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Oil Price Pass-Through on Sector-Level Prices: Evidence from Turkey

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Abstract: *As energy dependency is one of the main drivers of rising global inflation, understanding the sectoral outlook for the effects of oil prices on inflation is crucial. This paper investigates oil price pass-through to consumer prices in Turkey utilizing a Phillips Curve estimation approach. Extending the results in the literature, we estimate Brent crude petroleum price pass-through coefficients for the 2-digit sectoral components of the consumer price index. Then, we compare the sector-level pass-through rates to the ones obtained from the headline and core inflation. We also apply a recursive estimation modeling to track pass-through behavior over time for each inflation series. The paper has several conclusions. First, the long-run oil price pass-through to headline inflation is around 7%. Second, pass-through to the core and sectoral inflation rates exhibit a significant amount of variation from headline inflation. Results with core inflation rates depend on whether energy prices are included or excluded from the consumer basket. Third, the sectoral pass-through rate depends on the weight of the energy-related items in that sector. Our findings suggest that the transport sector has the highest degree of pass-through. Fourth, the rate of pass-through to all prices increases following the hikes in inflation rates in September 2018 and October 2021.*

Keywords: Brent Crude Oil Prices, Headline Inflation, Core Inflation, 2-Digit Sectoral Consumer Inflation, Oil Price Pass-Through, Phillips Curve

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1. Introduction

Rising energy prices are one of the important causes of supply chain bottlenecks, as well as the recent increase in global inflation rates. Understanding the sectoral outlook for the pass-through of oil prices to domestic inflation is necessary to develop policy remedies for inflationary pressures. The debate on oil price pass-through takes an important place in the literature and dates back to Hamilton (1983)[1]. Hamilton (1983) documents a positive relationship between oil prices and inflation and argues that the increases in oil prices can be used as an indicator of economic stagnation. However, a growing literature argues that these findings are specific to the period of high oil prices and cannot explain the economic recessions[2].

The significant fluctuations in oil prices in recent years have brought the discussion back to the agenda. The expansion of input-output linkages all around the world formed a complicated structure for the pass-through of oil price changes to inflation. Results in the literature show that the level and speed of pass-through may vary from sector to sector, depending on the sectors' relationship with international oil prices. Combined with the energy dependency, the heightened level of oil price volatility raises concerns in

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developing countries such as Turkey. Hence, understanding the pass-through dynamics is important for not only the formulation of monetary policy but also for the companies' pricing decisions.

The literature generally agrees that oil price pass-through is statistically significant[3]. But the effect is asymmetric, with negative oil price shocks having a smaller effect than positive ones (see for instance Hooker, 2002; Choi et al., 2018; Salisu et al., 2017). The recent literature, reports that the pass-through tends to decline in all countries in the long run, but the level of the fall depends on the economic conditions. The decline in average pass-through for industrialized economies is estimated to be much higher than for emerging economies. This is particularly explained not only by the favorable inflation environment (De Gregorio et al., 2007; Choi et al., 2018) but also by a faster reduction in oil intensity due to technological developments (Schneider, 2004; Blinder & Rudd, 2008; Shioji & Uchino, 2010; Valcarcel & Wohar, 2013). Along with this discussion, Choi et al. (2018) draw further attention to the fact that cross-country variation in oil price pass-through is related to the share of transport in the consumer basket and energy subsidies.

The studies on the Turkish economy focus on the linkage between consumer and oil prices and the results are generally consistent with the literature. According to Çatık and Önder (2011) and Çatık and Karaçuka (2012), the inflationary effect of oil prices decreases after 2002, a low inflationary period. However, Dedeoğlu and Kaya (2014), Yanıkkaya et al. (2015), Akçelik and Öğünç (2016), and Ertürk and Erkan (2021) document that the oil price pass-through has an increasing trend over time. Dedeoğlu and Kaya (2014) and Akçelik and Öğünç (2016) attribute the increase in pass-through rates to the increase in both oil prices and energy intensity in the economy. Ertürk and Erkan (2021) agree that the source of increased pass-through is the increase in petroleum density following 2002. In addition, they point out that the effect of oil price shock was eliminated in a shorter time compared to earlier periods due to the changing institutional structure. Altunöz (2022), furthermore, reports the non-linear and symmetric pass-through effect of crude oil prices on the inflation rate in Turkey. These findings suggest that policymakers should adopt different monetary policy responses to the rise and fall of global oil prices.

Results in the literature confirm the view that the level of oil price pass-through is largely connected to the oil density in the economy. However, these findings have been mostly evaluated by examining the oil prices and aggregate (headline and core) consumer price indices. A notable exception is Akçelik and Öğünç (2016), where the degree of oil price pass-through to the domestic inflation rate is investigated at different stages of the supply chain in Turkey. Akçelik and Öğünç (2016) first examine the link between oil and import prices, then carry out an analysis of motor fuel and transport service prices. They conclude the analysis by reporting the results on the aggregate price indices by paying attention to these intermediate stages.

In this study, we contribute to the oil price pass-through literature by performing an empirical analysis using 2-digit sectors listed in the COICOP[4] classification. COICOP classification is used to compute consumer price indices. We also consider the headline and six classifications of the core inflation series. Each of these inflation series differs with respect to the contents of energy-related items. As Choi et al. (2018) noted, variation in oil price pass-through is related to the share of transport in the consumer price index basket and energy subsidies. In line with this argument, utilizing sector-level data allows us to directly test the weight of oil-dependent sectors in explaining the decrease in pass-through.

We use monthly Turkish data between 2003-01 and 2022-10, which presents the case of an oil-importer emerging country implementing an inflation-targeting monetary policy. During this period, the Turkish and the world economy witnessed many structural breaks. For instance, COVID-19 is one of the important events in this period for both the world and the Turkish economy. At the same time, different monetary policies were implemented in Turkey during this period. In order to evaluate the pass-through coefficients correctly, these structural breaks should be taken into account in the analysis. For this purpose, in the second part of the empirical analysis we perform recursive estimation techniques to find out the path of the estimated parameters along the analysis period.

To sum up, our results show that oil price pass-through varies significantly across the sectors. The pass-through is higher in sectors with a higher weight of oil. Inflation rates exhibited sudden increases in

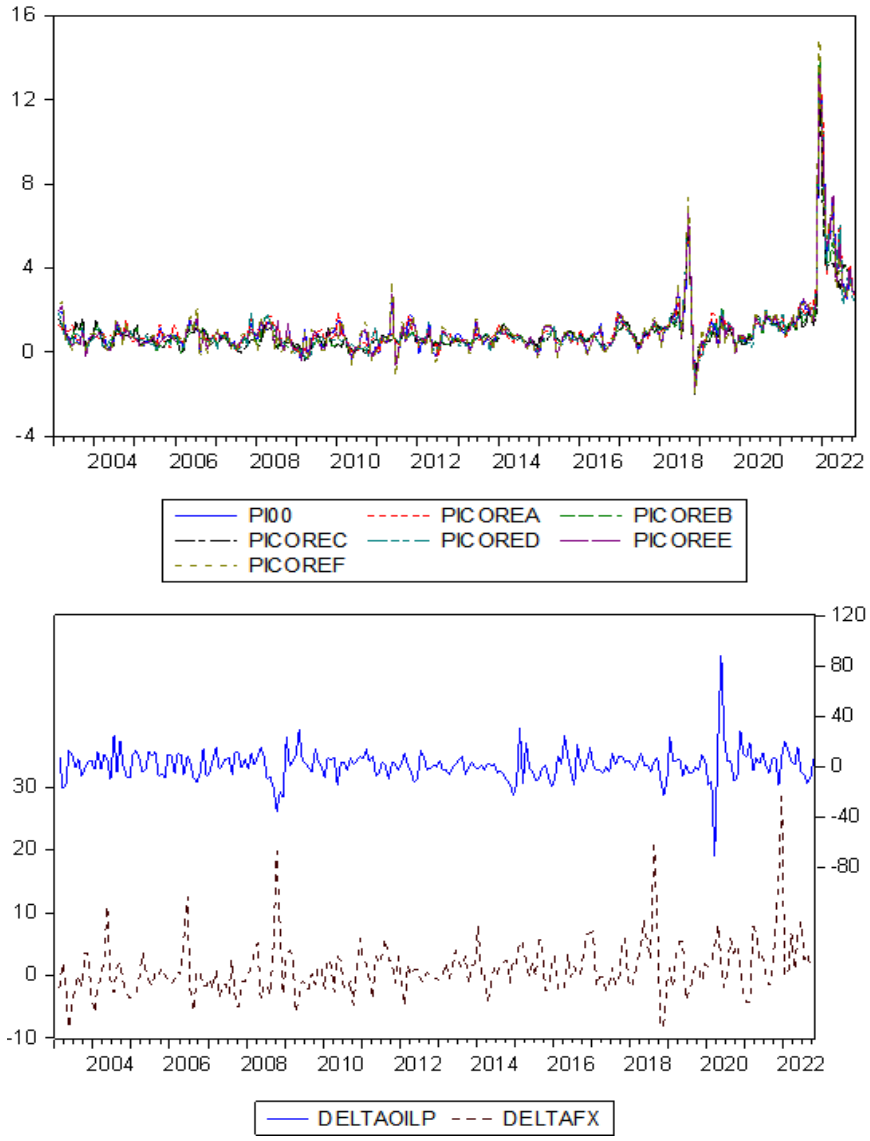
September 2018 and October 2021. These hikes were associated with large depreciations in the Turkish Lira. After each period, the oil price pass-through coefficients reached higher values.

The remainder of this paper is organized as follows. Section 2 describes the empirical methodology. Section 3 presents the estimation results by documenting the sectoral oil price pass-through rates. Section 4 concludes.

2. Data and Methodology

Our data set comprises price indices, industrial production index, foreign exchange rates, and oil prices. Our sample consists of monthly data and covers the period between January 2003 and October 2022. Percentage changes in price indices are used to calculate the inflation rates.

Figure 1. Patterns of Headline, Core Inflation Series, Changes in Brent Petroleum Prices, and Changes in the Exchange Rate

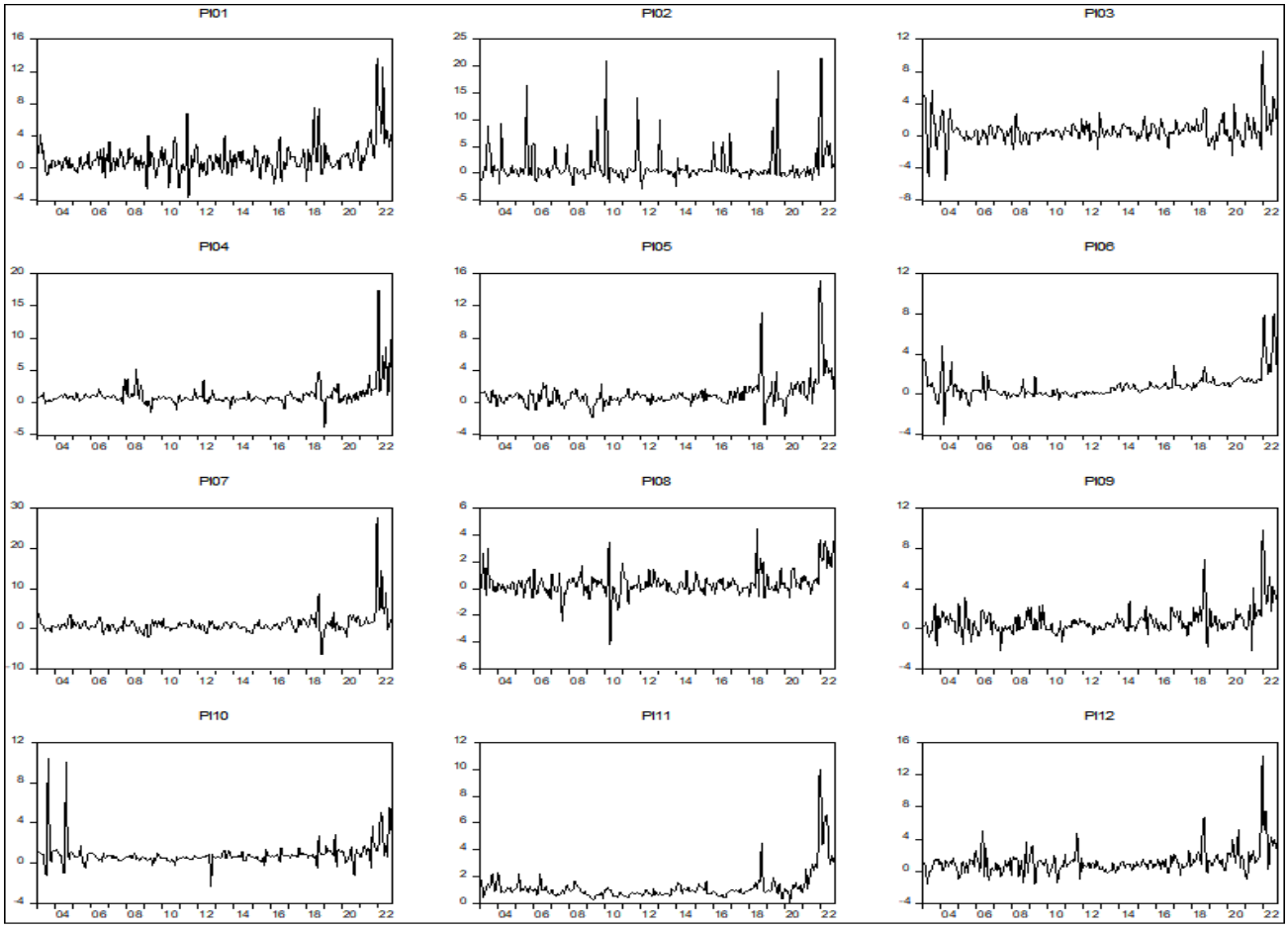


Note: *PI00: Headline inflation; PICOREA: Core Inflation A (excludes seasonal products);PICOREB: Core Inflation B (excludes unprocessed food, energy, alcoholic beverages tobacco, and gold); PICOREC: Core Inflation C (excludes energy, food and non-alcoholic beverages, alcoholic beverages, tobacco, and gold); PICORED: Core Inflation D (excludes unprocessed food, alcoholic beverages and tobacco); PICOREE: Core Inflation E (excludes alcoholic beverages and tobacco); PICOREF: Core Inflation F (excludes administered and directed prices); DELTAOIL: Percentage change in Brent petroleum price (right axis); DELTAFX: Percentage change in USA Dollar rates.*

Following Akçelik and Öğünç (2016), we account for core in addition to headline inflation. They argue that core inflation (CPI-D) allows them to isolate unexpected volatility and focus on a more refined measure of inflation. There are six core inflation measures documented by TURKSTAT and we consider all of them in this analysis. In addition, we contribute to the literature by examining how the pass-through behavior varies across the 2-digit sectors listed in the COICOP classification. Industrial production index and price indices are seasonally adjusted using the Census-13 methodology[5]. The foreign exchange rate is the TL/US dollar value. Brent Oil price (in US dollars, end-of-month values) is used for the oil price. Data sources are Federal Reserve Economic Data (oil prices), Central Bank of Turkey (price indices), and Turkish Statistical Institute (industrial production index).

The headline and core inflation series are plotted at the top panel of Figure 1. Inflation rates display significant increases in 2018 and toward the end of 2021. These developments lead the inflation rates to reach an upper-level platform. It appears that the increase in the domestic inflation series follows the path in the Brent petroleum inflation with a lag. The basic explanation for this pattern is related to the implementation of the echelle-mobil system in Turkey. In this system, the government aims to keep the pump price of the fuel as constant as possible by automatically matching the increases in fuel prices by decreasing the special consumption tax. The main purpose of implementing this tax system is to prevent frequent changes in fuel prices due to the volatility in the exchange rate and changes in oil prices. In fact, the sudden and rapid rise periods are closely related to the large exchange rate depreciations (Figure 1).

Figure 2. Patterns of Inflation in 2-digit Sectors of Consumer Price Index



Note: *PI01: Sector 1: "food and non-alcoholic beverages"; PI02:Sector 2: "alcoholic beverages and tobacco"; PI03: Sector 3: "clothing and footwear"; PI04: Sector 4: "housing, water, electricity, gas, and other fuels"; PI05:Sector 5: "furnishings, household equipment, routine maintenance of the house"; PI06:Sector 6: "health"; PI07: Sector 7: "transport"; PI08:Sector 8: "communications"; PI09: Sector 9: "recreation and culture"; PI010: Sector 10: "education"; PI11:Sector 11: "hotels, cafes and restaurants"; PI12: Sector 12: "miscellaneous goods and services".*

Figure 2 shows that the pattern of inflation varies across the sectors of the aggregate consumer price index. However, a close inspection reveals that all of them display a parallel movement to the exchange rate changes. The co-movements between the changes in the exchange rate movements and inflation rates are noticeable in sector 4: "housing, water, electricity, gas, and other fuels", sector 5: "furnishings, household equipment, routine maintenance of the house", sector 7: "transport" and sector 11: "hotels, cafes and restaurants" along the whole period. Note that these are the energy-related sectors of the consumer basket.

Before the regression analysis, we performed the necessary diagnostic tests. Our results from Augmented Dickey-Fuller tests indicate that all price variables are I(1) at levels. We find that inflation rates for all price indices, the percentage changes in exchange rates, the industrial production index, and oil prices are stationary.

For the empirical model, the lag length for each variable is selected using the Schwarz Information Criteria in univariate autoregressive models. The numbers of lags are reported in Appendix Table A1. The optimal number of lags for headline and core inflation rates is 3. Across the sectoral inflation rates, lag lengths vary from 0 (alcoholic beverages and tobacco) and 6 (health, education). The optimal lag length for the change in industrial production is 0 while it is 2 for exchange rate depreciation and oil price inflation. Hence, we include these variables in the regression analysis using their optimal lag lengths.

We apply ordinary least squares techniques to estimate the Phillips curve equation, a frequently used approach in investigating the effects of oil price changes on domestic inflation[6]. Yanıkkaya et al. (2015) also utilize a similar approach to analyze the Turkish case. However, our analysis covers not only aggregate but also sectoral components of the consumer price index. We estimate the following backward-looking augmented Phillips curve equation to obtain the pass-through from oil prices to inflation:

$$\pi_{jt} = \alpha + \sum_{i=1}^{k_1} \beta_j \, \pi_{jt-i} + \sum_{i=0}^{k_2} \phi_j \, y_{t-i} + \sum_{i=0}^{k_3} \lambda_j \, \Delta e_{t-i} + \sum_{i=0}^{k_4} \delta_j \, \pi_{t-i}^{oil} + \epsilon_{jt} \qquad (1)$$

where π_{jt}, y_{jt}, Δe_t, and π_t^{oil} represent inflation rates, the percentage change in industrial production index, changes in exchange rates, and oil price inflation respectively at time t. The subscript j accounts for sub-sectors of inflation, whereas subscript i is used for the lag length.

It is assumed that the impact of oil price change on the inflation rate is realized with a lag, and the lag length depends on the sectoral inflation rates. Using the estimated coefficients of equation (1), the long-run pass-through rate can be calculated as follows,

$$PT_{long-run} \equiv \frac{\sum_{i=0}^{k_4} \delta_i}{1 - \sum_{i=0}^{k_1} \beta_i} \qquad (2)$$

The short-term or immediate oil price pass-through is obtained by the value of δ_1.

3. Results

3.1. Phillips Curve Estimation

Results from the estimation of equation (1) for headline and core inflation (CPI-D) rates are reported in Table 1. Results for the headline inflation can be comparable to those of Yanıkkaya et al. (2015) and Ertürk and Erkan (2021). Our estimates imply that inflation follows a persistent path in Turkey. Output gap coefficients are positive which is consistent with theoretical predictions, but insignificant[7]. The coefficients of the exchange rate depreciation yield comparable pass-through rates with the literature, and capture the increase in the pass-through rate in the recent episode when the sample is restricted.

Table 1. Philips Curve Estimation Results: Headline and Core Inflation

Variables	Headline Inflation	Core Inflation (CPI-D)
π_{t-1}	0.475*** (7.29)	0.573*** (8.73)
π_{t-2}	-0.107 (-1.47)	-0.152** (-2.02)
π_{t-3}	0.282*** (4.97)	0.271*** (4.78)
Δy_t	0.005 (0.28)	0.022 (1.28)
Δe_t	0.110*** (7.429)	0.116*** (8.57)
Δe_{t-1}	0.056*** (3.08)	0.041** (2.41)
Δe_{t-2}	0.007 (0.41)	0.002 (0.10)
Π_t^{oil}	0.014*** (3.02)	0.012*** (2.76)
Π_{t-1}^{oil}	0.007 (1.26)	0.009* (1.77)
Π_{t-2}^{oil}	0.005 (1.10)	0.001 (0.24)
Constant	0.139* (1.85)	0.099 (1.46)
Adjusted R^2	0.6445	0.6924

Note: *CPI-D is the index used in Akçelik & Öğünç (2016) and it excludes unprocessed food, alcoholic beverages, and tobacco. Δy is the percentage change in the industrial production index, Δe is the TL/dollar exchange rate changes. Π^{oil} is the percentage change in oil price.* $* p < 0.10, ** p < 0.05, *** p < 0.01$.

Oil-price coefficients reported in Table 1 are positive, and close to the ones reported by Yanıkkaya et al. (2015) for the post-2002 episode. Yanıkkaya et al. (2015) attain oil price pass-through for the period of 1990Q1-2002Q2 and 2002Q3-2013Q3 and show that the oil price pass-through has a significant structural break. More specifically, the short-run pass-trough (δ_1) is estimated to increase from about -0.64% to 6.3%, while the long-run pass-through rate increased from 0.24% to 11.9%. Adopting a similar approach, Ertürk and Erkan (2021) investigates the 1980M1-2002M4 and 2002M5-2018M10 periods separately and document that the long-run pass-through rate increased from 7.23% to 13.10 % after 2002.

Table 2 reports the estimated pass-through rates for alternative definitions of core inflation. The exclusion of food, alcoholic beverages, and tobacco significantly eliminates the noisy movements and high unexpected volatility in the inflation series. Lower values for B and C classifications reveal that oil price inflation is directly transferred to domestic prices through consumption of the energy-related items. This finding is consistent with the explanation by Choi et al. (2018), that pass-through variation is related to the share of intensive oil use sectors in the general consumption basket.

Table 2. Oil Price Pass-Through to Core Inflation Rates

Sector	Short-run Pass-through	Long-run Pass-through
Headline Inflation	0.0142**	0.0746**
Core Inflation A (excludes seasonal products)	0.0120***	0.0774***
Core Inflation B (excludes unprocessed food, energy, alcoholic beverages tobacco, and gold)	0.0103**	0.0379*
Core Inflation C (excludes energy, food and non-alcoholic beverages, alcoholic beverages, tobacco, and gold)	0.0111**	0.0367*
Core Inflation D (excludes unprocessed food, alcoholic beverages and tobacco)	0.0120***	0.0702***
Core Inflation E (excludes alcoholic beverages and tobacco)	0.0143***	0.0720***
Core Inflation F (excludes administered and directed prices)	0.0178***	0.0749***

Note: *Short-run pass-through is represented by the current or immediate oil price change coefficient. Long-run pass-through rate accounts for lagged effects and persistence. B and C specifications exclude energy prices.* $* p < 0.10$,$** p < 0.05$, $*** p < 0.01$.

Next, we document that the level of pass-through depends on the weight of oil-related items in each sector[8]. Food and non-alcoholic beverages constitute the largest share (25.3%) in the consumer basket followed by transportation (16.8%), and housing-water-electricity-gas-other fuels (14.1%). Education, recreation & culture and health sectors constitute the lowest share in the consumption basket.

Table 3. Oil Price Pass-Through to Sectoral Inflation Rates

Sector	Short-run Pass-through	Long-run Pass-through
Headline Inflation	0.0142**	0.0746**
Sector 1: “food and non-alcoholic beverages”	0.0163*	0.0576**
Sector 2: “alcoholic beverages and tobacco”	0.0185	0.0350
Sector 3: “clothing and footwear”	0.0184**	0.0329*
Sector 4: “housing, water, electricity, gas, and other fuels”	0.0009	0.0859*
Sector 5: “furnishings, household equipment, routine maintenance of the house”	0.0162**	0.0305
Sector 6: “health”	0.0027	0.1034
Sector 7: “transport”	0.0421***	0.1605***
Sector 8: “communications”	0.0084*	0.0340**
Sector 9: “recreation and culture”	0.0085	0.0265
Sector 10: “education”	-0.0015	0.0215
Sector 11: “hotels, cafes and restaurants”	0.0038	0.0564*
Sector 12: “miscellaneous goods and services”	0.0110*	0.0416**

Note: *Short-run pass-through is represented by the current oil price change coefficient. Long-run pass-through rate accounts for lagged effects and persistence.* $* p < 0.10$,$** p < 0.05$, $*** p < 0.01$.

Among the sectors, imported oil prices are expected to affect prices in the transport sector directly as the share of imported oil consumed is reported under this item, where the weight is about 4.9% (Table A1). Oil prices are expected to have a secondary effect on consumer prices through electricity, gas, and other fuels consumption. These items constitute about 4.6% of the aggregate price index (Table A1).

Table 3 documents estimated values for short-run and long-run oil price pass-through for headline and 2-digit sectoral consumer price inflation. The short-run pass-through rates are significant in food and non-alcoholic beverages, clothing and footwear, furnishing, transport, and communications. The size of the short-run pass-through is about three times higher in the transport sector.

In the long run, the effects are well above the headline inflation only in transport. It is noteworthy that while the long-run pass-through is about 7% in headline inflation, it increases to 16% in the transport sector. The pass-through rate increases substantially in the long run in food and non-alcoholic beverages, clothing and footwear, housing, communication, and hotels. Both short and long-run pass-through rates across the 12 sectors exhibit significant variations. The short-run estimates vary from -0.15% for education (statistically insignificant) to 4.21% for the transport (statistically significant at a 1% level) sector. The estimates of long-run pass-through rates show a similar pattern and vary from 2.15% for education (statistically insignificant) to 16.05% for the transport sector (statistically significant at a 1% level). The transportation sector having the highest coefficient is in line with expectations, due to its high energy or oil-related items content[9].

3.2. Recursive Estimation of Phillips Curve

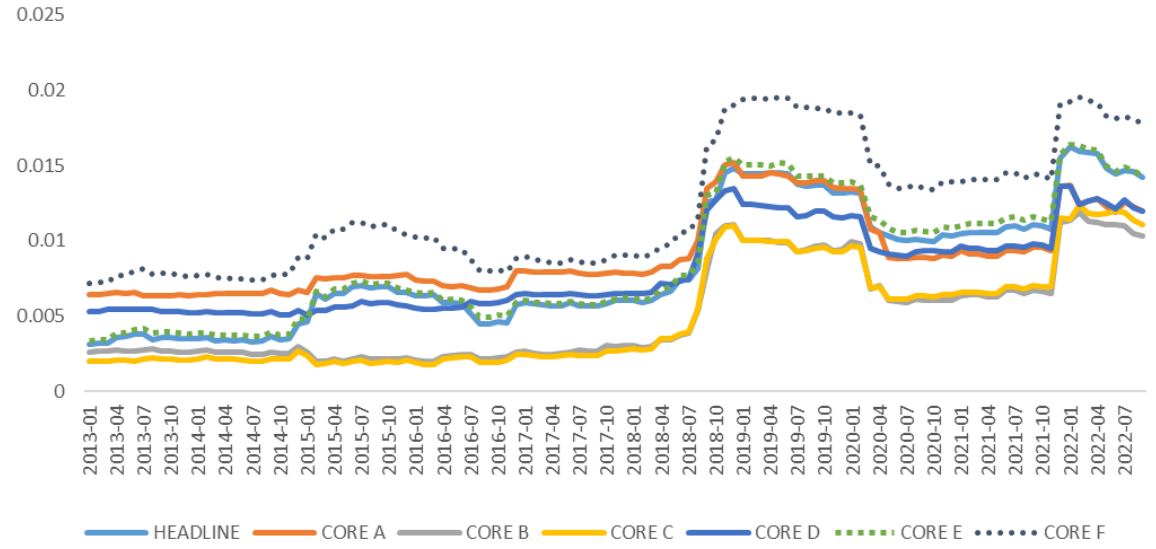
The literature states that the inflationary effects of oil prices diminish over time. However, studies on Turkey, such as Yanıkkaya et al. (2015), Ertürk and Erkan (2020), report an opposite finding. The results of these studies suggest an increase in the oil pass-through rate. We follow Yanıkkaya et al. (2015) and apply recursive regression techniques to examine in more detail how the pass-through of oil prices to inflation changes over time and across the sub-sectors of consumer prices. Yanıkkaya et al. (2015) show that both short and long-run pass-through rates of oil price to inflation for the 2000:1-2013:3 period are higher than the rates for 1990:1-2003:3.

Recursive least squares is an adaptive filter algorithm that recursively finds the coefficients that minimize a weighted linear least squares cost function relating to the input signals. In this method, the model is initially estimated by using T-K observations. The model is, then re-estimated by adding observations one at a time until the entire estimation period is covered. We implement this procedure and then plot the estimated coefficients against time to examine the path of the changing relationship in the whole estimation period.

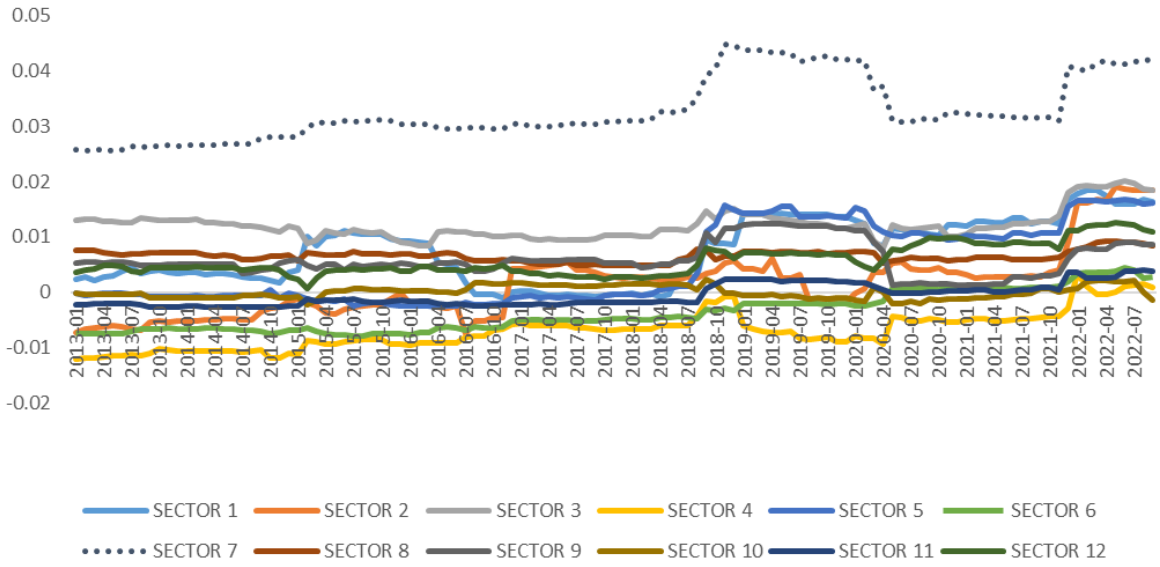
The initial estimates of the Philips Curve were attained using observations between 2003-01 and 2013-01. Figure 3 below displays the path of short-run pass-through for headline, core, and 2-digit CPI sector inflation series. Consistent with the findings in Yanıkkaya et al. (2015), the top panel of Figure 3 indicates an increasing trend in short-run pass-through in all headline and core inflation series. There are two spikes in 2018-09 and 2021-10, after which the pass-through coefficients attain a higher platform. The spikes are noticeably stronger for Core Inflation F (excludes administered and directed prices) series. Pass-through to Core Inflation B (excludes unprocessed food, energy, alcoholic beverages tobacco, and gold) and Core Inflation C (excludes energy, food and non-alcoholic beverages, alcoholic beverages, tobacco, and gold) series lies below the other series along the whole period.

Figure 3. Short-Run Recursive Estimates of Oil Price Pass-Through

Headline and Core Inflation Series



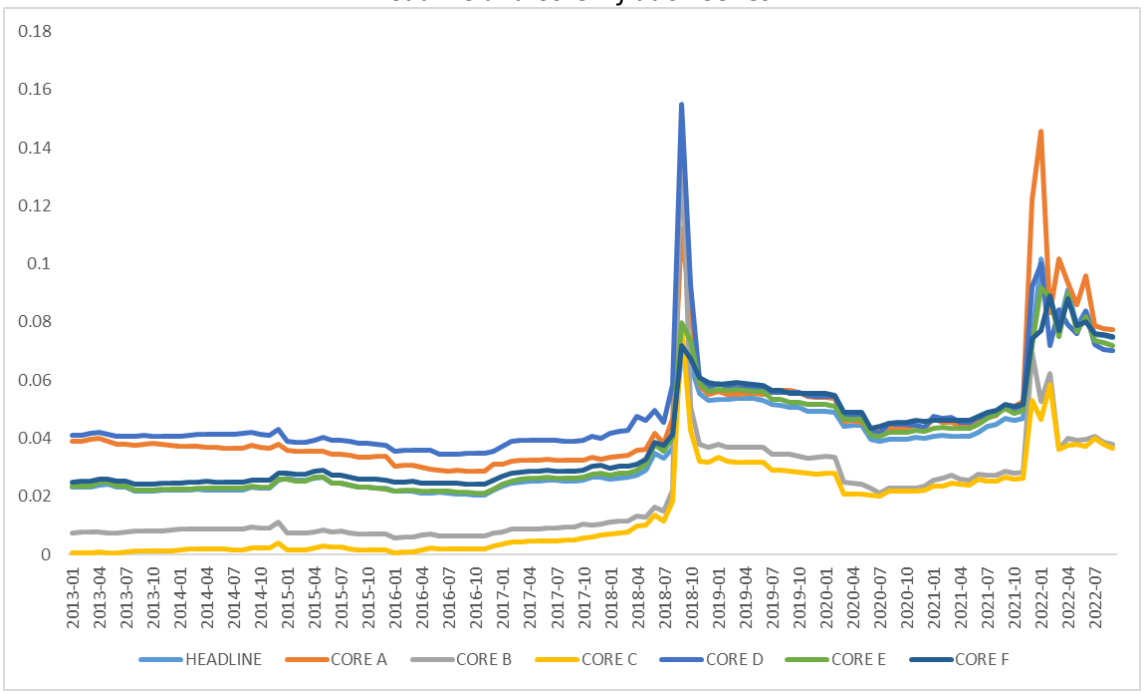
2-digit CPI Sector Level Inflation Series



In the bottom panel of Figure 3, the estimated short-run oil price pass-through coefficients of sector 7: transport are significantly higher than those for other sectors. This result is expected and reflects the sensitivity of prices in this sector to the changes in petroleum prices. The short-run pass-through is increasing over time.

Figure 4. Long-Run Recursive Estimates of Oil Price Pass-Through

Headline and Core Inflation Series



2-digit CPI Sector Level Inflation Series

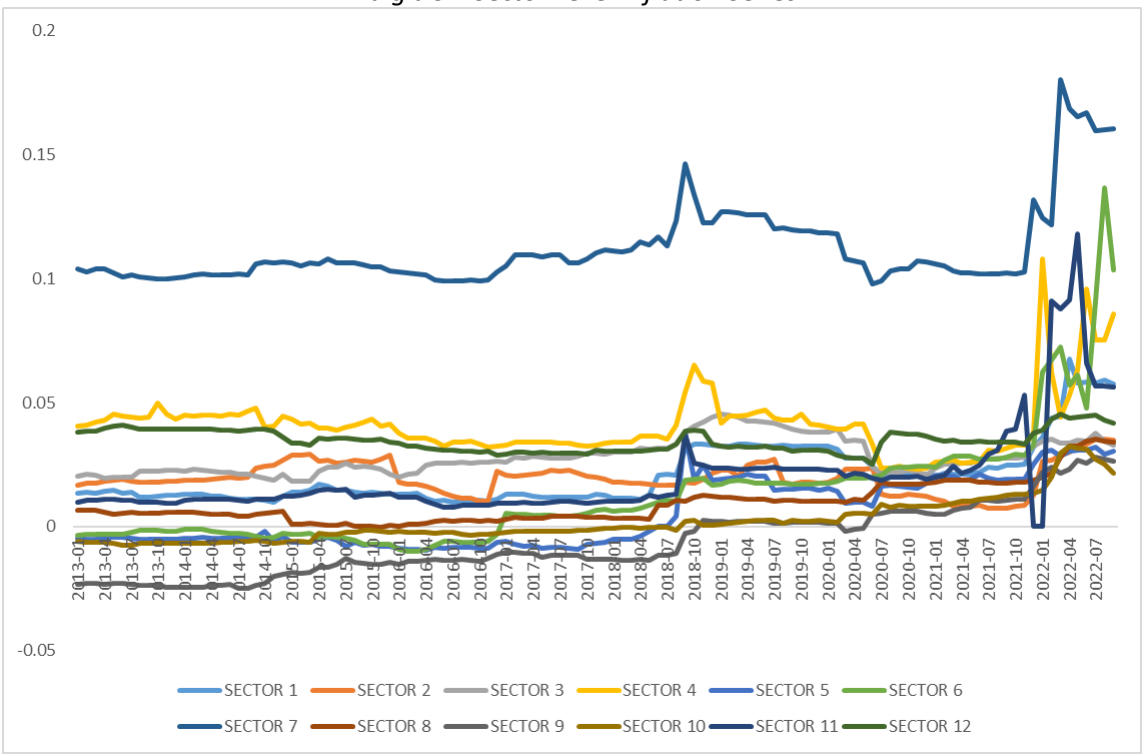


Figure 4 shows the path of long-run pass-through rates obtained from recursive estimation. Top panel plots show the pass-through rates for headline and core inflation rates. September 2018 and October 2021 are marked as path-breaking periods in coefficient estimates and consistent with the short-run pass-through, long-run coefficients attain higher rates after each period. Similarly, Core Inflation B and Core Inflation C pass-through are below the other series throughout the entire period, but it is noteworthy that the difference between the coefficient estimates has widened recently.

The bottom panel of Figure 4, reports the long-run oil price pass-through estimates. The trends of the long-term pass-through coefficients are similar to the path of the short-run pass-through coefficient. Transport sector inflation (Sector 7) displays the highest sensitivity to oil price changes. The coefficient size has increased significantly in recent years. A similar trend is also observed for other sectors. However, there are differences in the rate of increase in the estimated coefficient. The estimated coefficients for sector 4 (housing), 6 (health), and 11 (hotels) displays significant variation.

4. Conclusion

The literature agrees that the sensitivity of domestic inflation to changes in oil prices gradually reduced especially in developed economies. The decline in the pass-through rates is attributed to the developments in oil-saving technologies as well as the lower inflationary environments created due to the success of inflation-targeting regimes. The inflationary effect of oil price increases depends on the oil intensity, and oil intensity varies considerably among the sectors included in the consumer basket. Hence, this effect shows considerable heterogeneity from sector to sector in the aggregate consumer basket.

This paper contributes to the literature by examining the sectoral oil price pass-through in the period between 2003M1 and 2022M10, in Turkey. We estimate a backward-looking augmented Philips Curve for alternative specifications of core inflation and sectoral consumer prices. Next, we compare the pass-through dynamics with the results obtained for headline inflation.

Findings, in line with expectations, show that oil price pass-through substantially varies across sectors. Sectoral pass-through is related to the weight of oil-related items in the consumer basket, and oil-intensive sectors exhibit higher responsiveness to changes in oil prices. Accordingly, the highest level of oil price pass-through is observed in the transport sector in particular. The recursive estimates suggest breaks in the pass-through coefficients in September 2018 and October 2021. The pass-through increased significantly after each period. The increase is relatively higher in oil-related sectors.

Although efforts to decarbonize the world economy are on the agenda, fluctuations in oil prices will be a key issue for policymakers as petroleum is a key energy source to meet the world's energy needs in the near future. Our results regarding the heterogeneity in the sensitivity of sectoral inflation rates to the oil prices, depending on their oil-related content, add additional complications to policymakers' decision process. Therefore, policymakers in Turkey should plan their monetary and fiscal policies considering the heterogeneity of the impact of oil price changes on domestic sector-level prices. It is necessary to implement long-term policies that encourage renewable energy sources and the development of oil-saving technologies in all sectors, especially in sectors with high oil content. In addition, structural factors that cause fluctuations in oil prices should be identified and policies should be implemented accordingly to solve these problems.

Declarations and Disclosures

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writing the first draft of the manuscript, H. Saygılı; review and editing, M. F. Ekinci and H. Saygılı. The manuscript/article was read and approved by all the authors, and all authors accepted responsibility for their article.

Plagiarism Checking: This article was screened for potential plagiarism using a plagiarism screening program.

End Notes

1. *Darby (1982), Hamilton, (1983, 1996, 2003, 2011), Hooker (1996, 2002), Blanchard and Gali (2007), De Gregorio et al. (2007), Chen (2009), Alvarez et al. (2011) are prominent studies in this literature. See Kibritçioglu and Kibritçioglu (1999), Berument and Taşçı (2002), Dedeoglu and Kaya (2014), Yanıkkaya et al. (2015), Akçelik and Öğünç (2016), Ertürk and Erkan (2021) for the investigation of the Turkish case.*
2. *Hooker (1996) argues that the oil price shock in 1979 was not able to capture the dynamics of the 1980-1982 economic recession. See Hooker (1996, 2002), De Gregorio et al. (2007), Chen (2009) for a detailed discussion.*
3. *Salisu et al. (2017) provides an excellent review of the literature.*
4. *The classification of individual consumption by purpose (COICOP) classify and analyze individual consumption expenditures incurred by households, non-profit institutions serving households and general government according to their purpose. It includes categories such as clothing and footwear, housing, water, electricity, and gas and other fuels.*
5. *Classical Phillips Curve equation includes output-gap variable. Since the production index at COICOP classification is not available we use aggregate production index to compute output-gap.*
6. *See for instance De Gregorio et al. (2007), Hooker (2002), Chen (2009), Salisu et al. (2017).*
7. *We also used cyclical component of HP-filtered industrial production index. The coefficients of output gap have been more significant in this case. This specification brings quantitatively similar results on the oil price pass-through rates. However, our lag selection procedure suggested using more lags. Therefore, we chose to report the results with growth rates.*
8. *Table A1 in Appendix shows both the weights for main groups and items of consumer price index (2003=100) for 2022. See TURKSTAT web site for the details and explanations of the classification.*
9. *Choi et al. (2018) documented the link between transport and energy. Akçelik and Öğünç (2016) investigate the impact of oil price changes in the transport sector for Turkey.*

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Appendix

Table A1. Data Descriptions, Lag Specifications and Weights in Consumption Basket

Variable	Description	# of Lags	Weight in Consumption Basket (2022)
π_{00}	Headline Inflation	3	--
π_A	Core Inflation A	3	--
π_B	Core Inflation B	3	--
π_C	Core Inflation C	3	--
π_D	Core Inflation D	3	--
π_E	Core Inflation E	3	--
π_F	Core Inflation F	3	--
π_{01}	Sector 1 Inflation Rate (food and non-alcoholic beverages)	4	25.3156
π_{02}	Sector 2 Inflation Rate (alcoholic beverages and tobacco)	0	4.3064
π_{03}	Sector 3 Inflation Rate (clothing and footwear)	1	6.4238
π_{04}	Sector 4 Inflation Rate (housing, water, electricity, gas and other fuels)	5	14.1150
--	Item 0451001: Electricity fee	--	2.3156
--	Item 0452101: Natural gas fee	--	1.5496
--	Item 0452201: Tube gas fee	--	0.7827
π_{05}	Sector 5 Inflation Rate (furnishings, household equipment, routine maintenance of the house)	1	8.8550
π_{06}	Sector 6 Inflation Rate (health)	6	3.2365
--	Item 0611001: Medicines	--	0.6738
--	Item 0612002: Other health supplies	--	0.0967
--	Item 0613101: Corrective eye-glasses	--	0.1526
--	Item 0613102: Contact lense	--	0.0230
--	Item 0613201: Therapeutic appliances	--	0.0903
--	Item 0621201: Fees paid to specialist doctor	--	0.4586
--	Item 0622001: Dentist fee (Pulling)	--	0.1408
--	Item 0622002: Dentist fee (Filling)	--	0.4745
--	Item 0623101: X-ray fee	--	0.0433
--	Item 0623102: Ultrasound fee	--	0.0504
--	Item 0623105: MR fee	--	0.0729
--	Item 0623108: Laboratory analysis fee	--	0.2448
--	Item 0630001: Hospital bed fee	--	0.0362
--	Item 0630002: Surgical operation fee	--	0.5856
--	Item 0630003: Natural childbirth fee	--	0.0234
--	Item 0630004: Cesarean section fee	--	0.0696

Table A1. Data Descriptions, Lag Specifications and Weights in Consumption Basket (Continued)

Variable	Description	# of Lags	Weight in Consumption Basket (2022)
π_{07}	Sector 7 Inflation Rate (transport)	3	16.7953
--	Item 0722001: Petrol	--	1.4706
--	Item 0722002: Liquid petroleum gas fee (LPG)	--	1.3831
--	Item 0722003: Diesel	--	2.0143
--	Item 0722004: Motor oil	--	0.0448
π_{08}	Sector 8 Inflation Rate (communications)	3	3.7808
π_{09}	Sector 9 Inflation Rate (recreation and culture)	4	3.0614
π_{10}	Sector 10 Inflation Rate (education)	6	2.0348
π_{11}	Sector 11 Inflation Rate (hotels, cafes and restaurants)	3	7.1111
π_{12}	Sector 12 Inflation Rate (miscellaneous goods and services)	1	4.9643
Δy	Percentage Change in Industrial Production Index	0	--
Δe	Percentage Change in TL/USD Exchange Rate	2	--
Π^{oil}	Percentage Change in Brent Oil Price	2	--

Note: *Number of lags are selected according to the Schwarz Information Criteria in univariate autoregressive models. Data Source is Central Bank of Turkey for Price Indices and exchange rate, Turkish Statistical Institute for industrial production index, and Federal Reserve Economic Data for the oil price.*

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