A Post-Keynesian-Structuralist empirical approach to inflationary pressures in Turkey

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Abstract

The Turkish economy has been marked by a pattern of high and persistent inflation after the stagflationary period of the 1970s until the 2000s, and numerous attempts to reduce inflation have not yielded the desired results. Since the last few years, inflation has been on the rise again and hit a two-decade high of almost 85% in 2022. While acknowledging supply-side factors contributing to the ongoing inflationary process in Turkey, monetary authorities have faced challenges in dealing with internal and external disequilibria simultaneously and mostly remained focused on demand-side issues and implemented poorly managed monetary policy. The effect of chronic inflation on economic activity has proved to be destabilizing, especially in the last few years, due to external financing needs and low international reserves. Seeking to test the relevance of these cost-push factors as opposed to changes in demand-pull factors and monetary policy, we follow the post-Keynesian-Structuralist conflicting claims model of inflation. We focus on two external shocks that triggered recent inflationary pressures in Turkey: the prices of oil and exchange rates. We focus on unit labor costs as a potential transmission mechanism of the pass-through from these external shocks to domestic inflation. Using structural vector autoregression analysis, for the 2004–2023 period, we estimate the contribution of these shocks to inflation. Empirical results from the post-Keynesian identification strategy show that the most important driver of recent inflation is exchange rates, and oil price increases are also significant for increases in inflation. The role of external shocks and inflation on wages is significant, but the effect of unit labor costs on inflation is comparatively very limited to that of exchange rates, due to the loss of collective bargaining, declining union membership, and the widening productivity-pay gap since the 2000s. The empirical results indicate that Turkey faces a dilemma between controlling inflation due to local currency depreciation and undermining external competitiveness. Evaluating these counteracting effects, Turkey must apply monetary and fiscal policies in harmony to combat domestic inflation.

Keywords: Cost-push inflation, Turkey, Post-Keynesian structuralist model, conflicting claims model of inflation, VAR

JEL Codes: E31; E12

1. Introduction

Countries across the globe presently grappling with elevated inflationary pressures. Global inflation has exhibited a noteworthy escalation over the past year, rising from 4.7 percent in 2021 to 8.7 percent in 2022. At 4.7 percent in April 2023, inflation in advanced economies has reached its highest level since 1990. Developing and emerging economies (DEEs) are particularly

vulnerable to the adverse consequences of high inflation, where inflation tends to be higher and more volatile within these countries. Inflation in DEEs was on average above 6 percent between 2000–2010, and it declined to 5.2 percent between 2011–2020. However, in the year 2021, inflation experienced a notable upturn, reaching 9.8 percent (*World Economic Outlook (April 2023) - Inflation Rate, Average Consumer Prices*, n.d.). Global inflationary pressures continue to moderate, but inflation remains high considering historical standards. This signals that further declines in inflation rates are likely to be slow and at an uneven pace. Inflation rates have also started to decline recently as DEEs embraced monetary tightening policies, except for Turkey. As of 2023, the inflation rate in Turkey with 50.6 percent deviates from this trend, ranking second highest among emerging markets, following only Argentina.

Regarding the formalization of inflation, mainstream macroeconomists generally view inflation as a monetary phenomenon, or "price inflation". They emphasize demand-pull factors such as positive output gaps and inflation expectations and often use hybrid Phillips Curves to analyze the inflationary mechanisms. The critical assumption is that the inflation rate reacts to aggregate demand pressures, as indicated by the capacity utilization rate and/or unemployment rate. This advocates the adoption of an automatic formula in monetary policy, such as Taylor's rule (Seccareccia & Romero, 2022). Accordingly, Central banks have continued to raise policy interest rates in 2023 to deal with the current inflationary environment. However, policy rate hikes to slow the pace of inflation might prove inappropriate, considering the drivers of recent global inflation. Supply bottlenecks due to COVID-19 lockdowns and congestion in shipping, higher oil prices, and rising commodity and food prices due to the Ukraine war highlight the significance of supply shocks. Instead of dealing with the first-round effects of commodity and energy price increases on inflation, contractionary monetary policy in this scenario will only prevent the second-round effects by restraining claims for nominal wage increases, so that increasing costs do not permeate non-tradable sectors and impacting underlying inflation (Abeles & Panigo, 2015, p. 519). The question here becomes how sensitive an aggregate demand is in a particular country to changes in interest rates.

The post-Keynesian approach to inflation theory, on the other hand, traditionally prioritizes supply conditions over demand factors. Scholars adopting the post-Keynesian structuralist (PK-S) perspective prefer to explore alternative cost-push factors, including inertial inflation, nominal wages, profit margins, nominal exchange rates, and international commodity and energy prices. As advocated by Taylor (1988), this requires considering relevant structures for each economy, and building models tailored to institutional and geographical constraints, especially when applied to developing economies. According to the United Nations (2022), headline inflation rates reached double digits in 2021 in developing economies due to factors such as surging oil and food prices, supply chain disruptions, and the depreciation of domestic currencies. Global supply shocks continued to heighten in 2022 because of the conflict in Ukraine and the sanctions imposed on the Russian Federation have driven oil and food prices to historic peaks, exacerbating supply chain disruptions and shipping bottlenecks. Ha et al. (2022, p. 333) indicate that most of the fluctuation in inflation rates among low-income countries (LICs) and DEEs in recent decades can be attributed to external shocks. More than half of the variation in inflation rates among DEEs is due to global core price shocks, while domestic core price shocks constitute 73 percent of inflation in advanced economies. Global food and energy price shocks account for another 11 percent of inflation variation in DEEs.

The structural vulnerabilities of DEEs and the challenges encountered by monetary authorities in addressing internal and external imbalances are introducing an additional layer of complexity in reducing inflation. Monetary tightening policy by the Federal Reserve generates spillovers as it might result in substantial capital outflows and sharp depreciation of DEEs' domestic currencies, thereby exacerbating inflationary pressures. Considering these challenges, inflation can persist in the upcoming years, due to the vulnerability of DEEs to external shocks and their dependent position on core capitalist economies. Specifically, Turkey has a volatile inflation rate that has endured various phases of chronic and acute inflation since the 1970s. Although Turkey has had an inflation-targeting (IT) regime since 2002, it has not succeeded in reducing inflation to a sustainable level. Turkey offers a compelling case for studying recent inflation dynamics to observe the implications of monetary policy actions, as policymakers opted for a loose monetary policy to fight inflation in 2021 as an economic experiment contrary to standard macroeconomic prescription. Studying the drivers of recent Turkish inflationary pressures, and propagation mechanisms in Turkey is imperative for designing optimal policy tools in a country that has an inflation-targeting regime. From this perspective, identifying both the policy factors and structural characteristics to elucidate the varying speed and magnitude of pass-through effects in different scenarios, thereby disentangling the effect of external shocks on local inflation rates is crucial.

This paper is motivated by challenges and policy trade-offs confronted by Turkish policymakers in recent years when addressing the inflationary pressures resulting from external shocks. To base our analysis, we follow the PK-S open economy conflicting claims model of inflation which differentiates inflationary causes from transmission mechanisms. In conflicting claims models, the primary source of inflationary pressure in open economies is the struggle between firms and workers who have different reaction functions. While workers typically demand wage increases following external shocks as the cost of living increases, firms set their final prices after observing the outcomes of labor negotiations. Firms have a maximum acceptable level of real wage or wage share, which may differ from the workers' desired target. The gap between the desired and actual targets of workers explains that local inflation stems from distributive conflict following external shocks, as highlighted in the works of scholars (Taylor & Barbosa-Filho, 2021). Accordingly, the PK-S models highlight the significance of external shocks and how they propagate through conflicting claims models of inflation (Vera, 2014). The works of Abeles and Panigo (2015) and Bastian and Setterfield (2020) are particularly useful for guiding our analysis to examine the impact of external shocks on inflation rates through the conflicting claims transmission mechanism. The shared feature of these theoretical models is to provide an analysis of how external shocks, whether they affect the nominal exchange rate (as demonstrated by Bastian and Setterfield, 2020) or international commodity prices exported by small open developing economies (as shown by Abeles and Panigo, 2015), can lead to heightened inflationary pressures (Montes-Rojas & Toledo, 2022).

Consequently, our main goal is to understand the drivers of Turkish inflation and estimate the corresponding role of monetary policy. PK-S conflicting claims models, particularly the model of Bastian and Setterfield (2020) that focus on variations in the nominal exchange rate as a source of external shock are more appealing to Turkey. First, Turkey is heavily dependent on oil imports, and thereby oil price spikes impose significant costs on local inflation due to their potential pass-through effect. Given Turkey's chronic problems such as its fragile external position, including foreign-denominated debt, current account deficit, and limited international reserves, Turkish inflation is more exposed to global factors, as pointed out by Yilmazkuday (2022). These temporary shocks can affect the nominal exchange rate, which in turn could create permanent

inflationary pressures. Second, unit labor cost is an important dynamic that can influence the cost of production, as Turkey mostly exports labor-intensive goods. Currently, there are clear wage demands due to persistent inflation, but the union density in Turkey is lower when compared to other DEEs. When external shocks occur, local inflation pressures may not increase primarily due to their influence on wages. Nevertheless, examining the role of nominal wages as an inflationary transmission mechanism is crucial because the tightening of monetary policy aims to deal with the second-round effects of external shocks on inflation by keeping nominal wage claims in check and allowing real wage cuts. This allows us to compare the operation of monetary policy in Turkey via the exchange-rate channel (dealing with the first-round effect of external shocks by reducing the domestic value of imported goods) and aggregate demand (dealing with the second-round effect by suppressing demand).

Our empirical findings indicate that supply shocks are not only of greater importance but also that the pass-through effects of external shocks seem to have been strengthening over time. Findings from the baseline SVAR model show that the mean exchange rate pass-through (ERPT) to consumer prices is around 32 percent, while the ERPT has intensified in recent years. The mean pass-through from oil prices to consumer prices is 21,5 percent. Alternative identification of the SVAR model by changing the ordering of the variables does not alter results for external shocks significantly. The variance decomposition analysis reveals that policy rate shocks account for 10% of the forecast error in the inflation rate after a five-year period. However, their impact is more pronounced in the short term, with a ratio of 13.9% at the 6-month horizon. An interesting result that emerged from the empirical analysis is that a 1% change in the policy rate results in about 2% a reduction in inflation after a year, but the effect becomes positive after 2 years. Assessing the combined impact of the exchange rate and policy rate on inflation, this finding suggests that in Turkey, monetary policy primarily influences inflation through the exchange-rate mechanism. Variance decomposition analysis points out that labor costs are not a significant contributor to inflation in Turkey. This finding suggests that unit labor costs may have a relatively lower impact, and further investigation is necessary to understand the shock propagation. The initial impact of external shocks on price changes leads to higher nominal wages, resulting in second-round inflation. But the domestic inflation does not tend to intensify primarily due to the influence of these shocks on wages. In Turkey, this outcome aligns with the strategy of restraining wage increases to reduce inflation.

The organization of the paper is as follows. In the next section, we look into the facts of Turkish inflation since 2000 when Turkey adopted the inflation targeting regime, provide background information, and review the existing literature, specifically focusing on the relationship between interest rates, exchange rates, and inflation. In the third section, we present the structure of the empirical model and introduce the SVAR approach. The fourth section presents the empirical results. The last section concludes the paper with final remarks.

2. Previous research and the current work

Developing countries faced high inflation rates after the 1980s, prompting many to adopt disinflation programs initially centered around exchange rates, as their economies are highly vulnerable to the negative effects of external shocks such as energy and commodity prices, and exchange rates. However, these programs were later criticized for causing over-appreciation of their currencies and vulnerability to speculative attacks. Increased capital inflows and rising commodity export prices led to upward pressure on a country's exchange rate. This presented a policy dilemma for many nations because a stronger currency could erode the competitiveness of

their export-oriented industries and potentially hinder economic growth. Accordingly, dissatisfaction led to the emergence of "inflation targeting" (IT) policies starting in the 2000s, and numerous developing nations shifted to flexible exchange rates and began implementing IT frameworks (Benlialper & Cömert, 2016). In theory, IT assumes that inflation results from excess demand. Thus, the IT regimes focused on controlling aggregate demand with central banks adjusting policy rates as a primary tool to manage inflation. Within this framework, modern central banks often use a Taylor-type rule as a basis for formulating their IT principles, and the determination of the interest rate became the initial step in the monetary transmission mechanism for combating inflation (Ulug et al., 2023).

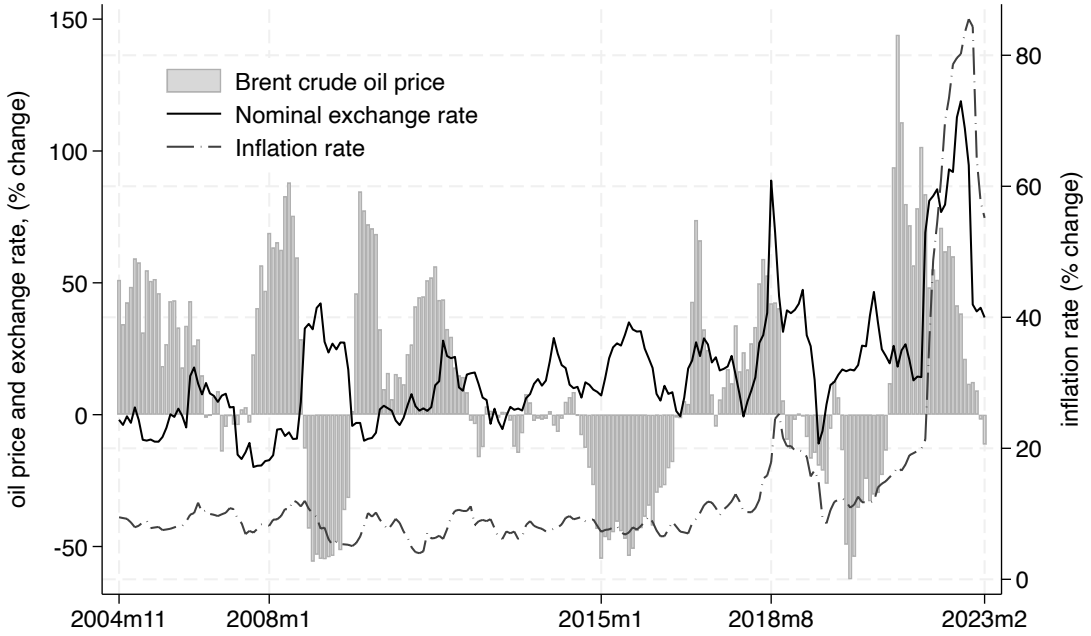
Chronic inflation has been a characteristic of the Turkish economy since the late 1960s. After a poorly designed IMF-directed stabilization program in 2001 resulted in a deep financial crisis that led to a 51% devaluation of the Turkish lira, a 7.4% contraction in GDP, and a high inflation rate of 61.6%, the initial response to the crisis of government was to implement high interest rates and an overvalued exchange rate policy. Later, the Turkish government started to implement an IT framework as part of the comprehensive neoliberal structural reform program (Orhangazi & Yeldan, 2021; Yeldan & Unuvar, 2016). First, the Central Bank of the Republic of Turkey (CBRT) permitted the Turkish Lira (TL) to float freely beginning in February 2001. Second, between 2002 and 2004, Turkey adopted implicit inflation targeting. The transition from implicit inflation targeting to a full-fledged system took place in 2006. Starting from this period, the macroeconomic strategy relied on the establishment of an "independent" Central Bank, and the primary objective of the Turkish central bank was established as "to achieve and maintain price stability". Through an independent Central Bank and prudent fiscal policies, the government aimed to attract foreign capital which would lower domestic interest rates, and in turn, was expected to stimulate consumption and investment, ultimately leading to sustained economic growth.

With the transition to a flexible exchange rate regime, the implementation of the IT regime, and the restructuring of the banking sector in the early 2000s, Turkey experienced a period of rapid economic growth and a decline in inflation during the period 2003–2007. The ongoing structural reform program, which was politically bolstered by the commitment of the newly formed AKP government, was acclaimed as a notable achievement. (World Bank, 2013). However, Epstein and Yeldan (2008) pointed out that the substantial reduction in inflation rates due to the implementation of IT is a matter of debate. The inflation performance of countries following the IT regime during this period is not superior to that of countries with different monetary policy frameworks. In fact, the high growth and low inflation period coincided with a surge in global liquidity and was accompanied by currency appreciation in Turkey. Favorable global liquidity conditions, high domestic interest rates, and the potential for capital gains attracted speculative short-term capital inflows during this period, leading to a fragile growth path. Therefore, nominal currency appreciation, rather than the demand-management policies through monetary policy could have been the key factor in curbing inflation in developing countries. Although the ERPT effect diminished for this period in Turkey, it remains one of the most significant factors alongside international energy and commodity prices explaining inflation in Turkey.

In practice, monetary policy in Turkey has operated through the exchange-rate channel, as nominal appreciation lowers the domestic prices of imported goods, thereby alleviating inflationary pressures originating from either within the domestic economy or from international commodity prices. Indeed, Kantur and Ozcan (2022) found that the cost channel of monetary transmission which shows the cost-pushing effect of an increase in the interest rate on a firm's

effective marginal cost function is negligible compared to the demand channel. The prices of imported final goods have a significant impact on inflation, and it is crucial to monitor exchange rate volatility when implementing inflation targeting. Accordingly, CBRT following the IT framework confronts challenging choices, given the close relationship between interest rates and prices, which is intricately linked to exchange rates, as can be seen in Figure 1. A straightforward visual examination indicates a discernible correlation between fluctuations in the nominal exchange rate and inflation, as well as between global oil prices and inflation. The episodes of surging inflation in Turkey were concomitant with external shocks. Moreover, Figure 1 also illustrates how nominal exchange-rate appreciation (shown as a fall in % change in the nominal exchange rate in the left axis of the graph) offsets the impact of global oil price spikes on headline inflation in Turkey.

Figure 1. Evolution of the monthly Consumer Price Index and the Nominal Exchange Rates during 2004:11-2023:02 in Turkey



Notes: The solid line corresponds to year-on-year percentage changes in exchange rates. An increase in the nominal exchange rate means domestic currency (TL) depreciation. The dashed and dotted line shows year-on-year percentage changes in the monthly inflation rate. The bar graph indicates year-on-year percentage changes in the global price of Brent crude, denominated in U.S. Dollars per barrel. The data sources used for this graph are shown in Appendix A.

Currency appreciation played a key role in keeping inflation under control, mainly by reducing the costs of imported consumer goods and, even more significantly, intermediate goods. According to the classification of broad economic groups (BEC), as of June 2023, intermediate goods accounted for 71.2% of total imports, while consumer goods accounted for only 14% (Turkish Statistical Institute, 2023). The appreciation of exchange rates was influenced not just by the rise in domestic interest rates but also by the decrease in interest rates in advanced economies. Until 2014, capital inflows due to global liquidity and the quantitative easing policies after 2008, coupled with high domestic interest rates, resulted in overvalued real exchange rates. This increased the import dependence of the entire economy and made it more vulnerable to exchange rate fluctuations. The recent inflationary period in Turkey is characterized by a reversal of this process.

The global financial tightening after 2018 had a negative impact on emerging markets, and Turkey was one of the most affected countries (Akçay & Güngen, 2019). This period aligns with the political tension between the USA and Turkey, which occurred when an American pastor Andrew Brunson was arrested in Turkey. During this period, growth slowed down, which led to a currency crisis where the Turkish lira depreciated by as much as 35 percent against the US dollar. Subsequently, there was a rapid increase in inflation, hitting 25% by the end of the year.

According to Epstein and Yeldan (2008, p. 17), the execution of monetary policy in DEEs can be exceptionally challenging when facing substantial, volatile, and speculative capital flows. From a policy perspective, DEEs face a challenge known as the *impossible trinity,* which suggests they cannot simultaneously pursue an independent monetary policy and control the exchange rate when the capital account is open. In such cases, policymakers must choose between maintaining an independent monetary policy or controlling the exchange rate (Botta, 2021; Kaltenbrunner & Painceira, 2017). Today, in many DEEs with floating exchange rate systems, the relationship between inflation and exchange rates is largely influenced by ERPT, which is also applicable to the Turkish case, as we demonstrated below. Several studies also found that DEEs tend to react to exchange rate movements within the IT framework (Aizenman et al., 2011; Gallagher & Magalhães Prates, 2014; Ho & McCauley, 2003). This question poses a challenge faced by DEEs in managing their monetary policies within an IT framework (Ulug et al., 2023, p. 2861). As a response, interest rates are set higher to manage exchange rate movements and control inflation in many DEEs (Gallagher and Magalhães Prates 2014; Botta 2021). Based on the Turkish experience between 2004 and 2019, the monetary policy stance was directed to ease the pressures on the TL via implicitly controlling exchange rates and keeping the TL appreciated by tight monetary policy. Benlialper and Comert (2016, p. 1571) also found that between 2002 and 2008, CBRT implemented an asymmetric policy stance by tolerating appreciation of TL but intervened when TL depreciated. This is because of the inability of Central Banks in DEEs to effectively control inflation, as the external factors are the main drivers of inflation. In such cases, central banks may favor currency appreciation as a strategy to counteract the adverse impacts of external shocks on domestic inflation. Empirical research on drivers of inflation also highlights the significant impact of exchange rates and imported commodity and energy prices on the inflation (see, e.g., Kara et al., 2017; Koc et al., 2021; Köse & Ünal, 2021). The drawback of using exchange-rate appreciation to control inflation in the long is, however, could be Dutch disease and unstable foreign debt dynamics.

Sharply raising central bank interest rates in a high inflation scenario to control aggregate demand via credit channel and expectations misses important dynamics in controlling inflation. First, resorting to IT regimes and prioritizing interest rates as a main policy tool means disregarding supply-driven inflation which cannot be managed through monetary policy. Policy rate hikes in the face of recent inflationary pressures coming from supply disruptions due to the COVID-19 pandemic and Russia's invasion of Ukraine cannot deal with the initial impact of price fluctuations in items like food and energy on the consumer price index. The tightening of monetary policy will only prevent the second-round effect of inflation by slowing down economic activity and hindering demand for higher wages arising from food and energy price increases. Second, mainstream proponents of demand-side inflation assume that there is no significant difference between developed and developing countries in terms of their inflationary processes and the tools used to combat it (Benlialper & Cömert 2016, p.1554). However, given the dependent position of DEEs on core capitalist economies, global factors such as interest rate spillovers and cost-push shocks are the main drivers behind the domestic inflation of DEEs. The lack of valid policy tools or

prescriptions to directly deal with the consequences of cost-push inflation means continuously missing inflation targets and undermining the credibility of the central bank in IT-adopting countries, which is the case in Turkey. This requires more solid solutions to prevent cost-push inflation, rather than only dedicating to the conventional monetary policy.

3. Model, data, and econometric methodology

The empirical model of Turkish inflation discussed in this section is based on the supply-side post-Keynesian approach to inflation theory. The empirical model is designed to examine the causal factors and their respective contributions to fluctuations in inflation.

3.1 Methodology

Following the seminal work of Sims (Benlialper & Cömert, 2016), SVAR models have become an increasingly popular method in macroeconomic analysis mainly because of their ability to simulate dynamic responses of macroeconomic variables to particular structural shocks. SVAR models use a set of restrictions that are broadly consistent with the economic theory to identify the system. A common way to differentiate between correlation and causation and to solve the "identification problem" is to disentangle the contemporaneous relations among the variables within the system, as introduced by Blanchard and Watson (1986) and Sims (1986). To specify the contemporaneous links, one must rely on the economic theory or the theoretical model under consideration.

SVAR model of order p can be formally written in the following structural form:

$$Ay_t = d + C(L)y_t + e_t \ , \ e_t \sim N\ (0, I) \qquad (1)$$

where y_t is $(n \times 1)$ dimensional vector of endogenous variables at time t, L represents a lag operator, C is $(n \times n)$ matrix of coefficients which concerns the lagged variables, d is $(n \times 1)$ dimensional vector of constants, A is $(n \times n)$ matrix of structural coefficients which represents the simultaneous relationships of the model, e_t is n-dimensional vector of serially uncorrelated, zero-mean structural shocks with an identity contemporaneous covariance matrix, $E[e_t e_t'] = I$ where I is a diagonal matrix. All the variables in the equation (1) are endogenous. Thus, the ordinary least squares (OLS) method is not appropriate to estimate the model. On condition that A is non-singular, solving for y_t provides the reduced-form representation of the VAR. The structural form VAR model can be written in reduced form by multiplying equation (1) by A^{-1}:

$$y_t = v + B(L)y_t + \varepsilon_t \ ; \ \varepsilon_t \sim N(0, \Sigma_\varepsilon) \qquad (2)$$

where $B = A^{-1}C$, $v = A^{-1}d$, $\varepsilon_t = A^{-1}e_t$ or $e_t = A\varepsilon_t$. Here, ε_t's are linear combination of e_t's and are called reduced form errors. Although equation (2) can be estimated via ordinary least squares (OLS) method, reduced-form innovations (ε_t) have no meaningful economic interpretation. To recover the structural parameters (A, C, I) and obtain the structural form of the reduced form, we need to identify restrictions to draw conclusions about the structural model. There are several methods to identify the SVAR model. Cholesky decomposition is one of the methods to restrict coefficients of the SVAR model which yields interpretive impulse response functions. This method imposes a triangular structure on matrix A to solve the model. However, it is a non-theoretical tool and a less technical method. The PK-S theoretical model mentioned briefly in section 2 is appropriate for using another method suggested by Sims (1986) who suggests utilizing economic intuition to identify the model.

Accordingly, our identification strategy follows Sims' (1986) approach, which suggests a non-arbitrary orthogonalization scheme and imposes short-run restrictions by specifying zero elasticities within the period. We use maximum-likelihood (ML) estimation for the VAR parameters. The central challenge in SVAR analysis is identifying the structural parameters. The identifying assumptions are often controversial, and in such a scenario, the data do not provide information to assess the validity of the restrictions. As a result, they cannot be tested using statistical methods (Lütkepohl & Woźniak, 2018). In recent years, the macroeconometric SVAR literature has increasingly adopted Bayesian methods. According to Litterman (1986) and Robertson and Tallman (1999), the incorporation of prior information enhances forecast precision in VAR models and strengthens the connection between VAR analysis and economic theory. To compare the results, we also estimate the same recursive structure by the Bayesian approach with Minnesota prior. The findings are largely consistent with each other. The IRFs and FEVDs are provided in Appendix D for comparison.

To initiate the analysis, we estimate a baseline model that is consistent with the PK-S model in guiding the causal ordering of the variables. Then, we change the structure of the current SVAR model and provide an alternative model with alternative restrictions and new addition of variables for a more complete specification.

3.2 Model description and baseline model

The empirical strategy is based on SVAR for Turkey between 2004:M11 to 2023:M7, which seeks to capture the shocks on *oil*, global oil prices, and *exc,* nominal exchange rate, on the system of variables. We are mainly interested in the responses of *cpi,* inflation, and *u*, the output gap to these shocks, and the pass-through from external shocks to *cpi* and *u*. To search for the mechanisms that propagate shocks, we include *ulc*, unit labor costs. First, labor cost is an important push factor in inflation, considering the labor-intensive production structure of Turkey. Second, the main propagation mechanism in PK-S explanations for inflation is through the conflicting claims between workers and firms. Although the empirical methodology does not allow us to differentiate the fundamental sources of inflation from the ways in which it propagates, impulse response functions show how external shocks transmit to unit labor costs. High import dependency on intermediate goods within the consumption goods sector in Turkey is likely to produce inflationary effects, as workers claim higher money wages due to external shocks. In this vein, real exchange rate depreciations could be disadvantageous for workers. This can lead to conflicting-claims-based wage-price inflationary spirals, especially in countries wherein conflicting claims are acute through strong trade unions or less flexible labor markets, as Bastian and Setterfield (2020) suggested. The impulse responses will enable us to observe the significance of incorporating unit labor costs when analyzing the impact of nominal exchange rate shocks on domestic inflation dynamics.

The identification of shocks depends on various methods. As the primary identification strategy, we rely on short-term restrictions by applying a Cholesky scheme, which creates a recursive contemporaneous ordering among variables. Because the SVAR results depend on the sequence of the variables, this identification scheme will allow us to re-run the model with an alternative Cholesky ordering of the variables to check robustness. The recursive structure imposed on A^{-1} to handle simultaneity issues in identifying the baseline empirical model is motivated by the PK-S model. Accordingly, the ordering of the variables and the structure of identification of the baseline SVAR model becomes $y_t = [\Delta oil_t\ \Delta ulc_t, \Delta r_t, \Delta u_t, \Delta exc_t, \Delta cpi_t]'$.

i. It is assumed that Turkey takes innovations in global oil prices (*oil*) as exogenously given. Hence, oil price shocks are not influenced by shocks from other variables within the system. This is a common assumption used in the literature (e.g., see Yilmazkuday, 2022; Kose and Unal, 2021).[1] In this context, we impose block exogeneity, which means that shocks to other variables within the system cannot have an immediate impact on Δoil_t (oil price changes) that is determined globally. However, shocks to Δoil_t can affect other variables contemporaneously.

ii. Shocks to variables within the system except oil prices do not have an immediate impact on the Δulc_t, making unit labor cost the most exogenous variables alongside with *oil* in the context of inflation. Although wages respond to changes in exchange rate depreciations which put pressure on wages and labor bargaining, we assume that money wages and thus unit labor costs are affected by external shocks with a lag.

iii. Δr_t is allowed to affect inflation and exchange rate contemporaneously but is not affected by them, as CBRT controls policy rate and can choose to deviate from inflation targets. For example, instead of setting benchmark domestic interest rates for inflation to remain close to the target levels, Turkey implemented a loose monetary policy despite skyrocketing inflation and the sharp currency depreciation since 2021.

iv. Following Montes-Rojas and Toledo (2023) and Montes-Rojas (2019), we assume that Δu_t affect Δexc_t and Δcpi_t contemporaneously but affected by them with a lag. Changes in Δr_t, on the other hand, affect the output gap simultaneously.

v. Δexc_t is placed before inflation and after the interest rate, following Harvey (1991, 2005), Perry and Kline (2013), Bjørnland (2009), and Yilmazkuday (2022). Fluctuations in the exchange rate are mainly driven by changes in interest rates and *exc variables* immediately react to disturbances in monetary policy. The exchange rate can impact inflation contemporaneously (known as pass-through effects) before inflation influences the exchange rate. Thus, exchange rate shocks affect inflation, but are not contemporaneously influenced by inflation shocks.

vi. Finally, Δcpi_t is assumed to be the most endogenous variable within the SVAR system and responds to all variables contemporaneously.

To identify the short-run SVAR and structural form parameters, we needed to place $(n^2 - n)/2$ restrictions on the non-singular matrices of A and C. Our model is exactly identified.

3.3 Data collection

To decompose the external shocks within the SVAR framework, we use monthly data for the period 2004:M11 to 2023:M7 for Turkey. The primary reasons for selecting this period include the significant structural changes in the Turkish economy following the 2001 financial crisis, a notable disinflation process via structural adjustment programs between 2002-2005, and an explicit IT regime that began to be implemented in 2006. Also, in this period, a new consumer price index (CPI) methodology with the base year of 2003 has been adopted.

[1] Perry and Kline (2013, p. 17) uses another ordering strategy, assuming that oil prices are assumed to be affected to some degree by changes in the exchange rate.

For inflation (*cpi*), we use consumption-based inflation data obtained from the Bank of International Settlement (BIS) calculation.[2] We assume that there are two principal factors that impact inflation. First, given the assumption of correlation among international oil prices, global oil prices (*oil*) are represented by the global price of Brent crude, denominated in U.S. Dollars per barrel, and retrieved from the Federal Reserve Economic Data (FRED). Second, to indicate the exchange rate shocks (*exc*), we use changes in the U.S. dollar exchange rate which is measured as depreciation of the Turkish Lira. Third, to incorporate the cost pressures from wages, we use unit labor cost data (*ulc*) obtained from FRED. Quarterly data was transformed into monthly data by using the cubic spline interpolate method. Fourth, to highlight the impact of external shocks in exchange rate depreciations and oil prices on demand due to the dependent structure of Turkish local production on imported inputs and intermediate goods, we use output gap (u) data which is represented by capacity utilization rate data for the manufacturing sector which obtained from OECD.

We include the interest rate (r) variable in the SVAR model to analyze the responsiveness of aggregate demand to changes in interest rates, and the effectiveness of the credit channel compared to the exchange-rate channel in Turkey. As we have discussed above, the Turkish economy has been dealing with substantial challenges since 2018, mainly attributed to a sharp depreciation of the currency, and soaring inflation rates. The government has adopted a new economic policy approach called the Turkey Economy Model, which emphasizes a commitment to reducing interest rates until August 2023. To assess the outcomes of this monetary policy stance in the face of vicious the cycle of currency depreciation and high inflation in Turkey is critical to formulate appropriate macroeconomic policies. The primary policy instrument of the CBRT is the short-term interest rate. To capture the impact of monetary policy on inflation, we use the policy rate variable which we obtained from BIS, instead of money growth. Also, money is regarded as endogenous under the assumption that the Central bank has control only over short-term interest rates, not the money supply.

Table 1: Sample statistics for the endogenous variables within the SVAR system

Variables	Mean	SD	Min	Max
Δoil_t	98.721	32.497	35	174.4
Δulc_t	5.330	0.56	4.53	7.063
Δr_t	11.398	5.245	4.5	24
Δu_t	101.462	4.978	81.842	110.569
Δexc_t	3.946	4.113	1.158	18.886
Δcpi_t	64.886	28.593	28.815	131.866
N: 220				

Notes: Observations are indexed by year (t). N stands for the total number of observations.

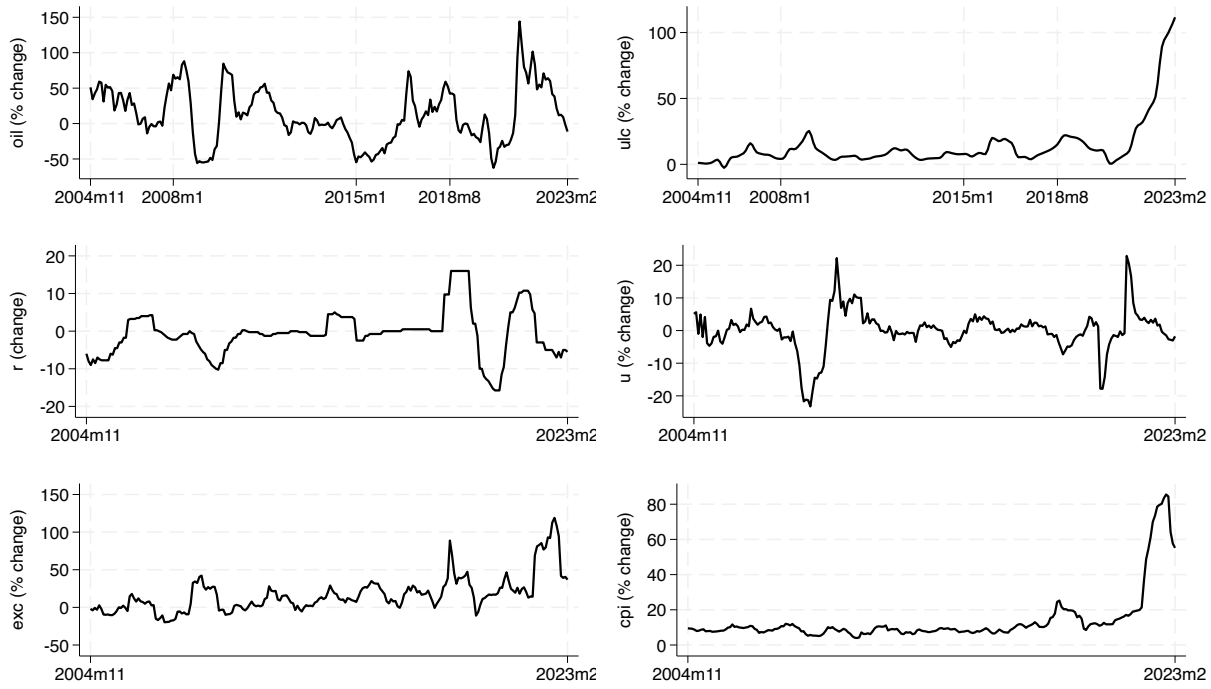
In the context of the SVAR model, percentage changes in monthly series of global oil prices, CPI, unit labor costs, and exchange rate were calculated as the year-on-year changes. For policy rate and output gap, we only use year-on-year changes. For *ulc*, we have also used the log

[2] Another option would be using the producer price index (PPI) as Turkish production is heavily dependent on energy and intermediate goods imports, and shocks in oil and nominal exchange rates are more related to PPI. However, we are also interested in demand-side inflation as the main argument of the New Keynesian Phillips Curve, and CPI is a better indicator since it reflects all final goods produced.

differences, as this transformation can be treated as an approximation of the percentage changes. However, following Lütkepohl (2011), we use level VAR. Thus, we have used percentage changes of *ulc* in the analysis. The description of all related data used in the analysis is described in Appendix A. A table of summary statistics for all key sample variables for the raw data is provided in Table 1. The monthly data series used in the SVAR model is depicted in Figure 2.

As a preliminary step to empirical analysis, we test for stationarity of the time series variables. We perform an augmented Dickey-Fuller (ADF) test to check for the presence of a unit root. The power of the ADF test is low when the root of a stationary process is close to the non-stationary boundary. For this reason, we also use the Zivot-Andrews (2002) stationarity test. Due to the impact of the economic crisis in 2007, the currency crisis in 2019, and other conditions unique to the Turkey that were explained above, the data exhibit a structural break in their deterministic component. Lee Strazicich (LS) (2003) unit root test which allows the endogenous determination of structural breaks is performed to get around this issue. The test results reported in Appendix B suggest the levels of the *oil, r, u, exc* and *cpi* series are stationary at the level, while *ulc* variable is stationary according to the LS unit root test at 10%. All the estimated individual VARs are stable, and the IRFs of all endogenous variables indicate all the variables converge to their long-run equilibrium values.

Figure 2: Time series plots of the variables used in empirical analysis



4. Empirical results

This section documents the baseline empirical results from the SVAR model, $y_t = [\Delta oil_t\ \Delta ulc_t, \Delta r_t, \Delta u_t, \Delta exc_t, \Delta cpi_t]'$. The VAR is estimated with four lags, considering Final

prediction error (FPE) and Akaike information criteria lag length criteria.[3] The model is stable with four lags, all roots lying within the unit circle (see Appendix C).

4.1 Drivers of inflation in Turkey

As we are interested in drivers of inflation, the main tool of interest in the analysis is the forecast error variance decompositions (FEVDs, henceforth) which measure the relative importance of all endogenous variables within the SVAR system in explaining the variability of the inflation rate over time. The FEVDs for the baseline model are listed in Table 2. The results were reported for the decomposition of the inflation for alternative horizons. At the 5-year horizon, exchange rate and global oil prices contribute the most to the volatility of inflation: 30 percent of the error in the forecast of the inflation rate is attributed to the exchange rate shocks, while 19 percent of the variation can be explained by oil price shocks in the SVAR. The initial effect of change in oil prices on the consumer price index is the largest and explains 2.7 percent of the total variation in inflation after a month. This corroborates the findings of Akcelik and Ogunc (2016, p. 46) who suggest that the initial effects of changes in oil prices on the consumer price index occur quickly, emerging through the prices of energy items such as motor fuels and bottled gas. Therefore, according to our model and its forecast error variance decomposition, the exchange rate and global oil prices are the primary drivers of inflation in Turkey.

Table 2. Forecast Error Variance decomposition of inflation

	Impulse variables					
Horizons	*cpi*	*exc*	*oil*	*r*	*u*	*ulc*
After 1 month	91%	0.03%	2.7%	5.3%	0.1%	0.5%
After 1 quarter	41%	39%	3.8%	13%	0.4%	1.5%
After 6 months	34%	41%	6%	14.7%	0.7%	2.4%
After 1 year	33%	37%	11.4%	14%	1.3%	3.5%
After 2 years	33%	32%	18.8%	10%	0.6%	3.1%
After 5 years	32%	30%	19%	11%	0.4%	5.4%

Notes: The percentages may not add up to 100% due to rounding.

The FEVDs also show that the unit labor cost and output gap explain approximately 5.8 percent of the percentage contribution of innovations from these variables to inflation. The weight of unit labor cost in explaining the variance in inflation rose steadily over the months. This result is at odds with the findings of Kose and Unal (2021), who point out the importance of labor costs in explaining Turkish inflation. In their study, unit labor costs became more significant over the months and explained 13% of the variation in inflation in the 24th month. Since our empirical model does not distinguish the main determinants of inflation from the mechanisms that propagate shocks, this finding implies that the unit labor cost is relatively less important and further analysis is needed to uncover the propagation of the shocks. According to the conflicting claims hypothesis, the main propagation mechanism of external shocks occurs through wages. Unit labor costs reflect the ex-post claims after a shock. They respond to the indirect effects of the pass-through of global oil price changes and exchange rate depreciation to consumer prices via production costs. The

[3] Akaike information criteria (AIC) is one of the most popular information criteria which aims to find the best-approximating model to the unknown true data generating process. AIC is known to perform better under small samples. Thus, SVAR(4) model is estimated with four lags for the accuracy of the impulse responses functions. We have also estimated with two lags, considering Hannan-Quinn (HQ) and Schwarz (SIC) lag length criteria. But using alternative lags do not have qualitative consequences for the results.

first-round effect of external shocks on price changes causes higher nominal wages, leading to second-round inflation. This result is expected for Turkey, as labor costs are pushed down to reduce inflation by restraining wage increases. Adjusted wage share data shows that the share of wages in GDP receded from its average of 55.49% between 1970-80 to almost 30% in 2019 in Turkey (OECD, 2014; TurkStat, 2020). The relative bargaining power of workers compared to firms is low in Turkey. According to Birelma (2022), while union density rose from 8% in 2013 to 13% in 2021, the International Trade Union Confederation (ITUC) indicates that Turkey has been among the ten worst countries for unions since 2016.

FEVDs also show that policy rate shocks have contributed to inflation, especially in the short run. At the 6-month horizon, 14.7 percent of the error in the forecast of the inflation rate is explained by changes in the policy rate, while its effect has been limited compared to external shocks. Assessing the combined impact of the exchange rate and policy rate on inflation, this finding suggests that in Turkey, monetary policy primarily influences inflation through the exchange-rate mechanism. It also underscores the strong connection between interest rates and prices in the Turkish context.

Figure 3. Historical decomposition of inflation, 2004:M11-2023M2

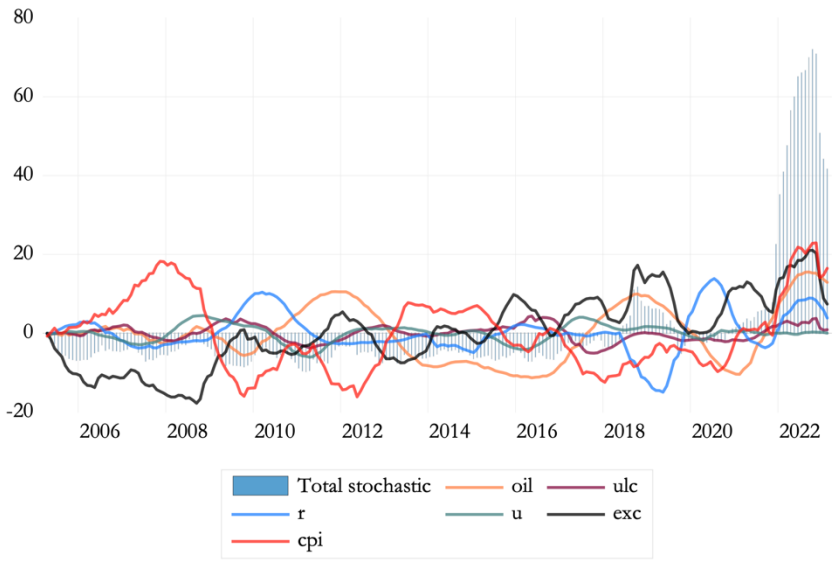


Figure 3 shows how each structural shock contributed to the evolution of inflation in the baseline SVAR. The summed effect of all the shocks included in the system on the inflation rate, which is shown by the total stochastic bars, is decomposed into shocks from each driver of inflation. Turkish inflation has historically been influenced by exchange rate fluctuations and global oil price shocks. The effect of the exchange rate shocks intensified over time, especially after the currency crisis in 2018, driven by a significant devaluation of the currency and extremely high inflation. The impact of policy rate shocks is relatively limited compared to exchange rate and global oil price shocks.

Figure 4. Responses of the inflation rate to Cholesky one s.d. innovation for the baseline model

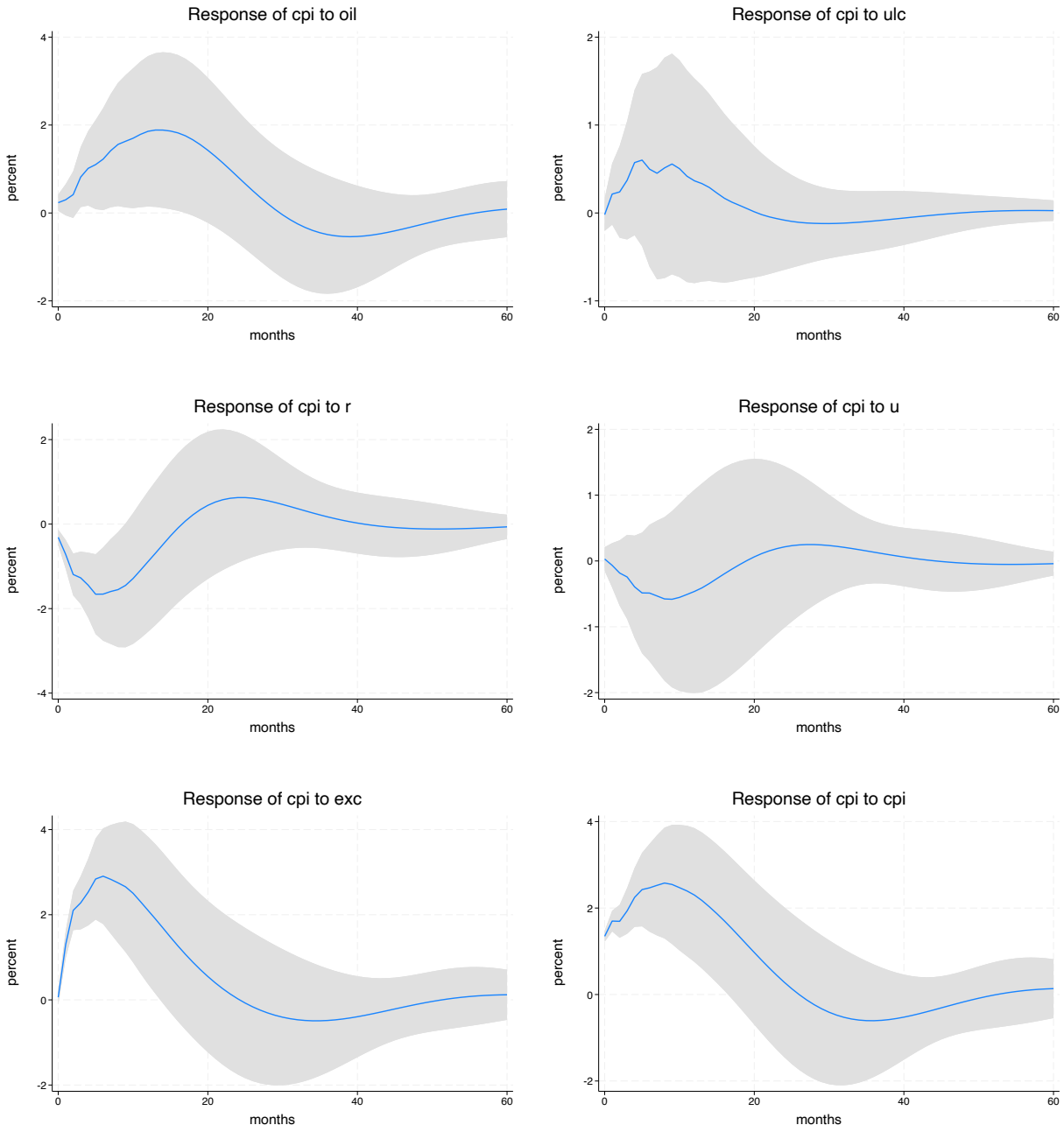


Fig. 4 shows results obtained from a conventional Cholesky decomposition which imposes lower triangularity on A in equation (1). Impulse responses for a horizon of up to 5 years after the one standard deviation (s.d.) shock in a change in system variables on inflation with two standard deviation bands are depicted below. The identification strategy mostly generates reasonable outcomes but presents a puzzle where inflation falls in response to a shock in the output gap in the middle-right panel. The output gap is a crucial monetary policy indicator in an inflation-targeting regime for central banks to assess inflationary pressures. While a positive output gap indicates demand-driven inflation due to high demand, our results indicate otherwise. Another result derived

from the figure is that an increase in unit labor costs can push inflation up, as shown in the top-right panel. However, the 95% confidence bands computed for the IRFs for unit labor costs and output gap indicate that there is no strong statistical evidence that the response is different from zero. As expected, the inflation rate reacts largely and positively immediately to a shock in the exchange rate, rising by 3%, and ultimately dies out after 2 years. Similar results are obtained for the response to oil price, but the immediate effect is less swift than that of the exchange rate, reaching a plateau of 2% percent after 18 months, then dropping after about two years. The policy rate drops inflation initially by around 1.7% and then reverses course within half a year, ultimately reaching equilibrium within 15 months. Figure 5 shows accumulated IRFs for the % response of the inflation rate due to a 1-standard deviation positive shock in system variables. Similar to the structural responses, the accumulated effect of a shock in oil price and exchange rate on inflation is positive and significant until 2 years, undergoes a negative effect in response to the increase in the wage share in the first two periods, and the confidence bands are somewhat wider in the following periods. The cumulative response to unit labor costs is slightly positive but not significant, while the cumulative response to the output gap is negative, but the effect is found to be insignificant.

Lastly, we can obtain the elasticity of inflation with respect to other variables from the corresponding cumulative impulse response (CIR) functions. In calculating the pass-through coefficients, we follow Rabanal and Schwartz (2001) and Yilmazkuday (2021, 2022). Accordingly, the pass-through coefficient is computed by comparing the cumulative response of price changes over a specific period (h months) to the cumulative response of changes in the impulse variable over the same period, in response to its own shock. For example, ERPT corresponds to the following ratio:

$$ERPT_{t,t+h} = \frac{cpi_{t,t+h}}{exc_{t,t+h}}$$

According to the equation above, we found that the impact of currency depreciation on inflation is positive for the whole period with an average pass-through rate of 32 percent and a median of 34 percent. Similarly, the mean oil price pass-through is about 21.5 percent with a median of 20 percent.

4.2 Inflation-exchange rate-interest rate dynamics

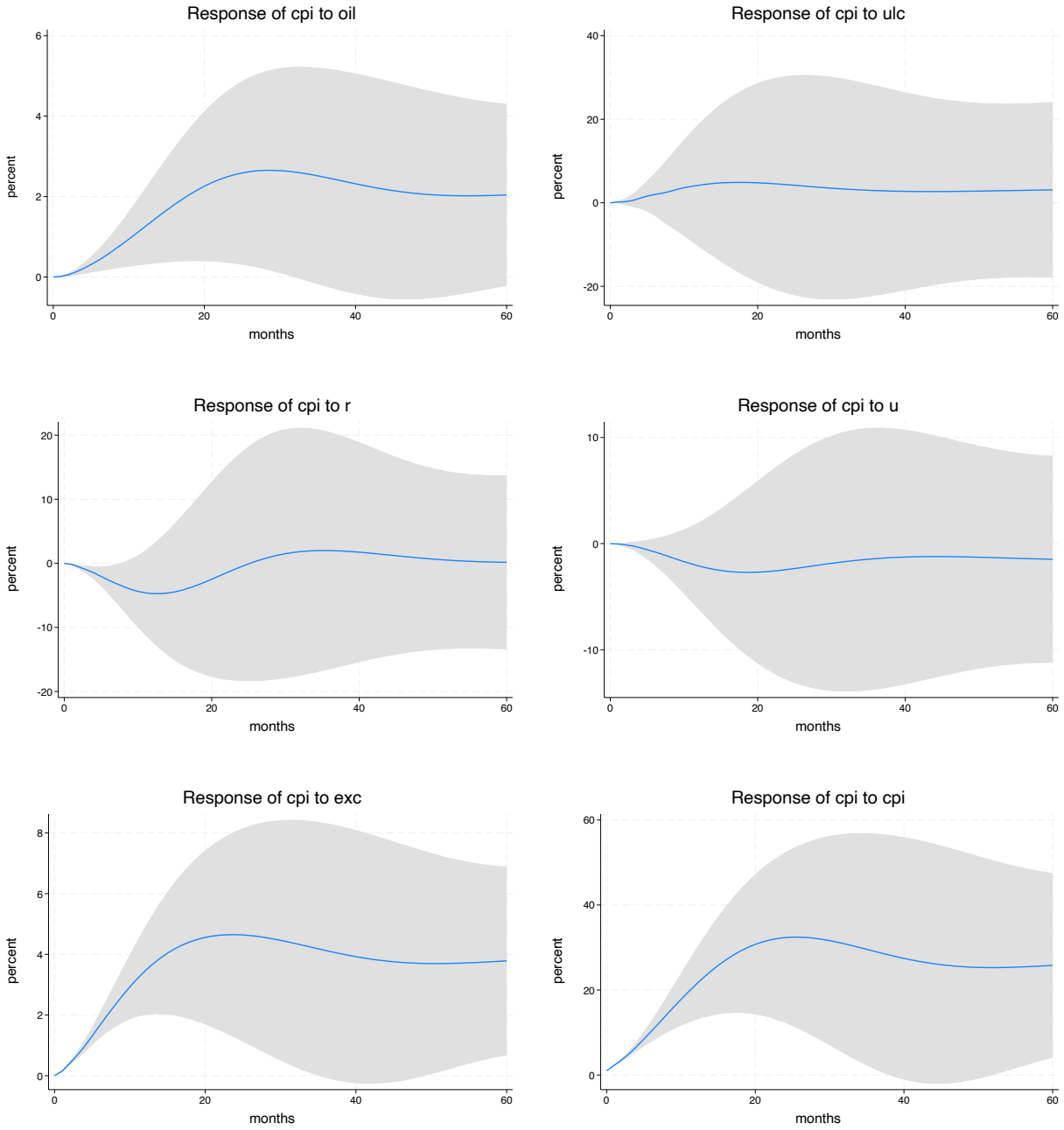
In section 2, we pointed out that the execution of monetary policy in DEEs is challenging due to the impossible trinity. Thus, for many DEEs with floating exchange rate systems, inflation and exchange rates nexus are largely influenced by ERPT, which is also applicable to the Turkish case, as demonstrated above. Now, we examine this hypothesis by plotting IRFs of exchange rate-inflation-interest rate from our model for the Turkish case as an illustration. Although we don't primarily aim to provide analysis on these interrelationships, we illustrate our IRFs from our model for understanding the interactions among the variables.[4]

The top left panel of Figure 6 indicates that exchange rate depreciations led CBRT to conduct contractionary monetary policy, accompanied by higher interest rates. Considering the period under consideration, these findings are expected and concurs well with the analysis of Ulug et al.

[4] To examine the monetary policy stance of the CBRT, the monetary policy reaction function must be used to capture the impact of changes in exchange rates on monetary policy. The reader may refer to Benlialper and Comert (2016) and Benlialper et al., (2017) for further analysis on the asymmetric exchange rate policy in IT regimes.

(2023), who found episodes of causality running from exchange rate to interest rate. Especially, the period after the currency crisis in 2018 until today coincided with high inflation and exchange rate volatility, where CBRT responded with tight monetary policy. But during this period, there were several episodes of loose interest rate policy from the government (e.g., from the last quarter of 2019 to August 2020, and between January 2021–January 2022), as President Erdoğan stated that the interest rates are 'the mother and father of all evil', and with the New economy model, the government followed an approach that suggests higher interest rates to keep inflation under control.

Figure 5. Accumulated response of inflation rate to one s.d. innovation for the baseline model



Examining the VD of interest rates, the exchange rate determines 19% of the error in the forecast of the interest rate after 5 years, while 53% of the variation in interest rate is explained by itself. On the other hand, 13% of the variation is explained by the inflation rate, and 10% is explained by the oil prices. In the alternative specification, we change the ordering of the variables and allow interest rate and inflation to be affected by the exchange rate, following McCarthy (2000) and Ogunc et al. (2018).

The top-right panel shows that CBRT policy rate increases are associated with domestic currency appreciation. However, the effect is short-lived, and not statistically significant. This suggests a decoupling of the correlation between interest rates and the exchange rate. The VD analysis for the exchange rate shows that the inflation rate (13 percent) and global oil prices (11 percent) contribute the most to the volatility of the exchange rate. 65 percent of the error in the forecast of the exchange rate is attributed to the exchange rate shocks. The exchange rate depreciates swiftly due to a one s.d. shock in the inflation rate according to the bottom left panel. This result seems consistent with the purchasing power parity (PPP): in the long run, the level of the nominal exchange rate must depreciate in line with PPP in response to an inflation shock. In section 3.2, we have assumed in (v) that exchange rates are not solely driven by inflation, and exchange rates impact inflation initially through ERPT. While a positive response of the exchange rate is expected, the inflation rate is not an important determinant of the exchange rate, upon examining the VD of exchange rates. Lastly, the response of unit labor cost is positive due to an inflation rate shock. This shows that nominal wages vary in line with prices.

4.3 Robustness checks

The alternative model uses the row vector $y_t = [\Delta oil_t\ \Delta u_t, \Delta exc_t, \Delta ulc_t, \Delta cpi_t, \Delta r_t]'$. In this specification, we allow the unit labor costs to respond to changes in exchange rates, following Perry and Kline (2013), as external shocks pass into consumer prices, which puts upward pressure on wage demands. Second, we allow interest rates to respond to changes in exchange rates and inflation. As we have discussed in Section 2, most DEEs allow exchange rate appreciations to control for inflation, as the external shocks are the main determinants of inflation. When controlling inflation through interest rate by demand channel is not possible, its inflation-reducing effect works through the exchange rate channel. This has also been the case in Turkey until 2019 and has been documented for the 2002-2008 period by Benlialper and Comert (2016).

The outcomes presented in Table 2 illustrate that the determinants of inflation in Turkey remain largely consistent when considering the imposition of alternative ordering. The only significant change is the decreasing impact of interest rate on inflation and unit labor cost on fluctuations in Turkish inflation changes. At the 1-year horizon, only 3.1 percent of the error in the forecast of the inflation rate is attributed to the interest rate in the SVAR. When allowing the interest rate to respond to changes in the exchange rate and inflationary shocks, it seems that the more immediate impact of the exchange rate on inflation is pronounced, as the interest rate is not allowed to contemporaneously affect inflation and exchange rate. The exchange rate now explains 34 percent of the error in the forecast of the inflation rate. This is because the time lag between interest rate changes and their impact on inflation, through the aggregate demand channel, is shorter, which is consistent with Svensson's (1999) statement that the lag of the direct exchange rate channel is shorter than that of the aggregate demand channel.

Figure 6. IRFs for exchange rate-inflation-interest rate nexus

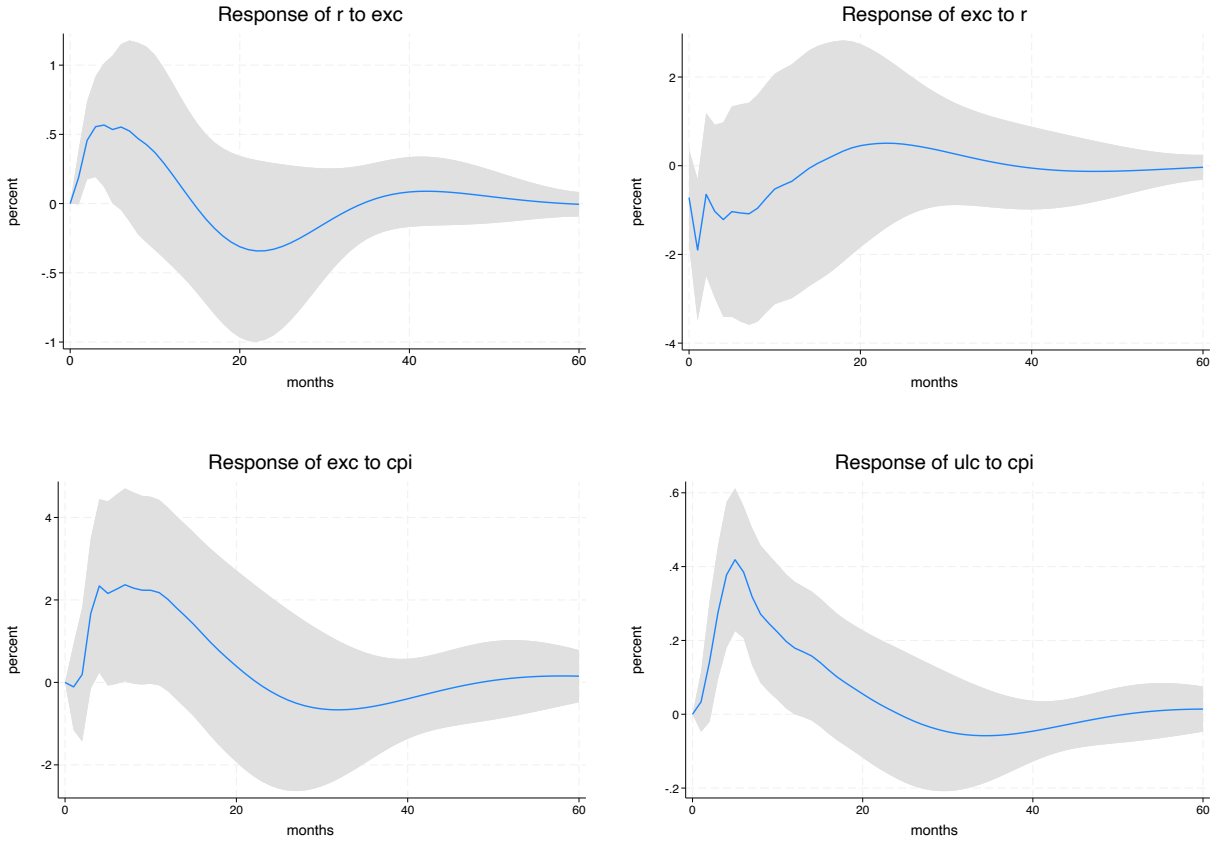


Table 2. FEVD of inflation for Robustness checks

	Impulse variables					
Horizons	*cpi*	*exc*	*oil*	*r*	*u*	*ulc*
After 1 month	96%	0.1%	2.6%	0.006%	0.2%	0.4%
After 1 quarter	48%	40%	3.8%	3%	0.5%	0.6%
After 6 months	43%	45%	5.5%	3.5%	1%	1%
After 1 year	39%	43%	10%	3.1%	1%	1.7%
After 2 years	38%	36%	18.8%	2.7%	0.8%	1.8%
After 5 years	38%	34%	19%	3.5%	0.6%	3.8%

Notes: The percentages may not add up to 100% due to rounding.

Conclusion

The literature on the drivers of inflation is generally divided into two perspectives. While the orthodox perspective places greater emphasis on demand-side factors, such as the output gap and inflationary expectations, the PK-S perspective highlights supply-side factors, including exchange rates and international commodity prices, wage demands, import prices, and markups as the central drivers of inflation dynamics in developing countries. Although the first perspective acknowledges the potential influence of supply shocks on inflation, it posits that their impact is primarily short-term, with long-term inflation being predominantly driven by demand-side factors. PK-S approach, on the other hand, contends that due to the large dependence on external sources in

domestic production, developing countries suffer from exposure to external shocks. Thus, supply-side factors carry more weight than demand-side factors. Post-Keynesian scholars recognize the importance of demand-pull inflation through the theory of endogenous money, which is both a fundamental component in the PK-S cost-push theory of inflation and demand-pull inflation. In this approach, banks are not only passive entities in lending activities, but actively encourage borrowers to extend their credit beyond their means. This practice, in turn, stimulates aggregate demand and subsequently gives rise to inflationary pressures (Kim, 2020, p. 640). In this context, the prevailing view among mainstream macroeconomists suggests that inflation is a monetary phenomenon, but the post-Keynesian perspective has conventionally linked inflation to the distributional conflict (Lavoie, 1992).

This paper presented empirical findings regarding the connection between external shocks and inflationary forces in Turkey by estimating SVAR models using monthly data spanning from 2004 to 2023. The empirical model of Turkish inflation is based on the supply-side post-Keynesian approach to inflation theory. According to our findings, a shock to the nominal exchange rate results in a 32 percent pass-through effect. External shocks impacting global oil prices lead to a 21.5 percent pass-through effect on the domestic inflation rate. The empirical findings from the SVAR analysis indicate that supply-side factors play a significant role in explaining Turkish inflation consistently over time. Additionally, interest rates account for 10% of the forecast error variance in inflation, with their inflation-reducing impact being more prominent in the short term.

The empirical findings presented here present significant challenges for policymakers in Turkey. While historical decomposition analysis suggests that policy rate shocks have played a role in inflation, their impact has been relatively limited compared to the effects of exchange rate fluctuations and changes in global oil prices. Monetary policy, particularly raising interest rates, is a crucial tool, but it may not effectively achieve the policy objectives of ensuring price stability. Our results suggest that the impact of interest rates primarily operates through the exchange rate channel, leading to domestic currency appreciation, rather than exerting control over demand. Consequently, the monetary policy has proven insufficient in mitigating inflationary pressures. Certainly, in the current scenario where global commodity and energy prices are on the rise, with nominal currency depreciation and high inflation, wage moderation was one of the solutions to prevent the second-round effect of external shocks on inflation.

Given that the prices of imported intermediate goods and energy prices have a significant impact on inflation, it is crucial to control exchange rate volatility when implementing IT-targeting policies. In terms of monetary policy, this may require monetary tightening, but this has additional costs to the economy as high interest rates put pressure on households as the household indebtedness ratio skyrocketed after the 1990s in Turkey. The current situation seems to leave monetary authorities without an effective tool to combat inflation, as the appreciation of TL becomes a necessity to achieve inflation targets, which can lead to Dutch disease symptoms. A potential implication of the empirical findings relates to the long run, which is the necessity of reducing Turkey's external dependence on imported inputs. This can be achieved through coordinated policies that address external trade, exchange rates, and industrial development by using monetary and fiscal policy tools in harmony to combat chronic domestic inflation.

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Appendices

Appendix A. Data sources and definitions

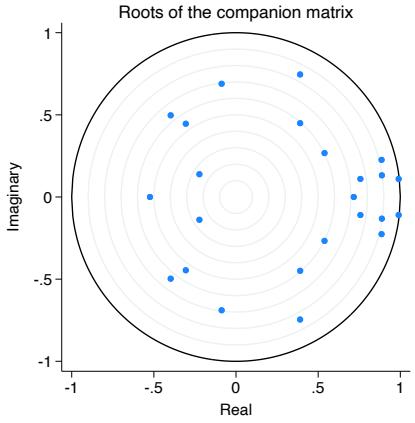
Variable	Definition	Source
Consumer price index	Year-on-year changes, in percent. (Raw data: Index, 2010 = 100).	Bank for International Settlements
Global Price of Brent Crude Oil in US dollars	Year-on-year changes, in percent. (Raw data: Index, Jan 2010=100, Monthly, Not Seasonally Adjusted)	FRED
US Dollar Exchange rates	Year-on-year changes, in percent. Exchange rates against USD Turkey - Turkish lira - Monthly - End of period	Bank for International Settlements
Capacity utilization rate	Log. Business Tendency Surveys for Manufacturing: Capacity Utilization. (Raw data: Apr 2010=100, Monthly, Seasonally Adjusted)	Organization for Economic Co-operation and Development (OECD)
Unit labor cost	Raw data: 2005=100, Quarterly, Seasonally Adjusted Year-on-year changes, in percent. Quarterly, Seasonally Adjusted	OECD
Central bank policy rates	Year-on-year changes, in percent. From 20 May 2010 onwards: 1-week official repo rate; from 20 Feb 2002 to 19 May 2010: Central Bank overnight borrowing rate.	Bank for International Settlements

Appendix B. Unit root and stationarity tests

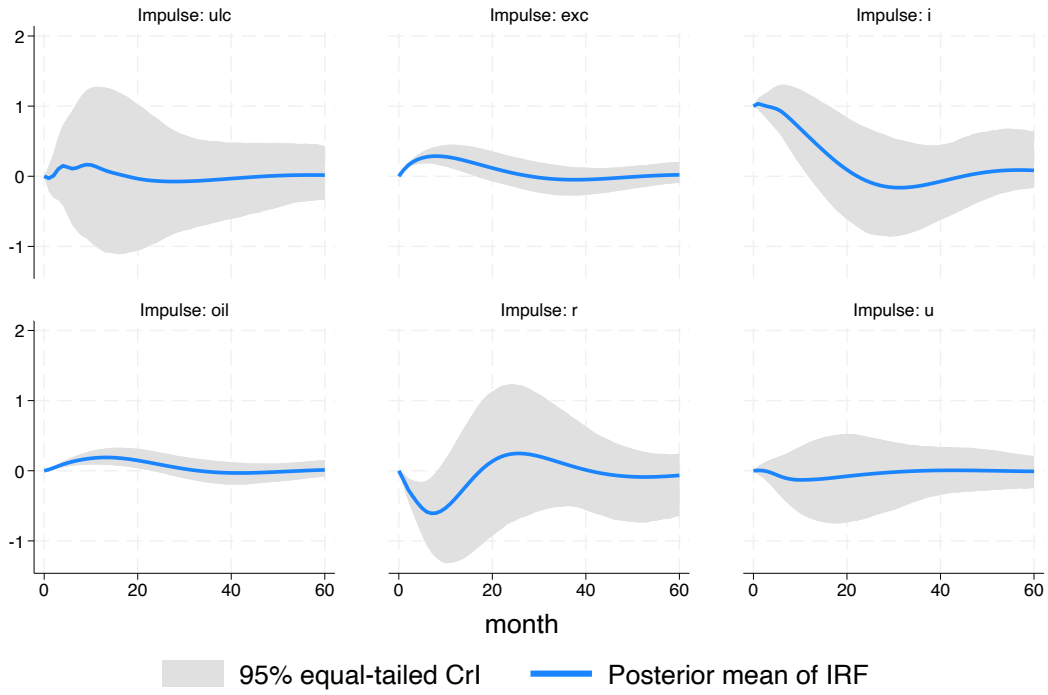
	ADF	Zivot-Andrews		Lee-Strazicich	
Variable	t-statistic	t-statistic	Break date	Trend break/crash model	Break dates
cpi	-4.361***	-6.616***	2020:02	-6.558***	2017:07 (TB1)
	(-3.432)	(-5.08)		(-5.89)	2021:05 (TB2)
exc	-6.402***	-6.833	2020:04	-4.597***	2018:11 (TB1)
	(-3.432)	(-5.08)		(-3.569)	2020:09 (TB2)
oil	-4.477***	-5.487**	2014:06	-4.12***	2016:11 (TB1)
	(-3.432)	(-5.08)		(-3.569)	2020:05 (TB2)
ulc	-0.034	-4.0694	2020:05	-5.643*	2017:09 (TB1)
	(-3.432)	(-5.08)		(-5.89)	2020:07 (TB2)
u	-5.208***	-6.404**	2009:10	-4.3188	2008:02 (TB1)
	(-3.432)	(-5.08)		(-3.569)	2010:03 (TB2)
r	-5.954***	-6.984***	2018:05	-6.18***	2015:05(TB1)
	(-3.432)	(-5.08)		(-3.57)	2019:08 (TB2)

Note: For the ADF, Zivot-Andrews, and Lee Strazicich tests, the null hypothesis is that the process is difference stationary or has a unit root. 5% critical values are in parentheses. To determine whether series have unit root or are nonstationary, test statistics for all the level variables are based on regressions including a linear trend besides a constant. TB1 and TB2 in the Lee-Strazicich test indicate trend break or crash dates in the model. ***, **, and * represent 1, 5, and 10% significance levels, respectively.

Appendix C. VAR stability check



Appendix D1. Bayesian estimates of IRFs for the inflation rate (Minnesota Prior)



Appendix D2. FEVD of the inflation rate (Results from the Bayesian estimates)