, namely direct and indirect channels that the availability of imports matters on domestic inflation.

As compliments to the theoretical views of Dexter et al. (2005), the issue whether importing activity boosts domestic inflation or not has also been empirically investigated. For instance, Rassekh and Wilbratte (1990), considering the Monetarist and Structuralist inflation models, examined the model that best explains inflation in the USA, UK, Canada, Japan and West Germany and concluded that the structuralist model that includes import prices as one of the explanatory variables performed better in explaining inflation. Gaomab II (1998) reviewed the factors that resulted in high level of inflation in the Namibian economy and proved that foreign prices and imported inflation from South Africa are boosting Namibian prices and inflation. Cheng and Tan (2002) identified the factors that contribute Malaysian inflation pattern and showed that external dynamics such as exchange rate and imported inflation are among the factors that boost Malaysian inflation. Bayraktutan and Arslan (2003) investigated the link between exchange rates, inflation and import volume in the Turkish economy by using causality analysis of Granger and indicated that there is bi-directional causal relationship between variables in question. Corrigan (2005) studied the link between import prices and inflation in the US economy and concluded that import prices have a significant role in explaining the US inflation patterns. Ferrucci et al. (2010) questioned the causes of increase in retail food prices in the Euro Area and proved that in the case of 10 percent increase in the price of imported commodities and if it accounts for 20 percent of the value of final spending, domestic inflation might increase by 2 percent. Ogbokor and Sunde (2011) investigated the relationship between import and inflation in the Namibian economy and presented that inflation in Namibia is heavily import driven. Muktadir-Al-Mukit et al. (2013) analyzed the link between import and inflation in the Bangladesh economy and pointed import as a cause of inflation. Chatelais et al. (2017) studied the impact of import prices on inflation in the Euro Area and found that import prices of manufactured goods explain the subsequent recovery of manufactured goods consumer price inflation. Munepapa and

Sheefeni (2017) investigated the impact of import on inflation in Namibia and revealed that while the impact is insignificant in the short-term, importing significantly increases inflation in the long-term. Ahmed et al. (2018) examined the link between inflation and exports & imports in the Pakistani economy and indicated that 1% increase in imports yields 0.57% increase in inflation over in the long-run.

2. Empirical model and data

In accordance with the views of the Monetarist and Structuralist Inflation Theories, the impact of import on inflation was examined by using an augmented log-linear inflation model that can be formulated as follows:

$$INF = f(DIFF, IMP) \tag{1}$$

where *INF* is the inflation rate, *DIFF* is the difference between money growth and income growth and *IMP* is the total import.

The study employs annual data covering the time period 1961 to 2017. Annual growth rate of the GDP deflator, annual growth rate of the Broad Money (M2), annual growth rate of GDP at market prices based on constant local currency and imports of goods and services proxy domestic inflation, money growth, economic growth and import volume, respectively. The source of data set used in this paper is World Development Indicators Database of the World Bank.

3. Methodology

The Engle and Granger (1987) with two-step residual-based procedure and/or Johansen and Juselius (1990) with system-based reduced rank regression are two of the analyses that deal with long-run relationships (cointegration) among macroeconomic variables. Since these techniques require integrated variables in a specific order, it is not appropriate to adopt them onto level relationship analyses.

Inadequacy of the cointegration tests that require specific order patterns for macroeconomic variables was partially solved after the Pesaran et al. (2001) have developed the bounds testing approach to cointegration (ARDL analysis). According to the concept of this analysis, the integration order of the variables does not matter for investigating the long-run relationship among variables in interest. Additively, Pesaran and Shin (1999) suggested that, irrespective of the underlying variables have different integration orders, the ARDL procedure yields consistent estimates of the long-run parameters by performing better in data sets with small sample size properties.

The bounds testing approach requires estimating the following ARDL representation of the theoretical inflation model that was augmented by including the import:

$$\Delta \ln INF_t = a_0 + \sum_{i=1}^{p} a_{1i} \Delta \ln INF_{t-i} + \sum_{i=0}^{p} a_{2i} \Delta \ln DIFF_{t-i} + \sum_{i=0}^{p} a_{3i} \Delta \ln IMP_{t-i} + \theta_1 \ln INF_{t-1} + \theta_2 \ln DIFF_{t-1} \quad (2)$$
$$+ \theta_3 \ln IMP_{t-1} + u_t$$

where u reflects the error term, p presents the lag length and Δ is the difference operator. There are two stages in the bounds testing analysis. The first one is to determine the existence of cointegration by testing proper hypotheses defined as $H_0: \theta_1 = \theta_2 = \theta_3 = 0$ and $H_1: \theta_1 \neq 0, \theta_2 \neq 0, \theta_3 \neq 0$. The procedure relies upon the classical F-statistic and two different types of critical values estimated by Pesaran et al. (2001) for deciding the availability of the link of cointegration. According to these separate critical values, all the variables in process are assumed as I(0) and I(1), respectively. Separation of the critical values makes all possible classifications of the variables covered by a bound. The rejection of the null hypothesis supports cointegration, whereas accepting the null refers no-cointegration. In addition, it may be benefited from the error-correction term, if separate bounds yield inconclusive results. Cointegration exists, if the error-correction term is negative and statistically significant.

Estimating the error-correction mechanism (ECM) is the next step of the ARDL cointegration analysis. It requires following transformation of equation (2):

$$\Delta \ln INF_t = \alpha + \sum_{i=1}^{p} \omega_k \Delta \ln INF_{t-i} + \sum_{i=0}^{p} \lambda_k \Delta \ln DIFF_{t-i} + \sum_{i=0}^{p} \delta_k \Delta \ln IMP_{t-i} + \varpi EC_{t-1} + u_t \quad (3)$$

where the residual of equation (2) is proxied by EC and the coefficient of it namely □ □ present the term of error correction (ECT).

Given that the parameter stability is not guaranteed by the cointegration relationship, it requires an extra step in order to prove the stability of the coefficients. Thus, the ARDL analysis generally goes alongside with cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) statistics of Brown et al. (1975). Accordingly, recursive regression residuals constitute the concept of these statistics. For proving stability, model's break points are used against the recursively updated CUSUM and CUSUMSQ statistics. Estimated model is said to be stable, if the break points cover the statistics.

4. Findings

Since conducting a stationary analysis is not necessary for the bounds testing framework, the Augmented Dickey-Fuller (ADF) test was adopted

for dealing with one of the most important time series properties of included variables. As shown below, variables in interest are stationary in level and/or first difference, and performing the bounds testing methodology is a proper choice for the purpose in consideration.

Table 2. Unit root test results

		Test
Level	Variables	ADF
Intercept	ln*INF*	-1.752 (0.40)
	ln*DIFF*	-2.302 (0.17)
	ln*IMP*	-1.157 (0.68)
Intercept+Trend	ln*INF*	-1.625 (0.77)
	ln*DIFF*	-2.243 (0.45)
	ln*IMP*	-1.894 (0.64)
First-Difference		
Intercept	ln*INF*	-7.886 (0.00)
	ln*DIFF*	-9.375 (0.00)
	ln*IMP*	-7.472 (0.00)
Intercept+Trend	ln*INF*	-8.013 (0.00)
	ln*DIFF*	-9.567 (0.00)
	ln*IMP*	-7.470 (0.00)

Numbers in parentheses are p-values.

Panel A in Table 3 illustrates the F-statistic and error-correction term that were utilized for deciding whether considered variables are cointegrated or not. Accordingly, either F-statistic or ECT support the cointegration relationship among variables in consideration.

Panel B in Table 3 presents the long-run cointegration vector. Obviously, coefficients of lnDIFF and lnIMP are statistically significant and positive. Accordingly, 1% increase in the difference of money growth and income growth raises the inflation rate by 1.06%. This result supports the validity of the Monetarist Inflation Theory in Turkish Economy. On the other hand, 1% increase in imports raises the inflation rate by 0.45%. This finding implies that the more the Turkish Economy imports, the higher it suffers from inflation.

Panel C in Table 3 shows the short-run regression relation of inflation-import nexus. Findings reveal that, despite the coefficient of the lnDIFF is relatively low, it is still statistically significant and it has positive impact on inflation. Accordingly, 1% increase in the difference of money growth and income growth in the short-run raises the inflation by 0.40%. However, since the lnIMP has no statistically significant coefficient, it is not possible to make any interpretation.

Panel D at Table 3 indicates the diagnostic checking results for the considered ARDL model. Accordingly, the assumptions of normality, no-functional misspecification, homoscedasticity and no-serial correlation were not violated.

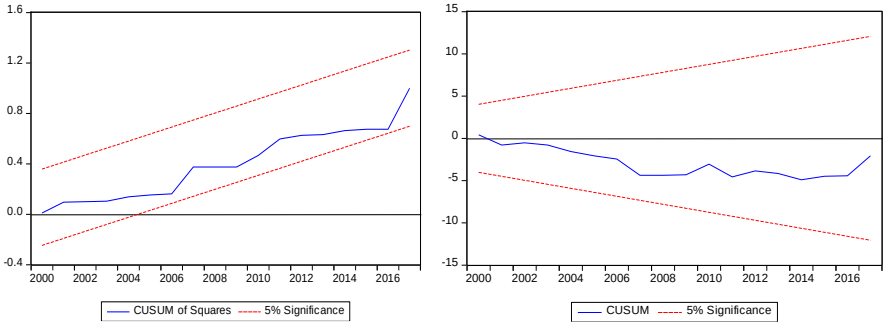
Table 3: Estimation results

	Dependent variable ln*INF*
Panel A	
F-stat	7.65
ECT	-2.134 [0.00]
Panel B	
ln*DIFF*	1.06 [0.00]
ln*IMP*	0.45 [0.01]
Panel C	
ln*DIFF*	0.40 [0.00]
ln*IMP*	0.24 [0.43]
Panel D	
Adj-R^2	0.91
Normality[a]	1.08 [0.58]
Functional Form[b]	0.02 [0.88]
Heteroscedasticity[c]	1.74 [0.18]
Serial Correlation[d]	0.17 [0.68]
Panel E	
CUSUMSQ	S
CUSUM	S

(4.19-5.06), (4.87-5.85), and (6.34-7.52) are the critical values that were provided in Table CI(v) Case V at Pesaran et al. (2001) for 10, 5, and 1 percent level of significance, respectively.
a: The Jarque–Bera test
b: The Ramsey Reset test
c: The White test
d: The Breusch–Godfrey LM test
Stable model is proxied by "S".
The brackets contain p-values.

Finally, according to the CUSUM and CUSUMSQ test results demonstrated at Panel E in Table 3 and graphs demonstrated in Figure 1, the ARDL output has stable long-run parameters at 5 percent level of significance.

Figure 1: Graphs of Stability Checking



Conclusion

In this study, the long and short-run impacts of import on inflation in the Turkish economy were examined by using annual time series data for the period 1961-2017. Thus, study utilized the bounds testing approach to cointegration and estimated an inflation model that contains the Monetarist and Structuralist inflation motives.

Results showed that views of the both Monetarist and Structuralist approaches hold for the explanation of Turkish inflation pattern for the period in consideration. Accordingly, domestic inflation in Turkey basically stems from monetary issues and it is also import driven. In this sense, findings of Dexter et al. (2005), Ogbokor and Sunde (2011), Muktadir-Al-Mukit et al. (2013), Munepapa and Sheefeni (2017) and Ahmed et al. (2018) who support the view that domestic inflation is also import driven are consistent with present findings. This result implies a policy that utilizes increased import instead of (or with) controlling money growth for stabilizing general price level may result in undesirable consequence in the Turkish economy. Thus, policy makers had better find ways to decrease total import volume. In this context, it is urgent to produce domestic production goods and substitute them with the imported ones. Given that the largest amount of Turkish import stems from non-renewable energy products, focusing more on renewable energy sources and adopting renewable energy products to domestic production may be beneficial for easing Turkish import volume.

Finally, since this is the first attempt for the Turkish economy, the current study analyzes the impact of total import on inflation. Disaggregating import into micro components such as import of consumption, intermediate and capital goods may create an opportunity for the future research.

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