


THE PASS-THROUGH EFFECT OF EXCHANGE RATES ON PRICES: THE CASE OF TÜRKİYE

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Abstract

Post-globalization price level developments affect inflation through imports within the country groups that countries trade with. In addition, with the floating exchange rate and open inflation targeting of many countries, the effect of the exchange rate on purchasing power is increasing day by day. Especially the fluctuations in the exchange rate have become an important issue recently due to the pass-through effect on domestic prices.

In this study, the pass-through effect of exchange rates to real prices and the factors affecting this are discussed, and inflationary pressure is especially emphasized. In the research conducted, vector autoregression (VAR) analysis was conducted between the period 2005:05 - 2018:02, and the pass-through effect of the exchange rate on producer and consumer prices was examined for Turkey.

Keywords: Exchange Rates, Pass-through Effect, Inflation

Jel Classification: E31, F31, E44

Özet

Küreselleşme sonrası fiyat düzeyinde meydana gelen gelişmeler ülkelerin ticaret içinde oldukları ülke grupları içindeki ithalatları yoluyla enflasyon üzerinde etkili olmaktadır. Ayrıca birçok ülkenin dalgalı kur ve açık enflasyon hedeflemesi ile birlikte döviz kurunun satın alım gücü üzerinden etkisi gün geçtikçe artmaktadır. Özellikle döviz kurunda yaşanan dalgalanmalar yurtiçi fiyatlara olan geçiş etkisi nedeniyle son dönemde önem arz eden bir konu olmuştur.

Bu çalışmada da döviz kurlarının reel fiyatlara geçiş etkisi ve bunu etkileyen faktörlere değinilerek özellikle enflasyonist baskı üzerinde durulmuştur. Yapılan araştırmada 2005:05 – 2018:02 dönemi arasında vektör otoregresyon (VAR) analizi yapılmış, döviz kurunun üretici ve tüketici fiyatları üzerindeki geçiş etkisi Türkiye için incelenmiştir.

Anahtar Kelimeler: Döviz Kurları, Geçiş Etkisi, Enflasyon

Jel Sınıflandırması: E31, F31, E44

INTRODUCTION

Exchange rates are at the center of many discussions on the international economy due to their important role in macroeconomic stability. The issue of the pass-through effect of exchange rate changes on domestic prices has become an important area of research in terms of monetary and exchange rate policies. This situation is even more important in countries where inflation targeting regimes are implemented. The reason for this is that low exchange rate pass-through will provide more freedom for sustainable independent monetary policies and will also facilitate the achievement of inflation targets by central banks.

Exchange rate pass-through cannot be explained in a single pattern. The reason for this is that the pass-through effect on domestic prices can vary depending on many factors such as the structure of the market in that country, pricing policy, substitutability of the product, general inflation conditions, the relative share of imported goods in the producer and consumer price index basket, effective exchange rate policy, the presence of non-traded goods among traded goods, the inflexibility of prices and wages of non-traded goods, and the market share of goods subject to foreign trade (Shah, 2005).

In this context, the effect of the pass-through from exchange rates to domestic prices was examined by taking into account the conditions of the Turkish economy. In the second part of the study, references were made to studies conducted in the literature on the subject, and in the third part; the relationship between exchange rates and prices was discussed, and the process of the pass-through effect and the pass-through effect in developing countries were examined. In the fourth part of the study, the pass-through effect of exchange rates on producer and consumer prices was examined for Turkey using vector autoregression (VAR) models between the period 2005:05 - 2018:02. In the conclusion part of the study, the results of the VAR analysis of the pass-through effect were evaluated.

LITERATURE REVIEW

Indeed, the pass-through effect from exchange rates to prices is at the center of discussions on monetary policy implementation and exchange rate regime, and is a frequently cited issue in terms of financial and macroeconomic stability due to its role in the transmission of external shocks (Damar, 2010).

Rossi (2002) examined the relationship between changes in nominal exchange rates and price levels in the 1994-2002 period. In the study where VAR analysis was used, it was emphasized that the pass-through effect ended after 1 year and that this effect was mostly felt in the first 4 months. It also argued that the pass-through effect started and ended earlier in

Turkey compared to other developing countries, and in addition, it had a greater effect compared to other countries.

Peker (2008) analyzed the exchange rate pass-through in the Turkish economy for the 1987-2006 period using the VAR method. According to empirical evidence, exchange rate shocks explain approximately 72% of the forecast error variance of prices in the medium and long term, and therefore, it has been concluded that exchange rate is an important source of national inflation.

In the study of Sever (2007), the relationships between exchange rate and inflation rate in Turkey were analyzed with the VAR method using data from the period 1987:01 and 2006:06. According to the findings obtained from the study, it was concluded that exchange rate changes have a high effect on inflation and interest rates, and exchange rate stability is an important factor in stabilizing inflation and interest rates.

In the study of Korkmaz (2015), the reflection of the nominal exchange rate on domestic prices was examined using a data set covering the period 2008:1 and 2014:11. As a result of the analysis, the existence of a long-term relationship between the nominal exchange rate, CPI and PPI variables was determined. According to the results of the Granger causality test, unidirectional causality was found from the exchange rate to the producer price index and from the consumer price index to the exchange rate.

Exchange Rate Pass-Through Effect: Conceptual Framework and Theory

The direction and speed of the changes in the exchange rate affecting domestic prices has become an important area of research. The transition effect, which is based on the law of one price and purchasing power parity, is the change caused by a one-unit change in the nominal exchange rate in domestic (national currency) import and foreign (foreign currency) export prices (Ari, 2010). Therefore, the transition effect of the exchange rate can also be briefly expressed as the percentage change in local prices due to a 1% unit change in the exchange rate. Knowing the speed and degree of the transition of exchange rate changes to domestic prices is of great importance for developing countries targeting inflation. As can be seen in the studies conducted in the literature, it is accepted that the transition effect of shocks experienced in the exchange rate channel on domestic prices is especially fast and high in the developing country group. Here, the effect and magnitude of the transition speed are important for these country groups in terms of controlling inflation.

The Process of the Pass-Through Effect on Prices

In studies analyzing the relationship between exchange rates and prices, the “law of one price” is shown as the theoretical starting point. Based on the theory, even if foreign prices remain constant, if the exchange rate appreciates and the domestic currency depreciates, it will cause import prices to increase or, conversely, prices to decrease. The high or low import prices through the exchange rate channel are also fundamental points in determining domestic prices. In addition, the reaction that the effect experienced here will create on local prices (transition effect) is as important as the high prices.

Especially in exchange rate-based price movements, the fundamental element affecting domestic prices is the costs of companies, which are the determinants of the input-output spiral. The high dependency on intermediate goods imports, especially in developing countries, causes cost inflation in the face of shocks in the exchange rate. The reflection of shocks to be experienced in the exchange rate on domestic sales prices by companies is also one of the overlooked details. Theoretically; If the firm reflects the changes in the exchange rate to its own domestic sales prices at a rate of 1/1, this is called the full pass-through effect, while if it reflects the changes in the exchange rate to the prices at an amount less than 1 unit against a 1-unit shock, it is defined as the partial pass-through effect.

There is a distinction that needs to be addressed here and is frequently encountered in studies in the literature. The mechanisms by which exchange rate changes affect domestic prices are divided into two. In the direct transmission mechanism, the change in the prices of imported raw materials or intermediate goods affects domestic production costs, and the change in the prices of final goods has a direct effect on domestic prices (Damar, 2010). In the indirect transmission mechanism, the depreciation of the national currency makes exported goods cheaper, causing an increase in demand for exported goods. As a result of the expensive imports, domestic demand turns to exported goods and imported substitutes, and increasing competition increases the prices of traded products. Thus, there is an increase in the prices of exported goods and substitutes. In addition, consumer prices increase by suppressing labor wages due to the increase in demand for imported substitutes and exported goods produced within the country. On the other hand, increasing costs and inflation will increase inflation expectations and wage demand, thus increasing inflation again (Shah, 2005).

Transition Effect and Applicable Monetary Policy

The fluctuations in exchange rates create cost-push inflation through price indices. In this case, it is one of the problems that all central banks need to solve. Since the effect creates greater

vulnerabilities in developing countries, the policies that central banks will implement, although it is an external shock, are also determinant on the pass-through effect to domestic prices. This study conducted on Turkey also uses basic solutions to reduce the inflationary pressures of exchange rate developments based on the literature. These solutions are;

- i. The most common use is to increase the policy rate. However, interest rate increases are usually made due to shocks in the exchange rate. Although it is intended to be used as a last resort, it is the most effective solution against the uncertainty experienced on the exchange rate. Generally, interest rate increases are made in order to suppress the exchange rate due to the increase in volatility after negative developments in the exchange rate during the relevant period. Here, the fact that the increase in the exchange rate affects inflation in the short term creates a short-term solution proposal for the interest rate increase on the exchange rate. However, the fact that the increase in interest rates also affects many macroeconomic items in the long term actually shows the negative effect of the deterioration in prices due to the transition effect of negative developments in the exchange rate on the economy in the long term.
- ii. It is the use of foreign exchange buying/selling transactions through open market transactions, which are used by central banks before interest and are called “pouring water on the fire”. Although the aim is generally to suppress the exchange rate by increasing the foreign exchange supply in the market during movements in the exchange rate, it is also possible that central banks do not have the authority to issue foreign exchange and that if this channel is used frequently, it will create the opposite effect of the expectation by decreasing the reserves. Especially when the crises of 1994 and 1997 are taken into consideration, the problems experienced in the foreign exchange channel due to speculative attacks have put central banks in a difficult situation and have exposed the “reserve” problem.
- iii. The central bank needs to follow a long-term program in inflation targeting. However, a program focused on core inflation can be implemented in addition to this. However, removing food and energy prices, which are affected by exchange rates and seasonal conditions, from this program will not create a realistic solution, especially in terms of production. Since developed countries mostly have intermediate goods import dependency in production, it is impossible for this input, which is directly affected by exchange rates, not to be reflected in prices. Although it is assumed that companies will accept the cost here until the break-even point, it is clear that it will reflect it on prices

after a while. Keeping price increases outside of inflation will not create a permanent solution.

- iv. In the literature, it is possible to present the studies on the independence of central banks as a suggestion at this point. It is generally desired that central banks act in line with government and fiscal policies as well as instrument independence. The occurrence of a situation outside this expectation causes speculation and uncertainty in the markets. The fact that uncertainty increases risk appetite also causes volatility to increase in exchange rates. In order to prevent possible negative effects, the fact that policy makers and the central bank act in line here also reduces the shock effect that may be experienced in the exchange rate.

Although the central bank has switched to inflation targeting, the change in the exchange rate can increase the import prices and thus inflation even if the prices of imported goods do not change in the international market due to the high import dependency of the economy. Especially in our country, where the weight of imported goods in the production function consists of investment and intermediate goods, and exchange rate fluctuations are high, it is extremely important to test the effect of exchange rate changes on inflation.

DATA AND METHODOLOGY

In the investigation of the pass-through effect of exchange rate shocks on producer and consumer prices, the work of McCarty (2000) was generally used as a reference method in modeling. In this study, the reference method was followed in VAR analysis and the pass-through effect was investigated between the periods of 2005:05 and 2018:02 in Turkey.

Data

For the relevant period, PPI (ufe), CPI (tufe), Import Unit Value Index (ibde), Real Effective Exchange Rate (rer) and Industrial Production Index (sue) variables were used.

Empirical Analysis

In case econometric techniques are used in economic analyses, the first step is to investigate the statistical properties of the time series to be analyzed. Because the assumptions made in the development of the econometric techniques to be applied should not be neglected. The first step in this process is that the time series used meet the stationarity criterion. Stationarity is defined as the time series data not continuously increasing or decreasing in a certain period of time, and the data showing scattering along a horizontal axis throughout time. In more technical terms, it is said that “a probabilistic process whose mean and variance do not change over time and whose common variance between two periods depends only on the

distance between the two periods, not on the period in which this common variance is calculated, is stationary” (Gujarati, 1999). In order to analyze the results of the pass-through effect of the exchange rate on domestic prices, the stationarity of the variables was first examined and the seasonality problem was resolved.

The investigation of whether the time series is stationary or not is carried out through unit root tests. Dickey-Fuller's (1979, 1981) parametric unit root tests DF and ADF and Phillips-Perron's (1988) nonparametric unit root test PP are widely used in determining stationarity. With these tests, it is possible to determine whether the time series is stationary or not, and if it is not stationary with the level value, how many times it becomes stationary when it is differenced. Stationarity properties and integration degrees related to the data are determined using the Extended Dickey-Fuller (ADF) test. The DF statistics obtained as a result of these tests are compared with the MacKinnon (1996) critical values, the following hypotheses are tested, and the seasonality problem is resolved by examining their stationarity.

$$H_0 : \delta = 0 \rightarrow \text{The series is not stationary (There is a unit root)}$$

$$H_1 : \delta \neq 0 \rightarrow \text{The series is stationary (There is no unit root)}$$

The null hypothesis states that the series is non-stationary, that is, it has a unit root, while the alternative hypothesis states that the series is stationary.

Table 1. ADF Test for Stationarity of Variables

Level	Constant		Constant & Trend	
	t-stat	p-value	t-stat	p-value
<i>libde</i>	-2.156197	0.2234	-1.774858	0.7122
<i>lrer</i>	-1.008993	0.7493	-3.009381	0.1332
<i>lsue</i>	0.563018	0.9883	-1.615027	0.7827
<i>ltufe</i>	4.949458	1.0000	2.530726	1.0000
<i>lufe</i>	2.751795	1.0000	1.119663	0.9999
1 st Difference	t-stat	p-value	t-stat	p-value
<i>libde</i>	-6.449043	0.0000*	-9.435492	0.0000*
<i>lrer</i>	-7.058195	0.0000*	-7.105538	0.0000*
<i>lsue</i>	-14.91051	0.0000*	-14.96680	0.0000*
<i>ltufe</i>	-2.934506	0.0439**	-10.25204	0.0000*
<i>lufe</i>	-6.720330	0.0000*	-4.408801	0.0029*

*: %1, **: %5 and ***: %10

The test results were evaluated according to MacKinnon 5% critical values. As a result of the test, it was seen that the variables were not stationary at levels in the case of constant and trend, but became stationary when their first differences were taken. The first step in the model's

estimation process is to determine the appropriate number of lags for the VAR model to be used in the analysis.

Table 2. Number of Lags AIC Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1661.127	NA	15622.55	23.84578	24.26404	24.01575
1	-1587.740	137.4059	7870.838	23.15944	24.10053*	23.54186*
2	-1548.540	70.61575	6450.504	22.95802	24.42194	23.55290
3	-1518.129	52.62642	6003.651	22.88126	24.86802	23.68861
4	-1484.668	55.53176	5370.018	22.76124	25.27082	23.78105
5	-1454.908	47.27768	5085.276	22.69373	25.72614	23.92600
6	-1428.272	40.42687	5062.274*	22.67052*	26.22576	24.11525
7	-1417.871	15.04819	6387.986	22.87760	26.95567	24.53478
8	-1381.296	50.32187*	5606.580	22.71342	27.31433	24.58307
9	-1355.796	33.27709	5813.523	22.70633	27.83006	24.78843
10	-1343.373	15.33082	7339.348	22.88472	28.53128	25.17929
11	-1313.146	35.15764	7293.852	22.81058	28.97997	25.31761
12	-1291.930	23.17148	8365.664	22.86426	29.55648	25.58375

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Since there are monthly data here, a 12-month lag was entered and as a result, the lag number in the AIC information criterion of the model was determined as 6.

After determining the lag number, autocorrelation and heteroscedasticity tests were performed on the errors of the VAR analysis, respectively.

Table 3. Aurocorrelation

Lags	LM-Stat	Prob
1	14.13125	0.9594
2	22.65154	0.5979
3	26.15862	0.3992
4	33.05369	0.1297
5	27.14695	0.3486
6	20.99975	0.6926
7	15.94276	0.9165
8	28.68329	0.2774
9	21.62540	0.6573
10	24.95937	0.4647
11	13.01856	0.9763

12	32.18278	0.1528
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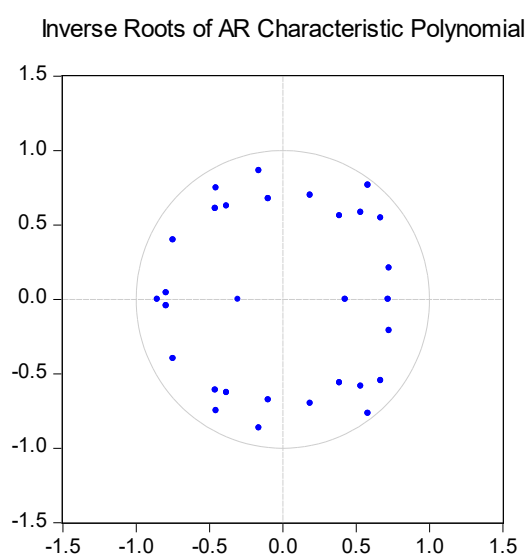
Probs from chi-square with 25 df.

Table 4. Heteroscedasticity Test

Chi-sq	df	Prob.
969.8379	960	0.4056

When we look at the results in the table, it is seen that there is no problem of autocorrelation or heteroscedasticity in the model.

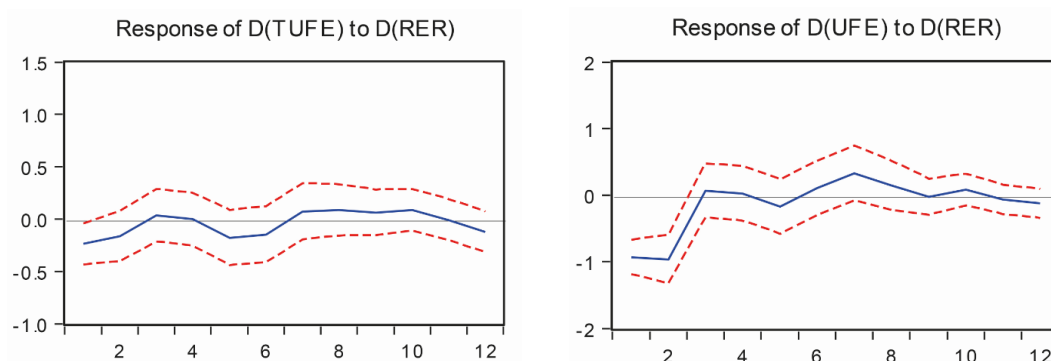
Figure 1. Characteristic Polynomial Roots Graph (AR Roots Graph)



In the last part of the study, the characteristic polynomial roots of the model should be examined to test the stability of the model. As seen in Figure 1, since all the roots are located within the unit circle, it can be said that the VAR model is stable. In the interpretation phase of the VAR model, impulse-response functions are used. The aim here is to examine the sensitivity of the dependent variables in the model to shocks belonging to other variables.

While calculating the exchange rate pass-through effect, the method used is the ratio of the cumulative action-reaction coefficient of the price indices to the exchange rate to the cumulative action-reaction coefficient of the exchange rate itself (Kara & Ögünç, 2007).

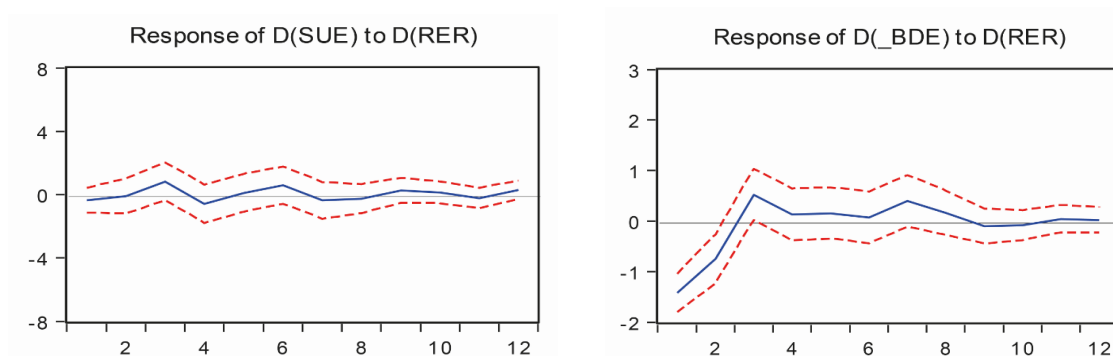
Figure 2. Response of CPI and PPI to Real Effective Exchange Rate Shock



According to the results obtained from the impulse-response analysis, consumer prices respond to the shock in the real effective exchange rate by -0.30 in the 1st month, 0.1 in the 3rd month, -0.20 in the 5th and 6th months, and 0.1 units from the 7th month to the 11th month, while the transition effect ends in the 11th month.

The response of producer prices to the shock in the real effective exchange rate is higher. While the PPI reacts by -1.0 in the first 2 months, 0.10 in the 3rd month and 0.4 in the 7th month, the transition effect ends in the 9th month.

Figure 3. Response of Import Unit Value Index and Industrial Production Index to Real Effective Exchange Rate Shock



In addition, fluctuations in the real effective exchange rate have also had an impact on the “Import Unit Value Index” and “Industrial Production Index” variables. While the industrial production index did not respond to the shock in the exchange rate in the first 2 months, it responded by 0.30 in the 3rd month and the transition effect ended in the 7th month.

The import unit value index also responded by -1.50 in the first month and 0.60 in the 3rd month, while the transition effect ended in the 7th month.

CONCLUSION

In Turkey, the exchange rate is one of the most important determinants of inflation and the monetary transmission mechanism. On the other hand, knowing the speed and degree of the transition effect also allows appropriate assessments to be made about the transmission of monetary policy towards inflation forecasts. The main reasons for the low transition effect are; firms changing their profit margins instead of making price adjustments in order not to lose market shares, the substitution effect that occurs when lower quality goods are consumed instead of imported goods as a result of the increase in the prices of these goods, the use of alternative goods instead of imported intermediate goods used in the production phase and other cost reduction methods. It is generally seen that the transition effect ends at the end of the first year in PPI and CPI, and although the transition effect is low, the reason why the transition effect on PPI is larger and faster compared to CPI can be explained by the high level of dependency on imported inputs and the fact that the price increases in imported goods in response to exchange rate changes are easily reflected in the PPI index.

REFERENCES

- Arı, A. (2010). Fear of Volatility and the Exchange Rate Pass-Through Effect. *Journal of Yasar University, Cilt 17, Sayı 5*, 2832 - 2841.
- Damar, A. O. (2010, Haziran). Examining the Pass-Through Effect from Exchange Rates to Prices in Türkiye. *CBRT General Directorate of Markets Specialization Qualification Thesis*, 4.
- Gujarati, D. (1999). Basic Econometrics. In D. Gujarati, *Basic Econometrics* (p. 713). İstanbul: Literatür Publishing.
- Hyder, Z., & Shah, S. (2005). Exchange Rate Pass-Through to Domestic Prices in Pakistan. *EconWPA*, 19.
- Kara, H., & Ögünç, F. (2007). Inflation Targeting and Exchange Rate Pass-Through: The Turkish Experience. *Central Bank of the Republic of Turkey*, 1-22.
- Korkmaz, S., & Bayır, M. (2015). The Effect of Exchange Rate Fluctuations on Domestic Prices. *Nigde University Journal of Faculty of Economics and Administrative Sciences, Volume 8, Issue 4*, 69-85.
- Leigh, D., & Rossi, M. (2002). Exchange Rate Pass-Through in Turkey. *IMF Working Paper*, 1-19.
- Peker, O., & Görmüş, Ş. (2008). Inflationary Effects of Exchange Rates in Türkiye. *Süleyman Demirel University Faculty of Economics and Administrative Sciences Journal*, 187 - 202.
- Sever, E., & Mızrak, Z. (2007). Relationships Between Exchange Rate, Inflation and Interest Rate: Türkiye Application. *Journal of Social Economic Research, Volume 7, Issue 13*, 264 - 283.

Annex – 1 : Impulse – Response Graphs

