Akademik Hassasiyetler **The Academic Elegance**
Yıl/Year: 2024 **Sayı/Issue: 24**
Cilt/Volume: 11 **Sayfa/Page: 297-324**
Araştırma Makalesi

Makale Gönderim Tarihi: 02/05/2023 **Makale Kabul Tarihi: 21/04/2024**

THE ASYMMETRIC EFFECT OF PRODUCER PRICES ON CONSUMER PRICES IN TURKISH ECONOMY

Bekir AŞIK*

Abstract

The aim of the study is to evaluate the asymmetric impacts of producer price on consumer prices and cointegration relationship between two price indexes for Turkish economy from 2003.M1 to 2022.M12. Another aim is to analyze the causality between Producer Price Index (PPI) and Consumer Prıce Index (CPI). The Autoregressive Distributed Lag Model (ARDL) and Non-Linear Autoregressive Distributed Lag Model (NARDL) are estimated to determine relation between PPI and CPI and asymmetric effects of PPI on CPI. The causality relation is examined using Toda-Yamamoto Granger Causality method. According to the results, there is a cointegration relation between CPI and PPI. The ARDL model implies that PPI has a positive impact on CPI both in the short time period and in the long time period. The NARDL model indicates that although positive shocks to the PPI have positive effects on CPI, negative shocks do not have statistically significant effect on CPI. In addition to these results, Toda-Yamamoto Granger Causality method indicates that a bidirectional causality is determined between two price indexes. In this paper, it has been found that PPI and positive shocks to PPI have an impact on CPI. Therefore, it would be useful to developed decreasing the effect of cost-push policies while implementing the inflation targeting.

Keywords: *Inflation, CPI, PPI, Nonlinear ARDL Model, Causality.*

TÜRKİYE EKONOMİSİNDE ÜRETİCİ FİYATLARI ENDEKSİNİN TÜKETİCİ FİYATLAR ENDEKSİ ÜZERİNDEKİ ASİMETRİK ETKİSİ

Öz

Bu çalışmanın ana amacı 2003.M1-2022.M12 döneminde Türkiye'de üretici fiyatlarının, tüketici fiyatları üzerindeki asimetrik etkilerini tespit etmek ve her iki fiyat endeksi arasındaki eşbütünleşme ilişkisini belirlemektir. Bununla birlikte Üretici Fiyatları Endeksiyle, Tüketici Fiyatları Endeksi arasındaki nedensellik ilişkisini de belirlemektir. Kısa ve uzun dönemde üretici fiyatlarının, tüketici fiyatları arasındaki eşbütünleşme ilişkisini ve asimetrik ilişkiyi belirleyebilmek için Doğrusal Gecikmesi Dağıtılmış Model (ARDL) ve Doğrusal Olmayan Gecikmesi Dağıtılmış Model (NARDL) tercih edilmiştir. Ayrıca iki fiyat endeksi arasındaki ilişkiyi tespit edebilmek

* Dr. Öğr. Üyesi, İstanbul Beykent Üniversitesi, İktisadi ve İdari Bilimler Fakültesi İktisat (İngilizce) Bölümü, bekirasik@beykent.edu.tr, https://orcid.org/0000-0002-2221-016X

için Toda-Yamamoto Nedensellik Testi kullanılmıştır. Elde edilen sonuçlara göre üretici ve tüketici fiyatları arasında eşbütünleşme ilişkisi vardır. ARDL modelinin tahmininden elde edilen sonuçlar hem kısa vadede hem de uzun vadede üretici fiyatlarının tüketici fiyatları üzerinde pozitif etkisi vardır. NARDL modeline göre ise üretici fiyatlarına gelen pozitif bir şokun, tüketici fiyatları üzerinde pozitif ve istatistiki olarak anlamlı etkisi varken negatif şokların istatistiki olarak anlamlı bir etkisine rastlanmamıştır. Bu sonuçlara ek olarak, Toda-Yamamoto Nedensellik Testi sonuçlarına göre her iki fiyat endeksi arasında karşılıklı bir nedensellik ilişkisi bulunmaktadır. TÜFE üzerinde ÜFE'nin etkili olması ve ÜFE'ye gelen pozitif şokların anlamlı bir etkisinin tespit edilmesi nedeniyle, enflasyon hedeflemesi politikası uygulanırken maliyet azaltıcı politikaların da geliştirilmesi faydalı olacaktır.

Anahtar Kelimeler: *Enflasyon, TÜFE, ÜFE, Doğrusal Olmayan ARDL Model, Nedensellik.*

Introduction

Inflation is not only one of the essential macroeconomic variables in an economy but also the most important indicator for policymakers, researchers, companies, and workers. Inflation is permanently increase in the price level and Consumer Price Index (CPI) and Producer Price Index (PPI) are mostly used to calculate the trend in price levels. CPI measures the changes in consumer prices paid by the households. Furthermore, CPI is the most essential index of the magnitude, and it is also crucial in determining the inflation trends. PPI measures the changes in prices of domestically produced goods that are produced by the producer over time. Moreover, PPI has a crucial role to judge the product price trend and the effects of production on industrial output values over a specified time. It performs inputs in the production processes and goods sold by companies. Therefore, if PPI increases, CPI is also expected to increase.

A fluctuation in one of the price indexes may affect the other one. Therefore, it is important for policymakers and researchers to determine which index influences the other or whether there is a bidirectional relation. According to the empirical literature, there are two main theoretical approaches used to express the relation between price indexes: supply-side approach and demand-side approach.

The supply-side approach indicates that if producer prices increase, this increase will have an impact on consumer prices. Consumer prices can be affected because the spillover effect in production chains has an impact on the prices (Tiwari, 2012). This shock to the production chain is called 'cost-push' shock and the initial impact of these shocks can be visible from the early stages of production chain. Supply side approach indicates that raw materials are used to produce intermediate goods and these intermediate goods are used to produce final goods. Thus, when a 'cost-push' shock hits to the price of inputs, changes of inputs can increase the price of intermediate and final goods.

Changes in prices of final goods have an effect on consumer goods. Thus, PPI is Granger cause CPI according to the supply-side approach (Akçay, 2011).

The demand side approach is the other theoretical explanation implying that if consumer prices increase, this increase will have an effect on producer prices. According to the Caporale et al. (2002), different preferences of raw materials and intermediate goods can affect the production costs, and these costs have impact on final goods, and services demand. Therefore, choices of raw materials between alternative uses can be stated for the final goods and services demand. Furthermore, it is assumed that the expected price of consumer goods can determine the demand for primary goods. With this assumption, CPI depends on the present demand and the expectations for the present demand and PPI depends on the expectations of demand (Cushing and MacGarvey, 1990). If demand of final goods changes, it will affect the input prices, thus CPI affects PPI.

Although there are two main theoretical approaches in the literature, there are some controversial results in the empirical research. The four different results are found in the empirical literature: PPI leads CPI, CPI leads PPI, bidirectional causality, and there is no causality.

It is especially important for conducting monetary policy to accurately determine the relation between producer prices and consumer prices. In the empirical studies, there are controversial results about the relation between CPI and PPI not only for Turkish economy but also developing and developed countries. These controversial results imply that this relation should be investigated employing new methods. The intention of this paper is to determine the cointegration and causality relation between CPI and PPI using Turkish data over the sample 2003M-2022M12 employing relatively new models. For this purpose, both Autoregressive Distributed Lag (ARDL) model and Non-Linear ARDL model have been implemented to determine the cointegration relation between CPI and PPI. Moreover, Toda-Yamamoto (1995) causality test is employed to find causality relation between to price indexes.

This study contributes to literature analyzing the asymmetric effects of producer prices on consumer prices. The relation between CPI and PPI is investigated by cointegration methods and causality tests in the empirical literature. Most of those studies were based on linear models, such as Vector Error Correction models and Autoregressive Distributed Lag (ARDL) and these models assume that there are symmetric effects of independent variables on dependent variable. In reality, there are positive or negative effects of independent variables on dependent variable. For this reason, Non-Linear Autoregressive Distributed Lag (NARDL) model is estimated to examine the asymmetric relationship between CPI and PPI. For this purpose, we organize the study as follows. The empirical literature is evaluated in Section 1. Data is introduced and methodology is explained in Section 2. Findings are evaluated in Section 3; and the conclusion is presented in the last section.

2. LITERATURE REVIEW

There are a lot of searches investigating the causality relationship for different number of countries for a certain period. According to the related literature, four different possible causality relations are found between CPI and PPI: the first one is the causality from PPI to CPI. This causality relation is related with the supply side approach. Secondly, the causality is from PPI to CPI and this is related with the demand-side approach. Third one is the bidirectional relation and finally there is no causal relationship.

In the empirical literature, there are vast amount of studies supporting the supply-side approach. One of the oldest studies belongs to Silver and Wallace (1980). They investigated effects of wholesale prices on CPI over the sample 1952-1977 in the USA using Pearson and Hatanaka-Wallece methods and they found that that there was a unidirectional causality from wholesale prices to consumer prices. In addition to this study, Guthrie (1981) found wholesale producer prices had more effect on CPI in the short-run.

Caporole et al. (2002) investigated the effects of one price index on the other one for G-7 countries over the sample 1976.Q1-1994.Q4. They found mixed results and the results showed that the causality ran from producer prices to consumer prices in the most countries. Ghazali et al. (2008) examined the relation over the sample 1986.M1-2007.M5 for Malasyia. Uni-directional relation was found from PPI to CPI in Malaysia. Shahbaz and Nasir (2009) estimated linear ARDL and VECM to search the long-run cointegration relation and causality relationship for Pakistan. However, they found that there was a bidirectional causality, the supply-side approach was stronger. Sidaoui et al. (2009) used VEC model and Granger causality to investigate the relation between price indexes for Mexican economy. Although they found long-run cointegration relation and causality relation from PPI to CPI, they could not detect any short-run causality between CPI and PPI. Kwon and Koo (2009) employed Toda-Yamamoto and Dolado-Lütkepohl Granger causality test to investigate the relation between CPI and PPI in the USA over the sample 1985-2001 and 2002-2008. According to the results, the causality was bidirectional, and it ran from CPI to PPI from 1985 to 2001, there was a unidirectional relationship from 2002 to 2008. Akçay (2011) searched the relation over the sample 1995.M1-2001.M12 for five developed countries. The results of these tests were complicated. First, the results of Johansen and Juselius cointegration method indicated that there was a cointegration relation in Germany but there was no cointegration relation in Finland, France, the Netherlands, and Sweden. Akçay (2011) reached conflicting findings. Hasan and Masih (2018) examined the determinats of food inflation in Malaysia employing ARDL and Non-linear ARDL model and the results implied that crude oil price, exchange rate, domestic prices and industrial production index had a cointegration relation with CPI. Khan et al. (2018) analyzes the relation for Central and Eastern European countries employing the bootstrap panel Granger causality test. According to the results, PPI affected CPI in Latvia, Lithuania, Romania, Slovakia, and Slovenia. CPI only affected PPI in

Hungary. Thus, it can be said that PPI is a primary contributor of CPI in most Central and Eastern European countries.

Suriani and Ridzqi (2019) investigated the impacts of commodity prices on CPI based on the inflation persistence in Aceh Province, Indonesia employing Partial Adjustment Model. Results indicate that groups of commodity price, namely, housing, water, electricity, gas, fuel, foodstuffs, and transportation, communication, and financial services, considerable impact on CPI. Thus, the supply-side approach was valid for Indonesian economy. Rizvi and Sahminan (2020) estimated a commodity augmented Phillips curve to analyze the effects of commodity prices on domestic inflation in Brazil, Russia, India, Indonesia, China, and South Africa. In all countries except Russia, oil and energy prices had positive impact on domestic inflation. Global food prices affected domestic inflation in India and Indonesia; metal prices had a negative impact in South Africa. Abbas and Lan (2020) investigated the pass-through of commodity and energy prices to inflation across different inflation regimes employing Markow-switching model for both developed and developing countries. They found that commodity pass through varied from one country to another. The impact of commodity prices on domestic inflation was asymmetric and energy was the principal commodity, which affected the inflation. Moreover, prices of food and agricultural commodities were very essential for developing countries. Sek et al. (2023) analyzed the asymmetric effects of commodity price changes on CPI employing the Markow-switching regression for Malaysian economy. The results indicated that asymmetric commodity prices changed affects inflation. Non-energy and precious metals have higher effect on CPI.

In the empirical literature, the causality from consumer to producer prices was also found by some studies. Colclough and Lange (1982) investigated relation between two price indexes in the USA from 1945.M1 to 1979M.12. According to the results, there was a causality from CPI to PPI. Hamid et al. (2006) investigated the nature of price transmission in the USA employing VAR method and Granger causality test. They investigated this relationship from 1926 to 1945, from 1946 to 1972, and from 1972 to 2003. According to the VAR method results, the change in PPI was significantly affected by CPI but PPI did not have any significant impact on CPI between 1926-1945 and between 1946-1972. One or two lag values of CPI affected PPI and two lag values of PPI affected CPI between 1972 and 2003. Moreover, Granger causality test results indicated that CPI was the cause of PPI but the opposite relation was not true. Gang et al. (2009) employed causality methods for Chinese economy and they found that CPI was Granger a cause the changes in PPI and PPI effected CPI with a time lag one to three months. Thus, the demand-side approach was stronger. Moreover, Shahbaz et al. (2012) found the same results for Pakistan by employing the frequency domain causality approach.

Mohd and Masih (2018) searched asymmetric relation between CPI and PPI using CPI, PPI and interest rate data of the United State, European Union, Singapore, and Malaysia. According to the results of ARDL model, the United States PPI, European PPI and Singapore CPI were cointegrated with selected variables. Mohd and Masih (2018) focused on the United States CPI and PPI relation for the purpose of Nonlinear ARDL model because they found that CPI was exogenous, and PPI was endogenous. Results implied that there was a asymmetric relation between CPI and PPI either in long-run or short-run. Furthermore, the cumulative effect on CPI on PPI was negatively asymmetrical. It meant that when CPI increased, PPI increased in smaller amount compared to when CPI reduced.

In addition to these studies, the bidirectional causality between two price indexes was also investigated. Jones (1986) searched this relation between consumer and producer prices in the USA from 1947M1 to 1983M12 using Wald Granger causality. Jones (1986) found a bidirectional relationship. Cushing and MacGarvey (1990) searched the relationship between CPI and wholesale price index in the American economy over the sample 1954-1987. They found that there was a bidirectional relationship between CPI and wholesale price index. Gang et al. (2009) examined the relationship in China over the sample 2001.M1-2008.M12. The results indicated that CPI was Granger cause to PPI. Thus, demand-side factors had much more effects than the supply-side factors in Chinese economy. Tiwari et al. (2013) analyzed causality between price indexes for Romania using Wavelet analyses and they found that there were cyclical effects between CPI and PPI. Özpolat (2020) investigated the long-run and causality relation between two price indexes for the Central and Eastern European countries over the period 1992-2017 employing panel cointegration and causality models. Results implied that there was a long-run cointegration between CPI and PPI and bidirectional causality relation was found between these variables.

Mert (2023) analyzed the relation between CPI and PPI using the threshold autoregressive and momentum threshold autoregressive model for Brazil, India, Indonesia, South Africa and Turkey. However, there was no asymmetrical relation in Brazil and India; there was an asymmetrical relation in Indonesia, South Africa, and Turkey. In addition to these results, although there was no asymmetrical causality in Indonesia, South Africa, and Turkey in the long-run, asymmetrical causality was found for these countries in the short-run. The transmission mechanisms also varied from country to country. In Indonesia, casual relation was from PPI to CPI; in South Africa from CPI to PPI; and in Turkey bidirectional causality was found.

Li et al. (2019) used VEC model to determine the cointegration relation between PPI and CPI for Chinese economy over the period 2008-2018. They found that cointegration relation existed and causality run from PPI to CPI.

Finally, some studies found no causality between CPI and PPI. Blomberg and Harris (1995) searched the relation between two price indexes between 1970 and 1994 in the USA using VAR model. They found that although prices of goods had a forecasting power explaining consumer prices in the 1970s and at the beginning of 1980s, the forecasting power of PPI was not powerful for determining the consumer prices at the end of the 1980s. Clark (1995) also employed VAR model in the USA over the sample 1959.Q2-1994.Q1. The results showed that PPI did not systematically affect CPI. Dorestani and Arjomand (2006) employed cointegration methods from 1960 to 2005 in the USA and cointegration relation could not be found between two series. Losada et al. (2018) investigated the relation between CPI and PPI for Brazil, Colombia, Ecuador, Peru, Paraguay, and Uruguay employing VAR, VEC models and Toda-Yamamoto Granger causality test. The results implied that there were no causality relations in Brazil, Colombia, Ecuador, and Uruguay. In Peru and Paraguay, there were causality relations. Oyeleke and Ojediran (2018) found no causality relation between CPI and PPI in Nigerian economy estimating Johansen and Engle-Granger methods.

In the empirical literature, there were vast studies that investigated the relationship in Turkish economy. First, we reviewed the studies that support the supply-side approach. Zortuk (2008) investigated the relationship in Turkish economy over the sample 1986.M1 to 2004.M12 using causality test and the supply-side approach was found. Yamak and Topbaş (2008) also investigated the cointegration relationship over the sample 1982.M1-2005.M5 for Turkish economy using Enders-Ludlow Nonlinear cointegration method. They found that both CPI and PPI had nonlinear structure and the change in PPI had an impact on CPI. In addition to these studies, Saraç and Karagöz (2010) used linear ARDL method for Turkish economy over the sample 1994.M1-2009.M12 to find the relation between price indexes. According to the results, the unidirectional causality ran from PPI to CPI. Erdem ve Yamak (2014) employed Kalman filter approach over the period from 1987 to 2012. According to the results, the transitivity from PPI to CPI decreased between the years 2003 and 2012. Yıldırım (2015) investigated the relationship between CPI and PPI employing cointegration methods, namely Autoregressive Distributed Lag model, Dynamic OLS model, Johansen cointegration method, and Gregory-Hansen method. Yıldırım (2015) analyzed the relationship over the sample 1987.M1-2013.M12 and two sub-periods. However, the pass-through from PPI to CPI was one-to-one over the full sample when the cointegration methods were employed except Gregory-Hansen method, the pass-through decreased when Gregory-Hansen method, which considers structural breaks. In the first sub-period (1987.M1-2001.M12), the pass-through from PPI to CPI was too high. In the second sub-period (2002.M1-2013.M12), the pass-through was the same with the previous sub-period when Dynamic OLS and Johansen cointegration method were employed. According to the results of ARDL model, the pass-through decreased from 2002 to 2013. Saatcioğlu ve Karaca (2017) employed Toda-Yamamoto test to analyze causality over the sample 2005.M1-2016.M12. They supported the supply-side approach. Oral and Eştürk (2022) found asymmetric relation between PPI and CPI for Turkish economy over the sample 2006-2021. The results indicated that the impact of negative shocks of PPI to CPI was bigger than the impact of positive shocks.

Secondly, some studies found the results that supported the demand-pull approach. Ülke and Ergün (2014) employed VEC model for Turkish economy from 2003 to 2013 using monthly data and they concluded that there was no causality in the short-run, but the unidirectional causality ran form consumer to producer prices. Abdioğlu and Korkmaz (2012) investigated the relationships between CPI and PPI over the sample 2003-2012 using Engle-Granger and Johansen cointegration methods. Moreover, they employed Granger causality and Engle-Granger error correction method to determine causality relation. They found that there were bidirectional causality relationships between two price indexes, but bidirectional relationship was found from CPI to PPI when sub-groups of price indexes were investigated. They concluded that increases in prices resulted from the demand side factors. Tarı et al. (2012) also searched the causality relation from 1987.M1 to 2008.M4 employing frequency domain approach. The results showed that although producer prices affected consumer prices in the short-run, consumer prices affected producer prices in the long-run. Öner (2018) analyzed the causality relationship over the sample 2004.M1-2016.M12 and Öner (2018) founds unidirectional relationship ran from CPI to PPI in Turkish economy.

Thirdly, some studies found the bidirectional causality between consumer and producer prices for Turkish economy. Akdi and Şahin (2007) investigated convergence relationship over the sample 1988.M1-2007.M10 using unit root tests. According to the results, there was a convergence between CPI and PPI. Terzi and Tütüncü (2017) employed ARDL method over the sample 2010.M5- 2016.M4. They found that there was a bidirectional cointegration relationship. Topuz et al. (2018) compared the relation between CPI and PPI in the UK and Turkey using VAR, impulse-response, variance-decomposition and Granger-causality tests. Results implied that there was bidirectional causality between two indexes for UK and Turkey. Kocak (2021) analyzed the relation between CPI, domestic PPI, and the agricultural sector PPI employing VEC model. According to the outcomes of the model, there were cointegration relations and short-run causality between these price indexes. Furthermore, the impact of agricultural sector and domestic PPI on CPI was lower than the effect of CPI on agricultural sector and domestic PPI. Thus, it meant that the effect of consumer prices was dominant than producer prices for Turkish economy. Demir (2022) also investigated the relation between two price indexes using hidden cointegration and asymmetric causality methods for Turkish economy. The results implied that the impact of changes in CPI on PPI was more dominant the impact of PPI on CPI in the-long run. Even though, there was a demand-side approach in the long-run for Turkish economy, supply-side approach was valid in the short-run.

Kara and Keskin (2021) investigated the transitivity of prices from 1996.M1 to 2020.M9 for Turkish economy and they found that the causality was bidirectional between price indexes in the long-run.

Finally, there were also researches that did not determine neither cointegration nor causality relation in Turkish economy. Akdi et al. (2006) employed Engle and Granger, Johansen's cointegration test, and seasonally robust periodogram–based test over the sample 1987.M1-2004.M8 for Turkish economy. Although the conventional cointegration test gave mixed results, the results of seasonally robust periodogram–based test showed that there was no cointegration relation. Bidirectional causality existed between these two series in the short-run, not in the long-run.

According to the empirical literature, there were vast studies investigating the relation between CPI and PPI for developing and developed countries. However, the results changed depending on the selected country groups, period and the method estimated and there were mode studies supporting the supply-side approach. The same outcome is valid for Turkish economy. Although there are a vast of studies that investigate the relation between CPI and PPI for Turkish economy employing cointegration methods, the asymmetric relation between two indexes have not been investigated enough. For this reason, the asymmetric relation between CPI and PPI should be investigated using new cointegration methods that test the asymmetric relation between CPI and PPI. In addition to cointegration methods, the different results obtained in the same causality methods conducted in the recent years for Turkish economy need further investigations. Thus, it would be useful to reconsider the causality relation between CPI and PPI for Turkish economy. Further studies on this issue may contribute to a more accurate determination of the relationship between producer and consumer prices in Turkey.

3. METHODOLOGY

The relation between CPI and PPI was investigated over the sample 2003.M1-2022.M12. The dataset contained producer price index (PPI) and consumer price index (CPI). All data were collected from Central Bank of Republic of Turkey. After seasonally adjusted was done using Census X-12 method, the logarithm of consumer and producer price index was taken.

3.1. ARDL Model

Different methods are estimated to find the cointegration relationship in the empirical literature. We adopted to employ ARDL and NARDL methods. Although there are several methods employs to explore the cointegration relations, the linear ARDL method is the one of the most employed cointegration methods in the empirical literature because of its advantages. First, ARDL model gives better results in the small and finite samples. Secondly, conventional methods claim that selected variables must be integrated of the same order. Unlike these methods, ARDL model can be employed even the selected variables integration degree is I(0) or I(1). On the contrary, Pesaran et al. (2001) implies that if the selected variables are integrated at I(2), or larger, ARDL model is invalid. Furthermore, different number of lag values of selected variables are allowed when the ARDL model is employed.

The linear form of linear model for the long-run was written as follows:

$$CPI_t = \beta_0 + \beta_1 PPI_t + u_t \quad (1)$$

where β_0 wass constant terms β_1 was the coefficient of dependent variable and u_t is the disturbance term. We could transform equation (1) into the generalized form of ARDL model as follow:

$$\Delta(CPI_t) = \alpha_0 + \varphi_1 CPI_{t-1} + \varphi_2 x_{t-1} + \sum_{j=1}^{p} \omega_1 \Delta\big(CPI_{t-j}\big) + \sum_{j=1}^{q_1} \omega_2 \Delta(PPI_{t-j}) + \varepsilon_t \quad (2)$$

The long-run coefficients were φ_1 and φ_2 are and the short-run coefficients were ω_1 and ω_2. The null hypothesis should be constructed to estimate the long-run relationship as follows: $H_0: \varphi_1 = \varphi_2 = 0$. Alternative hypothesis H_1 indicated that there is a long-run relation. Pesaran et al. (2001) proposed the following conditions to test the hypothesis: (1) If F-statistics is lower than the lower bound critical value, it means that long-run relationship does not exist; (2) If F-statistics is between lower and upper bound, decision is not conclusive; (3) If F- statistics is higher than the upper bound critical value, it indicates that long-run relationship exists.

The ARDL model also estimated short-run relation between CPI and PPI. To analyze the short-run dynamics between selected variables, the following regression was used:

$$\Delta(CPI_t) = \vartheta_0 + \sum_{i=1}^{p_1} \delta_i \Delta(CPI_t) + \sum_{i=1}^{p_2} \mu_i \Delta(PPI_t) + \psi ECT_{t-1} + \eta_t \quad (3)$$

The Error Correction is represented with the coefficient ψ and it represents the speed of adjustment of independent variables converging to its equilibrium. The coefficient of ECM should be negative to establish the convergence in the long-run.

3.2. NARDL Model

However, the effects of shocks that hit the independent variables on dependent variable can be either positive or negative; the ARDL model assumes a symmetric relationship between variables. For this reason, Shin et al. (2014) develops asymmetric ARDL model to distinguish the impact of negative and positive changes in the independent variables. Decomposition of negative and positive changes for PPI could be represented as follows:

$$PPI_t^+ = \sum_{L=1}^{T} \Delta PPI_L^+ = \sum_{L=1}^{T} MAX(\Delta PPI_L, 0) \quad (4)$$

$$PPI_t^- = \sum_{L=1}^{t} \Delta PPI_L^- = \sum_{L=1}^{T} MIN(\Delta PPI_L, 0)$$

where PPI_t^+ and PPI_t^- were positive and negative shocks, respectively. Generalized form of ARDL could be rewritten in nonlinear form by adding PPI_t^+ and PPI_t^- as follows:

$$\Delta(CPI_t) = \alpha_0 + \varphi_1 CPI_{t-1} + \varphi_2 PPI_{t-1} + \varphi_3^+ PPI_{t-1} + \varphi_3^- PPI_{t-1} + \sum_{j=1}^{p} \omega_1 \Delta\left(CPI_{t-j}\right) + \sum_{j=1}^{q_1} \omega_2 \Delta(PPI_{t-j}) + \sum_{j=1}^{q_3} \omega_3^+ \Delta(PPI_{t-j}) + \sum_{j=1}^{q_3} \omega_3^- \Delta(PPI_{t-j}) + \varepsilon_t \quad (5)$$

$\varphi_1,\ \varphi_2$, and φ_3 were long-run coefficients; ω_1, ω_2, and ω_6 were short-run coefficients and $q_{1,}\ q_2$, and q_6 were lag orders in equation 5.

The asymmetric relation between PPI and CPI could be examined by nonlinear ARDL model. To apply the nonlinear ARDL model, unit root tests should be performed to determine the integration of selected variables. Moreover, information criteria is used to determine the order of the distributed lag function. We employed Bound analysis to analyze the long-run relation.

3.3. Toda-Yamamoto Causality Test

Toda and Yamamoto test is employed regardless of the integration degree of selected series. Furthermore, the degree of integration of selected variables can be different when this method is employed.

According to Toda-Yamamoto (1995), even selected variables were first degree integrated; the causality test could be employed. To estimate the Toda-Yamamoto test, three steps should be followed: the first one is determining the maximum integration degree (dmax) of selected variables using unit root tests. The second step is selecting the appropriate lag length (k) using any information criteria tests in a VAR model. The third step is employing Granger causality to determine the causality relationships between selected variables using LA-VAR(k+dmax) model. The value of k is taken from VAR model and the value of d which shows maximum integration number of selected variables, and it is expressed as VAR(p+dmax). To test the hypothesis of LA-VAR model, the Wald test should be employed (Toda and Yamamoto (1995)).

$$CPI_t = \beta_0 + \sum_{i=1}^{k+dmax} \beta_i CPI_{t-i} + \sum_{i=1}^{k+dmax} \alpha_i PPI_{t-i} + \varepsilon_{1t} \quad (6)$$

$$PPI_t = \alpha_0 + \sum_{i=1}^{k+dmax} \alpha_i CPI_{t-i} + \sum_{i=1}^{k+dmax} \theta_i PPI_{t-i} + \varepsilon_{2t} \quad (7)$$

ε_{1t} and ε_{2t} were error terms which follow white noise process.

4. EMPRICAL RESULTS

First of all, the empirical results of ARDL and NARDL models are represented and evaluated. Then, the results of Toda-Yamamto causality test are represented.

4.1. Estimation Results of the Models

Integration degree of the selected variables should be determined before estimating the models. For this purpose, Augmented Dickey Fuller (ADF) test and Phillips-Perron test were implemented. The results of the unit root tests were represented in Table 1. When we analyzed Table 1, selected variables were first degree integrated and the cointegration test was able to be employed.

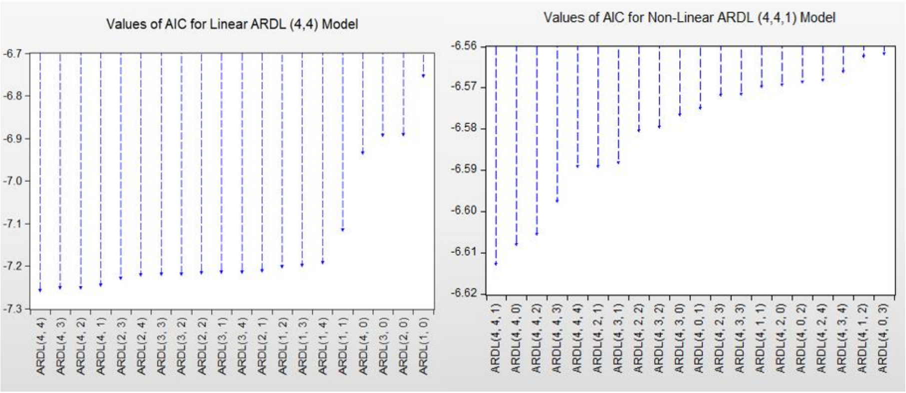
Table 1. Results of Unit Root Tests

Variables	Test	Level		First Difference		Integration Degree
		Constant	Constant and Trend	Constant	Constant and Trend	
CPI	ADF	2.798 (1.000)	3.883 (1.000)	-3.306** (0.016)	-4.013*** (0.009)	I(1)
	Phillips-Perron	3.584 (1.000)	5.511 (1.000)	-7.064*** (0.000)	-7.313*** (0.000)	
PPI	ADF	3.850 (1.000)	2.941 (1.000)	-6.878*** (0.000)	-7.724*** (0.000)	I(1)
	Phillips-Perron	3.706 (1.000)	2.973 (1.000)	-6.704*** (0.000)	-7.549*** (0.000)	

Note: 1%, 5%, and 10% significance level were represented with ***, **, *, respectively. Probability values were written in parentheses. The appropriate lag numbers were selected using Akaike Information Criteria (AIC).

The second step before estimating ARDL models, appropriate lag numbers should be selected. Akaike Information Criteria is used and appropriate lag numbers for linear ARDL and Non-Linear ARDL models are represented in Figure 1. According to Figure 1, appropriate lag numbers for linear ARDL model and non-linear model are (4,4) and (4,4,1), respectively.

Figure 1. Values of AIC for ARDL Models



Pesaran et al. (2001) developed the ARDL bound test to find the cointegration relation between selected variables. Table 2 represents the bound test results for both ARDL and NARDL method. The value F-statistics was over the upper limit and it meant that cointegration relation existed between producer and consumer prices.

Table 2. Bound Test Results for Cointegration

Model Specification	F-Statistic	Critical Values of Bound Test		Conclusion
Linear		I(0)	I(1)	
CPI-PPI	6.463	6.10*	6.73*	Cointegration
		4.68**	5.15**	
		4.05***	4.49***	
Non-Linear				
CPI-PPI	4.381	4.99*	5.85*	Cointegration
		3.88**	4.61**	
		3.38***	4.02***	

Note: 1 %, 5 %, and 10 % significance level were represented with ***, **, *, respectively.

The bound test results showed that there was a cointegration results. Therefore, the relation between CPI-PPI was estimated using both ARDL and NARDL models, and Table 3 showed the estimation results for linear models in the long-run and Table 4 represented short-run estimation results of linear models. If there was 1 % increases in PPI, CPI increased 0.56 %. The results of Breusch-Godfrey-Pagan test implied that there was homoscedasticity in the model. In addition to this, the results of Breusch-Godfrey autocorrelation test autocorrelation were not detected.

Table 3. Estimation Results for Linear Models in the Long-Run

	ARDL Model for CPI-PPI (4,4)
PPI	0.563***
	(0.000)
Diagnostic Tests	
Autocorrelation	1.627
	(0.198)
Heteroscedasticity	0.672
	(0.512)

Note: 1 %, 5 %, and 10 % significance level were represented with ***, **, *, respectively. Probability values were written in parentheses Breusch-Godfrey Test was employed for autocorrelation and the lag numbers were determined by using Akaike Information Criteria (AIC). 1 lag was selected for ARDL Model for CPI-PPI regression. Breusch-Godfrey-Pagan Test was employed for heteroscedasticity and 2 lags were selected.

According to the estimation results for linear models in the short-run as represented in Table 4, there were similar results for linear models in the long-run. When there were changes in the producer price index and CPI were effected positively and significantly by lags of PPI. Moreover, the effect of changes in PPI continued for three months. The lag of changes of CPI also had effects on changes in CPI in the short-run and the effects of these changes continued for 3 months.

The Error Correction Term (ECT) represents the speed at which consumer prices return to the equilibrium level when a shock hit the economy. The sign of the ECT was negative as expected and the value of the coefficient of ECT was -0.135. These results indicates that the there was a convergence to long-run equilibrium after a shock hits to economy.

Table 4. Estimation Results for Linear Models in the Short-Run

ARDL Model for CPI-PPI (4,4)	
Variables	Coefficient
D(CPI(-1))	0.222*** (0.000)
D(CPI(-2))	-0.046 (0.476)
D(CPI(-3))	0.219*** (0.000)
D(PPI)	0.353*** (0.000)
D(PPI(-1))	0.081* (0.069)
D(PPI(-2))	-0.049 (0.271)
D(PPI(-3))	-0.086* (0.062)
Constant	0.272*** (0.000)
CointEq(-1)	-0.135*** (0.000)

Note: D represented the difference of variables. 1 %, 5 %, and 10 % significance level were represented with ***, **, *, respectively. Probability values were written in parentheses.

The asymmetric relationship between CPI-PPI was investigated using Non-linear ARDL model. Table 5 represented the findings of the non-linear ARDL model in the long-run and Table 6 showed the estimated results in the short time. The positive shock in producer prices had a positive and statistically significant in the long term. If there was a 1 % increase in positive shock in PPI, CPI increased 0.59 % in the long-run. In contrast to positive shock, the impact of negative shock had positive but statistically insignificant. According to these results, there was an asymmetric effect of negative and positive shocks of PPI on CPI in the long period.

Table 5. Estimation Results for Non-Linear Models in the Long-Run

	ARDL Model for CPI-PPI (4, 4, 1)
Variables	
PPI_POS	0.578*
	(0.000)
PPI_NEG	0.111
	(0.726)
Diagnostic Tests	
Autocorrelation	1.711
	(0.183)
Heteroscedasticity	0.201
	(0.412)

Note: 1 %, 5 %, and 10 % significance level were represented with ***, **, *, respectively. Probability values were written in parentheses. Breusch-Godfrey Test was employed for autocorrelation and the appropriate lag number were determined by using Akaike Information Criteria (AIC). 1 lag was selected for ARDL Model for CPI-PPI regression. Breusch-Pagan-Godfrey Test was employed for heteroscedasticity.

There were similar results when we analyzed the estimation results of NARDL. The positive shock to the PPI and its lag had statistically significant and a positive effect on CPI. One month after a positive shock to the PPI, the effect of the shock turned negative but the magnitude of these shocks were quite small. Moreover, the negative shock on PPI had statistically insignificant effect on CPI and the value of negative shock was small when it was compared to the value of positive shock. Thus, it could be said that there was asymmetric effect of negative and positive shocks to PPI on CPI. Moreover, lag values of CPI had a notable impact on current CPI. When there was a change in CPI, the effects continue for four months.

The sign of the ECT was negative for the regression as expected and the value of the coefficient of ECT is -0.128. These results indicated that convergence to long-run equilibrium level occurred after a shock hit to economy.

Figure 2. Stability Test Results of ARDL Model

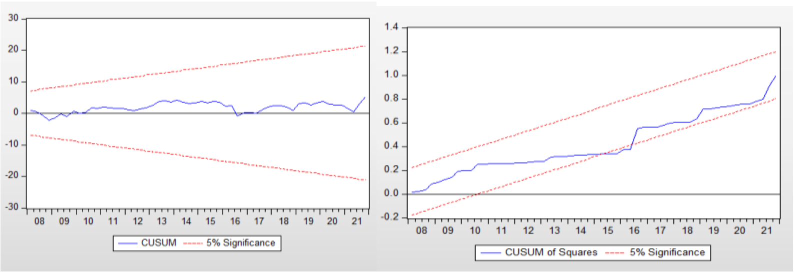
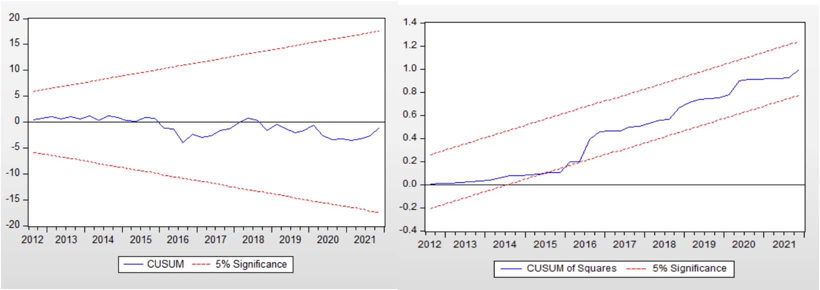


Figure 3. Stability Test Results of NARDL Model



In addition to the results of ARDL and NARDL models, Figure 1 represented the CUSUM and CUSUMSQ test results of ARDL model and Figure 2 represented the same test results of NARDL model. These tests were against the breakpoints and the null hypotheses of these tests were based on the instability of parameters. Figure 1 and 2 represented the ascertain significance of trajectory at the 95 % confidence bounds. According to the test results, the null hypotheses of CUSUM tests were rejected for both ARDL and NADL models. When we analyzed the CUSUMQ test graphics, the CUSUM of Squares line was out of 5 % boundaries in some points over the sample. These situations implied that there were doubts about the stability of the parameters.

Table 6. Estimation Results for Non-Linear Models in the Short-Run

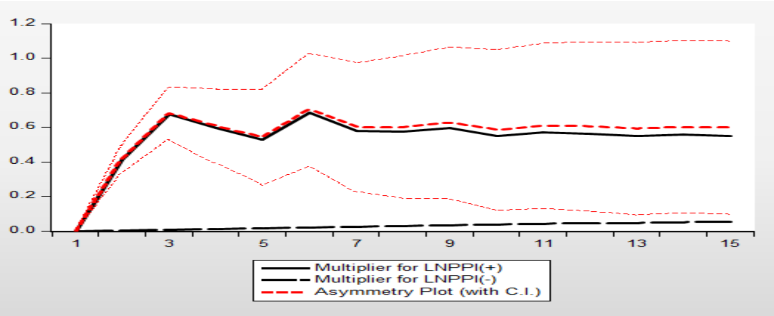
	ARDL Model for CPI-PPI (4, 4, 1)
Variable	**Coefficient**
D(CPI(-1))	0.209***
	(0.002)
D(CPI(-2))	-0.022
	(0.736)
D(CPI(-3))	0.188**
	(0.003)

D(PPI_POS)	0.389***
	(0.000)
D(PPI_POS(-1))	0.121**
	(0.013)
D(PPI_POS(-2))	-0.089*
	(0.073)
D(PPI_POS(-3))	-0.092*
	(0.073)
D(PPI_NEG)	0.014
	(0.671)
Constant	0.534***
	(0.000)
CointEq(-1)	-0.128***
	(0.000)

Note: D represented the first difference of variables. 1 %, 5 %, and 10 % significance level were represented with ***, **, *, respectively. Probability values were written in parentheses.

Finally, Figure 3 represented the cumulative multiplier effects of changes in PPI on CPI in the short-run. The effects of the increase in PPI were continuous over a year. The continuing effects of the cost-push shock to the production process could explain this situation and it could affect the consumer prices because of the spillover effect in the production processes as explained in the supply-side approach. Moreover, the impact of cost-push shock to the prices of inputs and changes of inputs affected the prices of final goods. Furthermore, the effects of negative shock to the PPI were insignificant and this movement of negative shock in Figure 3 was parallel with the findings of NARDL.

Figure 4. Multiplier Impacts of Changes in PPI



4.2. Results of Toda-Yamamoto Causality Test

To evaluate the Toda Yamamoto Causality test, it should be checked whether α_i is equal to zero or not in the equations (6) and (7). If one of the values of α_i is not equal to zero, there is a causality relation between the selected variables. If the value of α_i is equal to zero, there is not any causality relation between CPI and PPI.

According to the unit root test results, value of maximum integration degrees of CPI and PPI is equal to 1. The lag length of the VAR model is determined by various information criteria. Maximum lag length is selected as 12 because selected data frequency is monthly. The appropriate lag length of VAR model is selected 5 as represented in Table 7.

Table 7. The Appropriate Lag Length of the VAR Model

Lag Number	LR	FPE	AIC	SC	HQ
0	-	0.0008	-1.4111	-1.3797	-1.3984
1	2556.575	5.02e-09	-13.4332	-13.3391	-13.3952
2	56.8978	3.98e-09	-13.6669	-13.5101*	-13.6036
3	14.2255	3.86e-09	-13.6981	-13.4786	-13.6094*
4	2.9507	3.94e-09	-13.6752	-13.3930	-13.5612
5	13.3994*	3.83e-09*	-13.7037*	-13.3588	-13.5643
6	2.2396	3.94e-09	-13.6776	-13.2700	-13.5129
7	3.3525	4.01e-09	-13.6580	-13.1877	-13.4680
8	0.7936	4.15e-09	-13.6248	-13.0918	-13.4094
9	3.9790	4.22e-09	-13.6079	-13.0121	-13.3672
10	5.3772	4.26e-09	-13.5984	-12.9399	-13.3323
11	3.9861	4.34e-09	-13.5819	-12.8608	-13.2906
12	2.4787	4.45e-09	-13.5576	-12.7739	-13.2411

Note: LR represents sequential modified LR test statistics, FPE represents final prediction error, AIC represents Akaike Information Criteria, SC represents Schwarz information criteria, HQ represents Hannan-Quinn information criteria.

We can evaluate the results of Toda Yamamoto Causality test result after implementing unit root tests and determining appropriate lag length. We evaluate the Toda-Yamamoto test establishing lag length as $k+dmax$ = 5+1 = 6. In addition to this, the Toda Yamamoto Causality test is estimated with Seemingly Unrelated Regression method.

Table 8. Results of Toda-Yamamoto Causality Test

Null Hypothesis ($\boldsymbol{H_0}$)	Optimal Lag Length	Value of Maximum Integration Degree of Variables (dmax)	Statistic Value of Test
PPI ⇏ CPI	5	1	106.711*** (0.000)
CPI ⇏ PPI	5	1	17.127*** (0.000)

Note: 1 %, 5 %, and 10 % significance level were represented with ***, **, *, respectively. Probability values were written in parentheses.

The value of optimal lag length, the value of maximum integration degree of selected variables and the Toda-Yamamoto test results have been represented in Table 7. Results implied that bidirectional causality was found between CPI and PPI in the short-run in Turkish economy[1].

Conclusion

Changes in the inflation regime will lead to changes in the dynamics between producers and consumer price indexes. The pass-through effect of prices from PPI to CPI and the causality relation between these two price indexes depend on the inflation regime in an economy. The pricing behavior of the firms depends on the inflation regime and firms have low pricing power if the inflation rates are low. Therefore, firms can reflect changes in cost to the prices of intermediate and final goods in a limited extent. In contrast to this, firms have high pricing power when the inflation rates are high and firms can easily reflect changes in cost to the prices. For this reason, it is expected that the impacts of the changes in PPI to the CPI are too high.

The results were consistent with related literature and facts of Turkish economy. According to the results of the bound tests of both ARDL and NARDL models, cointegration relation was determined. Moreover, the impact of PPI on the CPI was positive and statistically significant for the estimation results of ARDL model. On contrary to the literature, we investigated the asymmetric impact of changes in producer prices on consumer prices. Estimation NARDL model showed that there were asymmetric effects of socks. However, positive shocks had a statistically significant and positive impact on CPI, the negative shocks had statistically insignificant impact on CPI in the long term. The outcomes of the model in the short term were similar with the outcomes of the model in the long term. The positive shock had statistically significant and positive impact on CPI and negative shock had statistically insignificant effect on CPI in the short term. Therefore,

[1] According to the ARDL model (4,4), bivariate long-run relationship runs from CPI to PPI. The value of Granger test is 18.328 and probability value is 0.000. Thus, causality runs from PPI to CPI. Moreover, the statistics value of Granger test is 3.583 and probability value is 0.007. Therefore, causality also runs from PPI to CPI. Thus, it can be said that bidirectional causality is determined between CPI and PPI in the long term in Turkish economy.

asymmetric effects of shocks were determined from PPI to CPI both in the short term and in the long term in Turkish economy. In other words, the asymmetric model could be applied to define whether the CPI responded more to increase than to decrease in PPI. These results were contradictory with the results obtained by Oral and Eştürk (2022). They found that the impact of negative shocks of PPI to CPI is bigger than the impact of the positive shocks. These contradictory results might be because of the period chosen. In this paper, the NARDL model was estimated over the sample 2003-2022, Oral and Eştürk (2022) estimated the model over the sample 2006-2021. Turkish economy switched from implicit inflation targeting policy to explicit inflation targeting policy in 2006. Thus, this change implies a structural transformation. This difference may also be due to the rapid changes in price levels in the Turkish economy in the recent years. The general price levels started to rise rapidly, and volatility of prices also increased. All of these structural transformations affect the results of cointegration methods. Therefore, in future studies, this relation between CPI and PPI should be analyzed with unit root and cointegration tests that take the structural transformations into account in order to obtain more reliable results.

In addition to the cointegration methods, Toda Yamamoto causality test was employed and according to the test results, a bidirectional relation was detected between PPI and CPI.

According to the outcomes, the impact of the PPI on the CPI increased in the high inflation regime. This result was in consistent with the theoretical explanation saying that firms had high pricing power and could easily reflect costs to the prices of intermediate and final goods during high inflationary periods. Another important reason for this result was that the structure of the Turkish economy depends on imported goods. If the value of exchange rates and prices of imported inputs increased, the cost of the production also increased. High production costs increased the producer prices and high producer prices increased consumer prices. Therefore, policymakers should develop structural reforms to decrease the import dependent production process in Turkish economy. These reforms will help the monetary authority to implement its inflation target policy as decreasing external cost factors.

As a result, it is required for monetary authority to concentrate on increasing the producer prices in order to control consumer prices in Turkish economy, which is dependent on imported goods.

Hakem Değerlendirmesi: Dış Bağımsız

Yazar Katkısı: Bekir Aşık: %100

Destek ve Teşekkür Beyanı: Çalışma için destek alınmamıştır.

Etik Onay: Bu çalışma etik onay gerektiren herhangi bir insan veya hayvan araştırması içermemektedir.

Çıkar Çatışması Beyanı: Çalışma ile ilgili herhangi bir kurum veya kişi ile çıkar çatışması bulunmamaktadır.

Peer Review: Independent double-blind

Author Contributions: Bekir Aşık: 100%

Funding and Acknowledgement: No support was received for the study.

Ethics Approval: This study does not contain any human or animal research that requires ethical approval.

Conflict of Interest: There is no conflict of interest with any institution or person related to the study.

Önerilen Atıf: Aşık, B. (2024). The asymmetric effect of producer prices on consumer prices in Turkish economy. *Akademik Hassasiyetler, 11*(24), 297-324. https://doi.org/10.58884/akademik-hassasiyetler.1291580

References

Abbas, S. K., and Lan, H. (2020). Commodity price pass-through and inflation regimes. *Energy Economics, 92*(104977), 1-45. https://doi.org/10.1016/j.eneco.2020.104977

Abdioğlu, Z., and Korkmaz, Ö. (2012). Tüketici ve üretici fiyat endekslerinde fiyat geçişkenliği: Alt sektörler. *Çukurova Üniversitesi İİBF Dergisi, 16*(2), 65-81.

Ağayev, S. (2011). Azerbaycan'da fiyatlar genel düzeyi ve döviz kuru ilişkisi. *H.Ü. İktisadi ve İdari Bilimler Fakültesi Dergisi, 29*(1), 1-19.

Akçay, S. (2011). The causal relationship between producer price index and consumer price index: Empirical evidence from selected European countries. *International Journal of Economics and Finance, 3*(6), 227-232. https://doi.org/10.5539/ijef.v3n6p227

Akdi, Y., and Şahin, A. (2007). Inflation convergence: Evidence from Turkey. *Finans Politik & Ekonomik Yorumlar, 45*(514), 69-74.

Akdi, Y., Berument, H., and Cilasun, S. M. (2006). The relationship between different price indices: Evidence from Turkey. *Physica A*(360), 483-492. https://doi.org/10.1016/j.physa.2005.05.037

Akkoç, U., and Yücel, M. E. (2017). Türkiye'de döviz kuru geçişkenliğinin asimetrik davranışı. *Uluslararası Yönetim İktisat ve İşletme Dergisi, ICMEB17 Özel Sayısı*, 903-9011.

Arslaner, F., Karaman, D., Arslaner, N., and Kal, S. H. (2014). The relationship between inflation targeting and exchange rate pass-through in Turkey with a model averaging approach. *CBRT Working Paper,* (14/16), 1-57.

Azgün, S. (2013). Türkiye'de döviz kuru hareketlerinin iç fiyatlara (ithalat, ÜFE, TÜFE) geçişi. *Sosyoekonomi, 2*(130205), 1-14.

Balcılar , M., Ozdemir, Z. A., and Shahbaz, M. (2019). On the time-varying links between oil and gold: New insights from the rolling and recursive rolling Approaches. *International Journal of Finance & Economics, 24*(3), 1047-1065.

Baum, C. F., Hurn, S., and Otero, J. (2021). The dynamics of U.S. industrial production: A time-varying granger causality perspective. *Econometrics and Statistics*, 1-10. https://doi.org/10.1016/j.ecosta.2021.10.012

Bayat, T., Özcan, B., and Taş , Ş. (2015). Türkiye'de döviz kuru geçiş etkisinin asimetrik nedensellik testleri ile analizi. *Eskişehir Osmangazi Üniversitesi İİBF Dergisi, 10*(2), 7-30.

Blomberg, S. B., and Harris, E. S. (1995). The commodity–consumer price connection: fact or fable? *FRBNY Economic Policy Review*, 21-38.

Bozdağlıoğlu, E., and Yılmaz, M. (2017). Türkiye'de enflasyon ve döviz ilişkisi: 1994-2014 yılları arası bir inceleme. *Bitlis Eren Üniversitesi Akademik İzdüşüm Dergisi, 2*(3), 1-20.

Caporale, G. M., Katsimi, M., and Pittis, N. (2002). Causality links between consumer and producer prices: Some empirical evidence. *Southern Economic Journal, 68*(3), 703-711.

Ca'Zorzi, M., Hahn, E., and Sanchez, M. (2007, March). Exchange rate pass-through in emerging markets. *European Central Bank Working Paper Series*(739), 1-34. https://doi.org/10.2139/ssrn.970654

Clark, T. E. (1995). Do producer prices lead consumer prices? *Economic Review, 80*(3), 25-39.

Colclough, W. G., and Lange, M. D. (1982). Empirical evidence of causality from consumer to wholesale prices. *Journal of Econometrics, 19*(2-3), 379-384. https://doi.org/10.1016/0304-4076(82)90012-4

Cushing, M. J., and MacGarvey, M. G. (1990). Feedback between wholesale and consumer price inflation: A reexamination of the evidence. *Southern Economic Journal, 56*, 1059-1072.

Delatte, A.-L., and Villavicencio, A. L. (2012). Asymmetric exchange rate pass-through: Evidence from major countries. *Journal of Macroeconomics, 34*, 833-844.

Demir, F. (2022). Investigation of asymmetric relationship between Consumer and producer prices in Turkey: Evidence from hidden cointegration and asymmetric causality analyses. *Alanya Akademik Bakış Dergisi, 6*(2), 2051-2067. https://doi.org/10.29023/alanyaakademik.1008222

Dolores, R. M. (2009). Exchange rate pass-through in central and east European countries: Do inflation and openness matter? *Eastern European Economics, 47*(4), 42-61. https://www.jstor.org/stable/27740130

Dorestani, A., and Arjomand, L. H. (2006). An empirical study of the relationship between consumer and producer price index: A unit root test and test of cointegration. *The Coastal Business Journal, 5*(1), 33-38. https://digitalcommons.coastal.edu/cbj/vol5/iss1/4

Erdem, H. F., and Yamak, R. (2014). Üretici fiyat endeksi ve tüketici fiyat endeksi arasındaki geçişkenliğin derecesi. *Anadolu Üniversitesi Sosyal Bilimler Dergisi, 14*(4), 1-13.

Gang, F., Liping, H., and Hu, J. (2009). CPI vs. PPI: Which drives which? *Front. Econ. China, 4*(3), 317-334. https://doi.org/10.1007/s11459-009-0018-z

Ghazali, M. F., Yee, O. A., and Muhammad, M. Z. (2008). Do producer prices cause consumer prices? Some empirical evidence. *International Journal of Business and Management, 3*(11), 78-82.

Göktaş, P. (2019). Türkiye'de döviz kurunun tüketici fiyatları üzerindeki asimetrik geçiş etkileri. *Sosyoekonomi, 27*(42), 29-50. https://doi.org/10.17233/sosyoekonomi.2019.04.02

Guthrie, R. S. (1981). The Relationship between wholesale and consumer prices. *Southern Economic Journal, 47*(4), 1046-1055. https://doi.org/10.2307/1058161

Gül, E., and Ekinci, A. (2006). Türkiye'de enflasyon ve döviz kuru arasındaki nedensellik ilişkisi: 1984-2003. *Sosyal Bilimler Dergisi,* 1, 91-106.

Gümrah, Ü., and Konur, F. (2017). Asimetrik döviz kuru geçişkenliği: Türkiye örneği. *Siyaset, Ekonomi ve Yönetim Araştırmaları Dergisi, 5*(4), 82-90.

Güven, E. A., and Uysal, D. (2013). Türkiye'de döviz kurlarındaki değişme ile enflasyon arasındaki ilişki (1983-2012). *Akademik Araştırmalar ve Çalışmalar Dergisi, 5*(9), 141-156.

Hamid, S. A., Thirunnavukkarasu, A., & Rajamanickam, M. (2006). Price transmission between DJIA, S&P 500 index, PPI and CPI. *Southern New Hampshire University Center of Financial Studies Working Papers, 5*, 1-21.

Hasan, A. N., and Masih, M. (2018). Determinants of food price inflation: Evidence from Malaysia based on linear and nonlinear ARDL. *MPRA Munich Personal RepEc Archive,* 91517, 1-27. https://mpra.ub.uni-muenchen.de/91517/

Helali, K., Kalai, M., and Thouraya, B. (2014). Exchange rate pass-through to domestic prices in Tunisia: A short and long-run analysis. *MPRA-Munich Personal RepEc Archive,* 62204, 1-18. https://mpra.ub.uni-muenchen.de/62204/

Ito, T., and Sato, K. (2008, October). Exchange rate changes and inflation in post-crisis Asian economies: Vector autoregression analysis of the exchange rate pass-through. *Journal of Money, Credit and Banking, 40*(7), 1407-1438. https://www.jstor.org/stable/25096316

Jones, J. D. (1986). Consumer prices, wholesale prices, and causality-more empirical evidence for the U.S., 1947–1983. *Empirical Economics, 11*, 41-55.

Kal, S. H., Arslaner, F., and Arslaner, U. (2015). Sources of asymmetry and non-linearity in pass-through of exchange rate and import price to consumer price inflation for the Turkish economy during inflation targeting regime. *CBRT Working Paper,* (15/30), 1-30.

Kara, A. H., and Öğünç, F. (2012). Döviz kuru ve ithalat fiyatlarının yurt içi fiyatlara etkisi. *İktisat, İşletme ve Finans, 27*(317), 9-28. https://doi.org/10.3848/iif.2012.317.3396

Kara, B., and Keskin, A. (2021). Üretici fiyat endeksi, tüketici fiyat endeksi ve maliye politikası: 1996-2020 dönemi ve Türkiye. *Kafkas Üniversitesi İİBF Dergisi, 12*(24), 881-899.

Kaygusuz, A. D. (2018). Döviz kuru dalgalanmalarının enflasyon üzerindeki geçiş etkisi: Türkiye örneği. *International Review of Economics and Management, 6*(2), 117-137.

Khan, K., Su, C.-W., Tao, R., and Lobont, O.-R. (2018). Producer price index and consumer price index: Causality in Central and Eastern European countries. *Ekonomický časopis, 4*(66), 367-395.

Khemiri, R., and Ben Ali, M. (2013). Exchange rate pass-through and inflation dynamics in Tunisia: A markov-switching approach. *Economics, 7*(1), 1-30. https://doi.org/10.5018/economics-ejournal.ja.2013-43

Kılıç, R. (2010). Exchange-rate pass-through to import prices: Nonlinearities and exchange rate and inflationary regimes. *TÜSİAD-Koç University Economic Research Forum Working Paper Series*(1033), 1-41.

Kim, K.-H. (1998). US inflation and the dollar exchange rate: A vector error correction model. *Applied Economics, 30*(5), 613-619. https://doi.org/10.1080/000368498325606

Kocak, N. A. (2021). Türkiye'de tüketici ve üretici fiyatları arasındaki ilişkinin alternatif tahmin yöntemleri kullanılarak analizi. *Business and Economics Research Journal, 12*(1), 33-47. https://doi.org/10.20409/berj.2021.309

Korkmaz, S., and Bayır, M. (2015). Döviz kuru dalgalanmalarına yurtiçi fiyatlarının etkisi. *Niğde Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 8*(4), 69-85. http://dergipark.ulakbim.gov.tr/niguiibfd/

Kwon, D.-H., and Koo, W. (2009). Price transmission mechanisms among disaggregated processing stages of food: demand-pull or cost-push? (A. a., Ed.) *2009 Annual Meeting, July 26-28, 2009*, 1-32. https://doi.org/10.22004/ag.econ.49332

Leigh, D., and Rossi, M. (2002). Exchange rate pass-through in Turkey. *IMF Working Paper,* (WP/02/204), 1-19.

Li, S., Tang, G., Yang, D., and Du, S. (2019). Research on the relationship between CPI and PPI based on VEC model. *Open Journal of Statistics, 9*(2), 218-229.

Losada, Ó. H., Arias, J. P., and Guzmán, J. C. (2018). Relationship between the consumer price index and the producer price index for six South American countries. *Apuntes del Cenes, 37*(66), 39-74. https://doi.org/10.19053/01203053.v37.n66.2019.6601

Manning, M. L., and Andrianacos, D. (1993). Dollar movements and inflation: A cointegration analysis. *Applied Economics, 25*(12), 1483-1488. https://doi.org/10.1080/00036849300000152

McCharty, J. (1999). Pass-through of exchange rates and import prices to domestic inflation in some industrialized economies. *BIS Working Paper,* (79), 1-48.

Mert, N. (2023). Transmission mechanism between consumer and producer prices in fragile five countries: Threshold cointegration and error correction. *Hacettepe University Journal of Economics and Administrative Sciences, 41*(2), 251-270. https://doi.org/10.17065/huniibf.1137805

Mirdala, R. (2014). Exchange rate pass through to domestic prices under different exchange rate regimes. *William Davidson Institute Working Paper*(1070), 1-38.

Mohd, R., and Masih, M. (2018). Testing the asymmetric and lead-lag relationship between CPI and PPI: An application of the ARDL and NARDL approaches. *Munich Personal RepEc Archive-MPRA,* (112500), 1-32.

Nguyen, T.-N. A., and Kiyotaka, S. (2015). Asymmetric exchange rate pass-through in Japanese exports: Application of the threshold vector autoregressive model. *RIETI Discussion Paper Series* (15-E-098), 1-26.

Nidhaleddine, B. C. (2012). Asymmetric exchange rate pass-through in the Euro Area: New evidence from smooth transition models. *Economics: The Open-Access, Open-Assessment E-Journal, 6*(2012-39), 1-28. https://doi.org/10.5018/economics-ejournal.ja.2012-39

Nogueira, R. J., and Leon-Ledesma, M. A. (2008). Exchange rate pass-through into inflation: the role of asymmetries and nonlinearities. *Department of Economics Discussion Paper,* 8(1), 1-46.

Oral, İ. O., and Eştürk, Ö. (2022). Üretici fiyatından gıda tüketici fiyatına asimetrik iletim. *Fırat Üniversitesi Sosyal Bilimler Dergisi, 32*(2), 676-684.

Oyeleke, O. J., and Ojediran, O. A. (2018). Exploring the relationship between consumer price index (CPI) and producer price index (PPI) in Nigeria. *Advances in Social Sciences Research Journal, 5*(11), 214-224. https://doi.org/10.14738/assrj.511.5450

Öner, H. (2018). Tüketici ve üretici fiyat endeksleri arasındaki ilişkinin Granger nedensellik testi yoluyla incelenmesi. *Finans Ekonomi ve Sosyal Araştırmalar Dergisi, 3*(1), 318-327.

Özkan, İ., and Erden, L. (2015). Time-varying nature and macroeconomic determinants of exchange rate pass through. *International Review of Economics and Finance, 38,* 56-66. https://doi.org/10.1016/j.iref.2015.01.007

Özpolat, A. (2020). Casual link between consumer price index and producer price index: an evidence from central and eastern European countries (CEECs). *ADAM AKADEMİ Sosyal Bilimler Dergisi, 10*(2), 319-332. https://doi.org/10.31679/adamakademi.594508

Reddan, P., and Rice, J. (2017). Exchange rate pass-through to domestic prices. *Central Bank of Ireland Eeconomic Letter Series,* (8), 1-11.

Rincon, H., and Rodriguez, N. (2016). Pass-through of exchange rate shocks on inflation: A Bayesian smooth transition VAR approach. *Graduate Institute of International and Development Studies International Economics Department Working Paper Series,* (13), 1-72.

Rizvi, S. A., and Sahminan, S. (2020). Commodity price and inflation dynamics: Evidence from BRICS. *Bulletin of Monetary Economics and Banking, 23*(4), 485-500.

Rowland, P. (2004). Exchange rate pass-through to domestic prices: The case of Colombia. *Revista ESPE - Ensayos sobre Política Económica, Banco de la Republica de Colombia, 22*(47), 106-125.

Saatcioğlu, C., and Karaca , O. (2017). Türkiye'de üretici fiyatları ile tüketici fiyatları arasındaki nedensellik ilişkisi: 2005-2016. *Sakarya İktisat Dergisi, 6*(2), 1-16.

Saha, S., and Zhang, Z. (2013). Do exchange rates affect consumer prices? A comparative analysis for Australia, China and India. *Mathematics and Computers in Simulation, 93,* 128-138. https://doi.org/10.1016/j.matcom.2012.11.002

Saraç, T. B., and Karagöz, K. (2010). Türkiye’de tüketici ve üretici fiyatları arasındaki ilişki: Yapısal kırılma ve sınır testi. *Maliye Dergisi,* (159), 220-239.

Sek, S. K., Sim, K. Y., Har, W. M., and Aric, K. H. (2023). Examination on the asymmetric effects of commodity price changes on sectoral CPI inflation of Malaysia. *AIP Conference Proceedings, 2500*(020023), 1-11. https://doi.org/10.1063/5.0110160

Selim, S., and Güven, E. A. (2014). Türkiye’de enflasyon, döviz kuru ve işsizlik arasındaki ilişkinin ekonometrik analizi. *Ekonomik ve Sosyal Araştırmalar Dergisi, 10*(1), 127-145.

Shahbaz, M., and Nasir, N. (2009). Producer and consumer prices nexus: ARDL bounds testing approach. *International Journal of Marketing Studies, 1*(2), 78-86. https://doi.org/10.5539/ijms.v1n2p78

Shahbaz, M., Tiwari, A. K., and Tahir, M. I. (2012). Does CPI Granger-cause WPI? New extensions from frequency domain approach in Pakistan. *Economic Modelling, 29*(5), 1592-1597. https://doi.org/10.1016/j.econmod.2012.05.016

Shi, S., Hurn, S., and Phillips, P. C. (2016). Causal change detection in possibly integrated systems: Revisiting the money-income relationship. *Cowles Foundation Discussion Papers,* (2059), 1-59.

Shintani, M., Hagiwara, A. T., and Yabu, T. (2013). Exchange rate pass-through and inflation: A nonlinear time series analysis. *Journal of International Money and Finance, 32*, 512-527.

Sidaoui, J., Capistran, C., Chiquiar, D., and Ramos-Franca, M. (2009). A note on the predictive content of PPI over CPI inflation: The case of Mexico. *Banco de México Working Paper,* (2009-14), 1-20.

Silver, J. L., and Wallace, T. D. (1980). The lag relationship between wholesale and consumer prices. *Journal of Econometrics, 12*(3), 375-387. https://doi.org/10.1016/0304-4076(80)90063-9

Suriani, and Ridzqi, F. (2019). Effect of commodity prices on inflation persistence: Partial adjustment approach. *Regional Science Inquiry, 11* (2, Special Issue), 121-135.

Tarı, R., Abasız, T., and Pehlivanoğlu, F. (2012). TEFE (ÜFE)-TÜFE fiyat endeksleri arasındaki nedensellik ilişkisi: frekans alanı yaklaşımı. *Akdeniz İ.İ.B.F. Dergisi*, (24), 1-15.

Terzi, H., and Tütüncü , A. (2017). Türkiye'de üretici fiyat endeksi ve tüketici fiyat endeksi arasındaki ilişkinin incelenmesi: ARDL sınır testi yaklaşımı. *Sosyoekonomi, 25*(34), 173-186. https://doi.org/10.17233/sosyoekonomi.289926

Tiwari, A. K. (2012). An empirical investigation of causality between producers' price and consumers' price indices in Australia in frequency domain. *Economic Modelling,* (29), 1571-1578. https://doi.org/10.1016/j.econmod.2012.05.010

Tiwari, A. K., Mutascu, M., and Andries, A. M. (2013). Decomposing time-frequency relationship between producer price and consumer price indices in Romania through wavelet analysis. *Economy Modelling,* (31), 151-159.

Toda, H. Y., and Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated process. *Journal of Econometrics*, (66), 225-250.

Topuz, Y. V., Yazdifar, H., and Sahadev, S. (2018). The relation between the producer and consumer price indices: A two country study. *Journal of Revenue and Pricing Management,* (17), 122-130. https://doi.org/10.1057/s41272-017-0125-x

Ülke, V., and Ergün, U. (2014). The relationship between consumer price and producer price indices in Turkey. *International Journal of Academic Research in Economics and Management Sciences, 3*(1), 1-20. https://doi.org/10.6007/IJAREMS/v3-i1/607

Volkan, A., Saatçioğlu, C., and Korap , L. (2007, August). Impact of exchange rate changes on domestic inflation: The Turkish experience. *Turkish Economic Assosiacion Discussion Paper*, (2007/06), 1-12.

Yamak, R., and Topbaş , F. (2008). Üretici fiyat endeksi ve tüketici fiyat endeksi arasındaki geçişkenliğin derecesi [Bildiri sunumu]. Dokuzuncu Ekonometri ve İstatistik Sempozyumu, İzmir.

Yıldırım, Z. (2015). Enflasyon rejimleri ve üretici enflasyonunda tüketici enflasyonuna geçişkenlik. *Central Bank Review,* 15, 89-114.

Yüncüler, Ç. (2011). Pass-through of external factors into price indicators in Turkey. *Central Bank Review, 11*, 71-84.

Zortuk, M. (2008). Türkiye'de tüketici ve toptan eşya fiyat endeksleri arasındaki nedensellik ilişkisi: 1986–2004. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi,* 20, 181-190.