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Exchange Rate Pass-Through into Import Prices: Evidence from Türkiye during 2010-2020 Period

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Abstract

This article analyses pass through of exchange rates into the import prices for an emerging economy, Türkiye, which faced severe fluctuations in the nominal exchange rate in the recent years, and experienced significant increases in domestic prices. The Turkish economy continues to struggle due to high inflationary pressures and a steep Turkish Lira (TL) devaluation particularly after 2017. This study aimed at examining the relationship between exchange rate and import prices using quarterly data for the period of 2010q1-2019q1, while the empirical methodology is framed in the multivariate cointegration analysis, along with the application of the Johansen cointegration test and the development of an autoregressive error correction vector for the determination of the pass-through in the long term. Our findings show that 85.6% of the fluctuations of the nominal exchange rate are transmitted to the import prices in the mentioned period, slower than the findings of the study by Akgunduz and his colleagues as the difference of import prices from its long-run relationship implied by the real exchange rate is likely dominated by energy prices in a strong manner. Second significant finding derives from the parameter that measures the speed of the pass-through, whose estimate has been found as -0.0125, inferring that the adjustment in short-term imbalances between import prices and the nominal exchange rate through changes in import prices is rather slow.

Keywords: *Exchange rate pass through, import prices, Türkiye.*

Öz

Bu çalışma, nominal döviz kurunda önemli dalgalanmalar ve yurt içi fiyatlarda artış yaşamakta olan gelişmekte olan ekonomilerden biri olan Türkiye'deki döviz kuru geçişkenliğinin ithalat fiyatları üzerindeki etkisini incelemektedir. Türkiye ekonomisi özellikle 2017'den bu yana yüksek enflasyon ve Türk Lirası'ndaki değer kaybı nedeniyle baskı altında kalmayı sürdürmektedir. Araştırma, 2010 ilk çeyreğinden 2019 yılı ilk çeyreğine kadar üç aylık verileri kullanarak döviz kurları ile ithalat fiyatları arasındaki ilişkiye odaklanmaktadır. Çalışma, uzun vadeli geçiş etkisini analiz etmek için çok değişkenli eşbütünleşme analizi, Johansen eşbütünleşme testi ve otoregresif hata düzeltme vektörünü kullanmaktadır. Sonuçlar, belirtilen dönemde nominal döviz kuru dalgalanmalarının %85,6'sının ithalat fiyatlarını etkilediğini, enerji fiyatlarının ithalat fiyatları üzerindeki etkisi sebebiyle Akgunduz ve arkadaşlarının 2020 yılında yaptıkları çalışma ile kıyaslandığında daha yavaş bir geçişkenliğin var olduğunu göstermektedir. Çalışmanın bir diğer önemli bulgusu ise geçiş hızına ilişkin tahmin edilen parametrenin -0,0125 olması, bunun da ithalat fiyatları ile nominal döviz kuru arasındaki kısa vadeli dengesizliklerin kademeli olarak düzeltildiğini göstermesidir.

Anahtar Kelimeler: *Döviz kuru geçişkenliği, ithalat fiyatları, Türkiye*

Introduction

Globalization has encouraged the international integration of emerging markets to grow in addition to developed ones, as stated by Peynirci (2023). Despite Turkish economy followed a fluctuating course after 1980s partly due to multifaceted political and economic circumstances, the economy continued to grow fast thanks to implementations of various economic reforms and execution of agreements such as the Customs Union (CU) in 1996 concerted with the European Union (EU), which led the economy to transform, as Ketenci (2014) emphasized.

Türkiye was hit hardly by the domestic financial crisis, which burst out in the banking sector in late 2000 and early 2001. The crises can be regarded as a milestone since it ignited the applications of the new set of economic reforms that targeted to put the economy back on track. After financial crisis, significant economic and political developments gave momentum to the integration of Turkish economy into world markets: Formal accession negotiations started with the EU in 2004, 6 zeros were knocked off from TL in 2005, various laws and regulations were harmonized with the EU acquis, foreign direct investments (FDI) into the country amounted to U.S. Dollar (USD) 19 billion in 2007, which was the highest in modern Turkish history, thanks to mentioned reforms. One other major change during this period was Türkiye adopting the inflation targeting regime after 2003.

Mentioned scenario partly changed particularly after 2010/11. Economic problems started to re-arise particularly following 2010 as trade deficits grew, foreign direct investments fell, and Türkiye had difficulties in managing to keep the inflation under control. Although exchange rate pass-through (ERPT) to inflation shrank after the adoption of inflation targeting regime in 2003, as Bari (2020) highlighted, its contribution to the consumer price index (CPI) and producer price index (PPI) in addition to its link with import prices were remarkable in this period. Figures 1 and 2 below show how Turkish foreign trade, and CPI changed between 2010 and 2020, respectively.

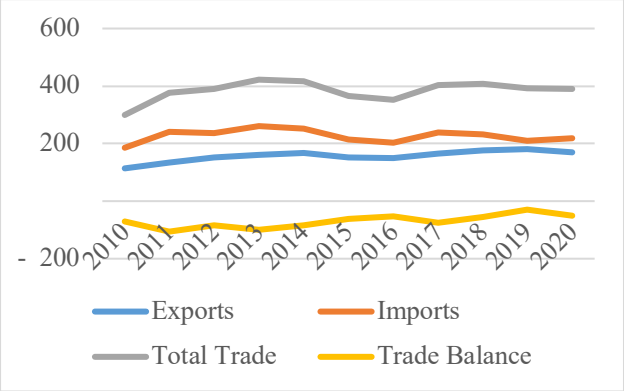

Figure 1. Turkish Foreign Trade (in Billion U.S. Dollar) 2010-2020.

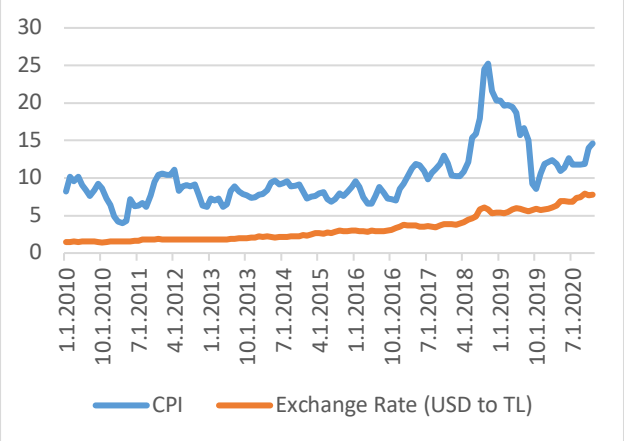

Figure 2. Consumer Price Index (%, Year over Year), USD/TL Exchange Rate, 2010-2020

According to Figure 1, Türkiye's foreign trade followed a fluctuating course between 2010 and 2020 while the trade deficit was persistent during this decade. The CPI spiked particularly after 2016 and hit its peak in 2018, as shown in Figure 2. There was no correlation detected between CPI and foreign trade as depicted.

In this framework, scholars claim that the relatively stable economic environment of Türkiye deteriorated after 2010s as the investments slowed down, the inflation rates increased, current account deficit (CAD) grew, and economic vulnerabilities accelerated. To illustrate it, TL severely depreciated against major currencies. Despite USD/TL rate stood at 1.49 as of December 31, 2010, the rate rose to 5.95 as of December 31, 2019. These fluctuations likely impacted Türkiye's foreign trade through the channels of export and import prices and impacting domestic inflation.

In line with this, the purpose of this paper is to evaluate the pass-through of the exchange rates to the import prices in Türkiye during 2010 and 2019 through analyzing the degree and speed of adjustment to the equilibrium of ERPT.

To answer this question, at a theoretical level, we rely on the approach developed by Campa and Goldberg (2005), while the empirical development is framed in the multivariate cointegration analysis, with the application of the Johansen Cointegration Test (JCT) and the development of an autoregressive error correction (EC) vector for the determination of the long run pass-through. Considering that Türkiye frequently experience fluctuations in the nominal exchange rate, trade balance coupled with surges in inflation, this paper motivates the choice of Türkiye in a view to analyse specific economic dynamics and transmission mechanisms in this emerging market. The estimation of ERPT is based on the data covering the period 2010q1-2019q1. [1]The reason why this time interval is taken into consideration is that Türkiye experienced various economic undulations in this period, as noted above.

The paper is organized as follows: Section 1 provides an introduction, Section 2 conveys literature review, Section 3 specifies the economical formulation and econometric formulation, Section 4 demonstrates the empirical strategy, Section 5 provides the empirical results and last section conveys conclusions. In this study, firstly a literature review is conducted. Then, the findings obtained are evaluated by making an analysis with the econometric data. The findings are commentated afterwards.

Literature Review

As mentioned above, the studies which addressed the mechanism of exchange rate pass-through to inflation, namely ERPT, are discussed in this section. The mechanism of ERPT to import prices has been largely analyzed in the literature, be it from a cointegration framework or a static framework, as the behavior of import prices is certainly important in the formulation of optimal monetary policies to maintain stable inflation and macroeconomy.

Global integration has led to an increase in the interconnectedness of foreign trade markets, serving as a conduit for the transmission of domestic economic developments, such as fluctuations in exchange rates, onto export and import prices. This phenomenon has been highlighted by Aron, Macdonald, and Muellbauer (2014), among others. The empirical models examined the extent of complete, delayed, and incomplete ERPT, as well as the apparent decline in ERPT in certain countries since the 1980s, in relation to aggregate import prices and domestic consumer price indices. Scholars have made significant contributions to the analysis of ERPT by studying cases from various countries, as noted below.

Numerous studies have focused on the impact of exchange rate fluctuations on import prices, including works by Swamy and Thurman (1994), Webber (1999), Campa and Goldberg (2002), and Barhoumi (2006). These studies try to answer the following question: How does the exchange rate influence domestic consumer prices through the prices of imported consumer goods and imported inputs used in domestic production?

The standard models assume ERPT is linear (in logs of prices and the exchange rate), while other research also investigated asymmetries in price responses to exchange rate fluctuations, as illustrated by Bussière (2007), Marazzi & Sheets (2007), Coughlin & Pollard (2003). Much literature investigates a different non-linearity: apparent secular declines in ERPT with structural/regime changes.

Various industry-specific factors can result in a wide range of exchange rate pass-through effects on domestic prices, as highlighted by Goldberg (2005), McCarthy (2007), and Bhattrai and Schoenle (2014). This means that different industries may show varying responses in domestic prices to fluctuations in exchange rates. One possible explanation is the shift from uniform raw materials

[1] *Complete data set showing Exchange Rate Pass Through dynamics is available at https://figshare.com/articles/dataset/DataPassThrough_xls/12420701*

in the trading basket (which adjust prices quickly) to diverse manufactured goods and services, as discussed by Campa and Goldberg (2002). Another factor could be the changing geographical distribution of trading partners, such as Chinese imports impacting the exchange rate pass-through in the United States, as noted by Marazzi and Sheets (2007).

A significant macro-explanation is the implementation of transparent and stable monetary policies, following Taylor (2000). Until recently, there have been limited studies testing these hypotheses on trade and domestic prices in emerging markets and developing countries. These economies, which are small, open, and heavily reliant on trade, possess unique characteristics that can complicate the estimation of exchange rate pass-through, as emphasized by Aron, Macdonald, and Muellbauer (2014).

Despite this, there is an ongoing increase in the literature that investigate ERPT for a emerging economies like Türkiye, which is one of the developing countries regularly experiencing fluctuations in exchange rates, hikes in domestic consumer prices and deteriorations in trade balance, which makes Türkiye an interesting case study.

Dedeoglu and Kaya (2014) conducted a rolling Vector Auto Regressive (VAR) analysis to examine Exchange Rate Pass-Through (ERPT) between 1995 and 2012. Their results indicate a significant decrease in ERPT following the adoption of an inflation targeting regime in Türkiye, with ERPT having a greater impact on producer prices than on consumer prices during the inflation targeting period. In a separate study, Civcir and Akcaglayan (2010) investigated ERPT and the monetary policy reaction function of the Central Bank of the Republic of Türkiye (CBRT) over two periods (1987-2001 and 2001-2009) using a VAR model. They highlighted that the primary channel through which inflation is fueled in Türkiye is the depreciation of the domestic currency, even under an inflation targeting regime.

The research by Karagoz et al. (2016) aimed to quantify the pass-through effects of exchange rates on prices in regions that implement inflation targeting regimes such as Asia Pacific, Latin (South) America, and Türkiye. To assess the pass-through effects from exchange rates to domestic prices, the authors developed a model with five variable factors and applied a VAR approach. They discovered that the pass-through effect in Latin America and Türkiye is higher compared to Asia Pacific economies.

Another noteworthy study conducted by Karahan (2017) involved a time series analysis of ERPT for the Turkish economy. The analysis utilized a single equation error correction model (ECM) estimation. Karahan (2017) specifically examined the effect of adopting an inflation targeting regime in 2006 on ERPT in Türkiye. The study utilized monthly data and considered two distinct periods: 1995-2000 and 2006-2014. The main findings indicated a reduction in the degree of pass-through, with values decreasing from 0.665 in the first period to 0.218 in the second period. This reduction was attributed to the adoption of the inflation targeting regime.

Ciftci and Yilmaz (2018) explored the non-linear dynamics of exchange rate pass-through (ERPT) and inflation persistence in Türkiye. They employed the Smooth Transition Regression (STR) model to identify different regimes characterized by the magnitude of exchange rate movements. These regimes exhibited variations in ERPT and inflation persistence indicators. The study demonstrated that inflation persistence and ERPT for the Consumer Price Index (CPI) are high in a regime with a significant import price shock. Additionally, ERPT and import price pass-through to the Producer Price Index (PPI) are more influential in a high depreciation regime.

Saygili et al. (2019) explored the heterogeneity of exchange rate pass-through into industry-specific import, producer, and consumer prices. They discovered that the responsiveness of prices to aggregate and relative exchange rate changes varies significantly depending on the imported input contents. The study highlighted that direct exchange rate impacts are more substantial than indirect effects, with the importance of indirect effects being largely influenced by industries such as energy, basic metal, and chemicals that provide intermediate inputs to other sectors. Furthermore, they found that relative and aggregate exchange

rate changes have opposing effects on domestic prices, indicating that asymmetric information about industry-specific exchange rates can lead to pricing opportunities.

A study conducted by Bari (2020) investigated the influence of exchange rate fluctuations on domestic prices in Türkiye from 2003 to 2019. Bari pointed out that the structural inflationary issues in Türkiye were a result of the reliance on imported intermediate goods, along with inflation expectations. Consequently, fluctuations in exchange rates have a notable impact on domestic inflation. By utilizing VAR analysis to analyze the import price index (IPI), the consumer price index (CPI), and producer price index (PPI), the author concluded that the structural problems of the Turkish economy are linked to the dependence on imported intermediate goods for final production, dollarization, and the pass-through of imported prices to consumer prices.

As outlined by Akgunduz et al. (2020), despite the relatively clear pass-through behavior in Türkiye, the empirical estimates for pass-through rates vary widely. Some studies on the Turkish case have utilized either VAR or single equation estimations. Akgunduz et al. (2020) calculated the export and import pass-through rates based on product-level data from Türkiye, revealing that changes in the TL exchange rate mainly affect the prices of exports and imports in TL, and to a lesser extent in the currencies of trading partners. They determined the export and import pass-through rates using Turkish 6-digit product-level data, concluding that TL exchange rate changes primarily impact TL prices of exports and imports, and subsequently affect their prices in trading partners' currencies. The average pass-through rate to TL prices is estimated at 82% for exports and 89% for imports.

Saygili (2022) delved into the impact of invoicing currency and global production integration on the exchange rate pass-through effect on import and export prices in Türkiye using 3-digit product-level data categorized by end use and 2-digit sector-level data. The study revealed that the pass-through rate significantly influences both export and import prices, with a notably higher pass-through for goods priced in local currency.

Demirel and Karaoglu (2021) conducted a study to analyze the impact of exchange rate on inflation in Türkiye. This analysis is crucial for effectively combating inflation and developing appropriate policy proposals. Their research focused on examining the asymmetric relationships between exchange rate and inflation using a nonlinear autoregressive distributed lag model. The study covered the period from 2004: Q1 to 2019: Q4. The findings revealed that the pass-through effect of exchange rate on inflation in Türkiye is asymmetric in the long run.

Turel and Orhan (2022) conducted a study on the asymmetric behavior of exchange rate pass-through in Türkiye. They utilized a threshold VAR model to investigate the asymmetries in exchange rate pass-through based on various factors such as size, direction, and the inflationary environment of an emerging market economy with a significantly devalued domestic currency and a double-digit inflation rate. Their research revealed that the transmission of exchange rate shocks to domestic inflation is stronger in the upper regime compared to the lower regime. Additionally, they found that the pass-through increases with the magnitude of shocks, and there is a positive relationship between inflation and exchange rate pass-through.

Kal et al. (2022) analyzed the influence of market share on exchange rate pass-through to prices in the Turkish manufacturing sector. Their research, based on disaggregated data at the four-digit industry level, demonstrated that exchange rate pass-through in the manufacturing sector follows an asymmetric U-shape pattern with respect to market share. This suggests that highly competitive and concentrated industries exhibit a higher pass-through of exchange rate movements in both directions (appreciation and depreciation) to local producer prices compared to moderately concentrated sectors.

Within this framework, it is possible to suggest that there are various empirical studies that focused on Turkish case from different perspectives. Like some of others, this research intends to evaluate ERPT particularly into import prices in Türkiye while the empirical development

is framed in the multivariate cointegration analysis, with the application of the JCT and the development of an autoregressive EC vector (VECM) for the determination of the long run pass-through, which makes our study to be offering a different approach that helps the readers better understand the ERPT to import prices mechanism, during the decade of exchange rate fluctuations, high inflation, and trade imbalance.

Our aim in our econometric analysis is to address the ERPT into import price for Turkish case, and we will focus on the following analysis by Campa and Goldberg (2005).

Econometric Formulation

For the sake of our analysis, we focus on Campa and Goldberg (2005) as analyzing how prices react to exchange rate fluctuations is our major goal for research. According to the theory, the import prices can be gathered as a transformation of the export prices of the trading partners which is given by the following notation, where lowercase letters represent logarithms.

$$P_t^m = E_t P_t^x \quad (1)$$

where P_t^m depicts the prices of the imports, P_t^x shows export prices of the trading partners and finally E_t is the nominal effective exchange rate. If we take the logarithm of in Equation 1, following equation is obtained:

$$p_t^m = e_t + p_t^x \quad (2)$$

Furthermore, the export prices are a function of a profit margin over the marginal costs of Türkiye's trading partners' exports.

$$p_t^x = mkup_t^x + mc_t^x \quad (3)$$

where mc_t^x depicts exporters' marginal costs and $mkup_t^x$ demonstrates the profit margin. Substituting Equation 3 in Equation 2, we obtain:

$$p_t^m = e_t + mkup_t^x + mc_t^x \quad (4)$$

Exporters in an industry may decide to fully absorb ER fluctuations through the margin or alternatively the margin be independent of ER variations (which is denoted as the full pass-through). The alternative actions by these exporters can be depicted as:

$$mkup_t^x = \rho + \Omega e_t \quad (5)$$

while it can be asserted that marginal costs move in parallel with export market wages w_t^x and demand conditions in the export destination country y_t

$$mc_t^x = \delta_0 y_t + \delta_1 w_t^x \quad (6)$$

If we replace Equation 5 and 6 in Equation 4, we arrive at the following equation for import prices:

$$p_t^m = \rho + (1 + \Omega) e_t + \delta_0 y_t + \delta_1 w_t^x \quad (7)$$

Note that ERPT is β=1+Ω and this will be subject to the pattern of existing competition in the industry. (If Ω=0, we will have a complete PT.) Thus, the prices of the imports will be dependent to export markets' wages, nominal exchange rate (NER), in addition to the demand conditions in the export destination country.

By conducting our study, we aim to address the ERPT dynamics into import price for Turkish case through basing our analysis on Campa and Goldberg work (2005).

Integration

By using the formations depicted above, firstly, in order to designate the non-stationarity of the time series, augmented Dickey-Fuller (DF) test has been applied. This test basically allows to statistically determine the existence of unitary roots in the autoregressive representation of the time series data. The implementation of the DF test is based on the general auxiliary regression.

$$\Delta X_t = \varphi(t) + \rho X_{t-1} + \delta_1 \Delta X_{t-1} + \cdots + \delta_k \Delta X_{t-k} + \varepsilon_t \quad (8)$$

where ε_t is a white noise process which has 0 mean, a constant variance and uncorrelated

autocovariance. The deterministic trend is depicted by the φ(t) and three cases have been taken into consideration:

$$\varphi(t) = \alpha + \beta t$$
$$\varphi(t) = \alpha$$
$$\varphi(t) = 0$$

The inference which lets us specify the non-stationarity of the time series is denoted through the following hypothesis test:

H0: ϱ = 0 vs. H1: ϱ < 0

where the rejection of the null hypothesis implies that the time series will be stationary while the non-rejection of the null demonstrates the non-stationary time series. Dickey-Fuller (1981) includes the tables showing the critical values which allow us to construct the rejection regions for the standard significance levels.

JCT below would help us analyze the presence of cointegration, and reveal whether we would be able to conduct an illustratory analysis.

JCT and VECM

A group of variables can be regarded as cointegrated if they all have the same order of integration while a linear combination of these variables which is stationary can be found and JCT is a technique used to reveal mentioned relationship. (An Xt variable is integrated of order d, denoted I(d), if ΔXt is stationary. If a variable is stationary, it is denoted by I(0).) Until today, many scholars developed different methodologies in order to specify and determine whether a set of variables are cointegrated. Among these, one of the most widely used method is the one by Johansen (1988). Accordingly, Johansen's cointegration method takes as its starting point the representation as a VAR of the variable vector $X_t' = (x_{1t}, x_{2t}, \dots, x_{nt})$

$$X_t = \Pi_1 X_{t-1} + \cdots + \Pi_k X_{t-k} + \Phi D_t + \varepsilon_t \quad \varepsilon_t \sim IN(\vec{0}, \Omega) \tag{9}$$

where Dt is a vector of deterministic variables and all variables in X_t have the order of integration I(1). In this setting, reparametrization of the fundamental VAR is possible, which is as follows:

$$\Delta X_t = \Pi X_{t-1} + \sum_{j=1}^{k-1} \Gamma_j \Delta X_{t-j} + \Psi D_t + \varepsilon_t \tag{10}$$

where $\Gamma_j = -\sum_{i=j+1}^{k} \Pi_i$ and $\Pi = \sum_{i=1}^{k} \Pi_j - I$ i = 1, …, k-1

The main element in the implementation of the JCT is the matrix Πnxn in Equation 10. If the range (r) of this matrix is located in the interval (0, n) it can be decomposed in the form $\Pi = \alpha_{nxr} \beta'_{rxn}$, where the rows of the matrix β'_{rxn} contain cointegration r vectors that allow building r stationary linear combinations of the variables in the vector Xt. The speed of adjustment can be measured by the parameters in the matrix α_{nxr} in the case of short run imbalances between a variable in Xt and its long run equilibrium. At this point it is possible to note that trace and maximum eigenvalue statistics allow us to make statistical inferences about the range of the matrix Πnxn, while these stats have non-standard distributions which are generated by Monte Carlo methodologies. In this way, it is possible to conduct our data analysis and model as below with the dataset we gathered.

Data and the Model

In the analysis, we used a sample for the ERPT estimate which covers the time interval between 2010 and 2019, on a quarterly basis. In line with the formulation depicted in Equation 7, industrial production index (IPI) and the import unit value index (IUVI) were utilized in order to create proxies for Turkish import prices and demand conditions. The figures for these variables were compiled using the datasets offered by TUIK. The nominal effective exchange rate (NEER) data were retrieved from Bruegel Group's database where the data contain values of real and nominal effective exchange rate indices for a number of countries. Accordingly, we decided the use the following functional relationship intending to construct the proxy variable of wages (W) in the export market, which is as follows:

$$W_t = NEER_t * IUVI_t/REER_t \quad (11)$$

while the real effective exchange rate is represented by REER in the paper. All variables have base year 2010. Table 1 below demonstrates the variables which are employed for the study:

Table 1. Economic Variables

Variable	Definition of Variable
IVIU	Import Unit Value Index
NEER	Nominal Effective Exchange Rate
W	Exporter Cost
IPI	Industrial Production Index

Source: Author's abbreviations.

Table 1 demonstrates the abbreviations of the economic variables that we used in our study. Table 2 below indicates the summary statistics of the variables where the data are measured in logs.

Table 2. Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
IVIU	4593841	0.11525	4386374	4762149
NEER	4007718	0.32921	3169686	4449802
W	4198162	0.28453	3717971	4588582
IPI	4796439	0.11967	4503469	5016357

Source: Author's calculations (2023).

According to the descriptive statistics given in Table 2, the mean of IVIU and IPI are higher than NEER and W while the standard deviations of mentioned variables are lower than those of NEER and W.

Results and Findings

We demonstrate the results gathered via the implementation of the Augmented DF test by means of which we determine the order of integration of each variable stated above. Table 3 demonstrates the outcomes of the test, and all variables are measured in logarithms.

According to Table 3, as for the function φ(t) refers the deterministic tendency in the auxiliary regression (Equation 8), for the case of the iuvi series φ(t) = 0, for graphically displaying the behavior of a random walk without drift under H0, while in the cases of the variables neer, w and ipi, φ(t) = α+βt was adopted.

Table 3. Unit Roots Test Results [2]

	Level			First differences		
Variable	Stat	p-value	Lag	Stat	p-value	Lag
IVIU	-0.366	---	1	-3.079***	---	0
NER	-0.259	0.99	4	-3.652***	0.0048	3
W	-2929	0.15	1	-3.659***	0.0047	0
IPI	-1534	0.81	4	-19.963***	0.0000	0

Source: Author's calculations (2023).

As introduced in Table 1, in no case it is possible to reject the null hypothesis of the existence of at least one unit root, while the null hypothesis of non-stationarity is rejected for all variables at any level of significance, thus implying that the four series are stationary in first differences. In the light of these, it can be stated that the series are I (1).

We also present the outcomes of the application of the JCT and the estimate of the VECM established in this section. According to the economic formulation in Equation 7, the equilibrium relationship in the long run from which the ERPT will be estimated can be specified as:

$$iviu_t = \beta_0 + \beta_1 neer_t + \beta_2 ipi_t + \beta_3 w_t + \varepsilon_t \quad (12)$$

where ε_t represents the error term and the lowercase letters reflect the logarithms of the variables denoted in Table 1 above.

In the first place, it was not possible to reveal a viable cointegration vector estimating LR relationship at the Equation 10, since found cointegration relationships did not make economic sense taking into account that the coefficients did not respect the signs which are required by the economic theory. For this, we decided to review whether it would be doable to gather a subset of the variables which would allow a stationary linear combination that would lead to good ERPT estimation.

[2] ****, **, * denote that the null hypothesis of a unit root in the series can be rejected at the significance level of 1%, 5% and 10%. The maximum lag used was four quarter.*

In the end, iuvi and neer have been designated as the cointegrated variables; therefore, the estimated LR relationship has been shown as:

$$iviu_t = \beta_0 + \beta_1 neer_t + \varepsilon_t \quad (13)$$

where we displayed the results of the estimation of the respective VECM in Table 4.

Johansen (1988) developed the method that allows the estimation of all the different cointegration relationships that may exist between the series by taking into account the VAR model. Since the JCT is based on VAR, the optimum number of lags of the established models must be determined and our selection is made according to the information criteria for determining the optimum lag length. Accordingly, it is significant to underline that the number of lags chosen was 5 and for the number of lags of the VECM was of order 4 to construct the fundamental VAR in Equation 9. Besides, centered seasonal dummies were introduced aiming to capture the possible existence of deterministic seasonality in order to capture the structure of temporal dependence of data in the quarterly frequency.

As Table 4 demonstrates, VECM was statistically adequate while the error vector has been adjusted to a multivariate normal (p-value = 0.369) and the errors are serially uncorrelated (p-value = 0.235). Both maximum eigenvalue and the trace tests reject the null range hypothesis for the matrix in Equation 10, while the second column displays that the range 1 hypothesis cannot be rejected by both tests, at the 95% confidence level.

Table 4. Johansen Cointegration Test and VECM [3]

Null Hypothesis	r = 0	r ≤ 1	r ≤ 2
Trace Test	16.88**	1.64	---
Critical Value (95%)	15.41	3.76	---
Null Hypothesis	r = 0	r = 1	r = 2
Max-eigenvalue Test	15.23**	1.64	---
Critical Value (95%)	14.07	3.76	---
Estimation Pass-Through (p values in parentheses)			
Degree of Pass-through	-0.856 (0.029)		
Speed of Pass Through	-0.012(0.017)		
Diagnostic Statistic (VECM)			
Statistic Test	$Chi\chi^2$	df	p-value
Normality	4.283	4	0.369
LM-Test	5.553	4	0.235

Source: Author's calculations (2023).

Table 4 also shows that the estimate of the long term pass-through (β1) is -0.856, demonstrating that 85.6% of the fluctuations of the NER are transmitted into the import prices (the pass-through is not complete) in the long term. On the flip side, given that (β1) is significantly different from zero at the significance level of 5% in Equation 7 (where $(1 + \Omega) \neq 0 \Rightarrow \Omega \neq -1$). Therefore, the findings reveal that Türkiye's trading partners do not fully absorb ER fluctuations in the profit margin.

Another significant result derives from the parameter that measures the speed of the pass-through, whose estimate has been found as -0.0125, proving that the adjustment in short-term imbalances between import prices and the NER through increases or decreases in import prices is very slow; which means that the system corrects the imbalances of the previous period between $iviu_t$ and $neer_t$ in Equation 12 at the speed of 1.25 percent quarterly. This was obtained thanks to the estimation of an EC model as shown below:

$$\Delta \text{iuvi}_t = \underset{(0.0033)}{0.0029} - \underset{(0.005)}{0.0126}(\text{iuvi}_{t-1} - \underset{(0.347)}{0.756}\text{neer}_{t-1} + 8.231) - \underset{(0.0225)}{0.1391}\Delta\text{neer}_{t-1} + \underset{(0.0454)}{0.8257}\,\Delta w_{t-1} + \underset{(0.0043)}{0.0070}sc2_t + \underset{(0.0044)}{0.0007}sc3_t + \underset{(0.0043)}{0.0069}sc4_t \quad (14)$$

Note: T = 37 (2010q1 – 2019q1), R^2 = 0.9254, R^2_{Adj} = 0.9099 with sc2, sc3 and sc4 centered seasonal dummies variables. Standard errors are in parentheses. The data are measured in logarithms.

Conclusion

This study focuses on the estimation of ERPT in Türkiye for 2010q1-2019q1. Departing from some of existing studies, this paper employs VECM approach. We revealed that in the long run 85.6% of the fluctuations of the NER are transmitted to the import prices (the pass-through is not complete), while the speed of adjustment to

[3] *** denotes that the null hypothesis can be rejected at the significance level of 5%.*

equilibrium was -0.0125. In conclusion, the imbalances between import prices and the NER in the quarter (t-1), are corrected in the quarter (t) to the speed of 1.25 percent quarterly.

Despite an important paper by Akgunduz et. al. (2020) revealed that exchange rate changes get reflected rapidly into import prices, at a rate of 89% while the standard error of that estimate was about 0.03, we found the estimate is 0.76, which appears to be outside the 95% confidence range of Akgunduz et al (2020) estimate. Despite we know from Akgunduz et al. (2020) that the impact on import prices is essentially instantaneous (or, rather, takes place in the same month) and there isn't much of a lag, in contrast we found out a slower speed of adjustment, which is not perfectly in line with the data plots shown in Figures 1 and 2 in Akgunduz et al. (2020). We think that the reason for the slower adjustment is probably that the difference of import prices from its long-run relationship implied by the real exchange rate is likely dominated by energy prices in a very strong manner. Therefore, changes in oil prices etc. likely account for most of the residual of the cointegrating relationship. Energy prices are, afterall, commodity prices--i.e., an asset price. In other words, one should not expect energy prices to exhibit strong mean reversion, and in fact they do not. This probably explains the absence of a strong speed of adjustment in the residual of the ERPT relationship, and that estimated speed may have nothing to do with the speed of adjustment of import prices to exchange rate changes.

The reason why we selected the study by Akgunduz et al.(2020) as a center of analysis is that it is one of the most recent and pioneer studies shedding light on how Turkish exchange rate changes are reflected into import prices.

In other respects, the expenditure switching policy seems to be not very successful to diminish the chronic CAD -due to the high dependence on imports, especially of raw materials and intermediate goods-, which together with the depreciation of the currency that has been accentuated from 2017, explain in part the increase of the ERPT and increasing inflation in 2018. Besides, it appears the impacts of the currency crisis in 2018 have not disappeared yet: Fluctuations in the nominal exchange rate, inflation rate and current account balance continue in the last couple of years.

One limitation of our study might be the strong focus on the Turkish case only. A similar analysis can be conducted for other developing countries so that results can be compared the results. Within this framework, our study can be improved by applying similar methodologies for other developing countries like Indonesia, Mexico and South Africa etc. where appropriate.

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References

Akgunduz, Y. E., Bastan, E. M., Demiroglu, U., & Tumen, S. (2020). Product-level estimates of exchange rate pass-through: Evidence from Türkiye. *The World Economy*, *44*(7), 2203-2226. https://doi.org/10.1111/twec.13060

Aron, J., Macdonald, R., & Muellbauer, J. (2014). Exchange rate pass-through in developing and emerging markets: A survey of conceptual, methodological and policy issues, and selected empirical findings. *The Journal of Development Studies*, *50*(1), 101-143. https://doi.org/10.1080/00220388.2013.847180

Barhoumi, K. (2006). Differences in long run exchange rate pass-through into import prices in developing countries: An empirical investigation. *Economic Modelling*, *23*(6), 926-951. https://doi.org/10.1016/j.econmod.2006.04.006

Bari, B. (2020). Exchange rate and import price pass-through in Türkiye. *Business and Economics Research Journal*, *11*(3), 609-620. https://doi.org/10.20409/berj.2020.272

Bhattarai, S., & Schoenle, R. (2014). Multiproduct firms and price-setting: Theory and evidence from U.S. producer prices. *Journal of Monetary Economics*, *66*, 178-

192. https://doi.org/10.1016/j.jmoneco.2014.05.002

Bruegel. *Data Sets, Real and Nominal Exchange Rates.* [Retrieved 2022-11-12] Available at: https://www.bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database/#:~:text=DOWNLOAD%20DATASET&text=The%20real%20effective%20exchange%20rate,economic%20research%20and%20policy%20analysis.

Bussiere, M. (2007). Exchange rate pass-through to trade prices: The role of non-linearities and asymmetries. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1016669

Campa, J. M., & Goldberg, L. S. (2002). Exchange rate pass-through into import prices: A macro or micro phenomenon? *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.920835

Campa, J. M., & Goldberg, L. S. (2005). Exchange rate pass-through into import prices. *Review of Economics and Statistics*, *87*(4), 679-690. https://doi.org/10.1162/003465305775098189

Choudhri, E. U., & Hakura, D. (2012). The exchange rate pass -through to import and export prices: The role of nominal Rigidities and currency choice. *IMF Working Papers*, *12*(226), https://doi.org/10.5089/9781475510232.001

Ciftci, M., & Yilmaz, M. H. (2018). Nonlinear dynamics in exchange rate pass-through and inflation persistence: The case of Turkish economy. *Asian Journal of Economic Modelling*, *6*(1), 8-20. https://doi.org/10.18488/journal.8.2018.61.8.20

Civcir, I., & Akçağlayan, A. (2010). Inflation targeting and the exchange rate: Does it matter in Türkiye? *Journal of Policy Modeling*, *32*(3), 339-354. https://doi.org/10.1016/j.jpolmod.2010.03.002

Coughlin, C. C., & Pollard, P. S. (2003). Size matters: Asymmetric exchange rate pass-through at the industry level. https://doi.org/10.20955/wp.2003.029

Dedeoglu, D., & Kaya, H. (2014). The Evolution of Exchange Rate Pass-Through in Türkiye: Does Inflation Targeting Matter? *Afro Eurasian Studies*, 3(1), 26-33.

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, *49*(4), 1057. https://doi.org/10.2307/1912517

Jimborean, R. (2013). The exchange rate pass-through in the new EU member states. *Economic Systems*, *37*(2), 302-329. https://doi.org/10.1016/j.ecosys.2012.08.006

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, *12*(2-3), 231-254. https://doi.org/10.1016/0165-1889(88)90041-3

Kal, S. H., & Çiftçi, M. (2022). Market structure and exchange rate pass-through in the Turkish manufacturing industry: Evidence from sectoral data. *Bulletin of Economic Research*, *74*(4), 995-1016. https://doi.org/10.1111/boer.12329

Karahan, Ö. (2017). Exchange rate pass-through in Türkiye before and after the adoption of inflation targeting regime. *Financial Assets and Investing*, *8*(2), 37-48. https://doi.org/10.5817/fai2017-2-3

Karagöz, M., Demirel, B., & Bozdağ, E. G. (2016). Pass-through effect from exchange rates to the prices in the framework of inflation targeting policy: A comparison of Asia-Pacific, south American and Turkish economies. *Procedia Economics and Finance*, *38*, 438-445. https://doi.org/10.1016/s2212-5671(16)30215-5

Karaoglu, N., & Demirel, B. (2021). Asymmetric exchange rate pass-through into inflation in Türkiye: A NARDL approach. *Fiscaoeconomia*, *5*(3), 845-861. https://doi.org/10.25295/fsecon.925369

Ketenci, N. (2017). The effect of the European Union Customs Union on the balance of trade in Türkiye. *Foreign Trade Review*, 52(4), 219-232. https://doi.org/10.1177/0015732516660801

Marazzi, M., & Sheets, N. (2007). Declining exchange rate pass-through to U.S. import prices: The potential role of global factors. *Journal of International Money and Finance*, *26*(6), 924-947. https://doi.org/10.1016/j.jimonfin.2006.12.003

McCarthy, J. (2007). Pass-through of exchange rates and import prices to domestic inflation in some industrialized economies. *Eastern*

Economic Journal, *33*(4), 511-537. https://doi.org/10.1057/eej.2007.38

Özlale, Ü., & Yeldan, E. (2004). Measuring exchange rate misalignment in Türkiye. *Applied Economics*, *36*(16), 1839-1849. https://doi.org/10.1080/00036840420002 79735

Peynirci, Nilay Bıçakcıoğlu (2023). Internationalization of emerging market multinational enterprises: A systematic literature review and future directions. *Journal of Business Research,* 164, 1-22. https://doi.org/10.1016/j.jbusres.2023.114002.

Saygılı, H. (2022). Invoicing currency, exchange rate pass-through, and value-added trade: The case of Türkiye. *International Journal of Finance & Economics*, *28*(4), 4401-4419. https://doi.org/10.1002/ijfe.2657

Saygılı, H., & Saygılı, M. (2019). Exchange rate pass-through into industry-specific prices: An analysis with industry-specific exchange rates. *Macroeconomic Dynamics*, *25*(2), 304-336. https://doi.org/10.1017/s13651005190001 8x

Swamy, P., & Thurman, S. S. (1994). Exchange rate episodes and the pass-through of exchange rates to import prices. *Journal of Policy Modeling*, *16*(6), 609-623. https://doi.org/10.1016/0161-8938(94)90011-6

Taylor, J. B. (2000). Low inflation, pass-through, and the pricing power of firms. *European Economic Review*, *44*(7), 1389-1408. https://doi.org/10.1016/s0014-2921(00)00037-4

Tekin, R. B., & Yazgan, M. E. (2009). Exchange rate pass-through in Turkish export and import prices. *Applied Economics*, *41*(17), 2221-2228. https://doi.org/10.1080/00036840701222 454

Türel, M., & Orhan, A. (2022). Asymmetries in exchange rate pass-through in Türkiye: A threshold VAR analysis. *Prague Economic Papers*, *31*(3-4), 276-295. https://doi.org/10.18267/j.pep.806

Turkish Statistical Institute. *Data Center, Foreign Trade Indices. [*Retrieved 2022-10-09] Available at: https://biruni.tuik.gov.tr/medas/?kn=62&locale=en

Webber, A. G. (1999). Dynamic and long run responses of import prices to the exchange rate in the Asia-Pacific. *Asian Economic Journal*, *13*(3), 303-320. https://doi.org/10.1111/1467-8381.00087