THE TRANSMISSION MECHANISM OF MONETARY POLICY SHOCKS IN TURKIYE

by
TAYFUN KURTİNİ

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Approved by:

Prof. Mehmet Baç . . . .
(Thesis Supervisor)

Assoc. Prof. İnci Gümüş . . . .

Asst. Prof. Mehmet Özsoy . . . .

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ABSTRACT

THE TRANSMISSION MECHANISM OF MONETARY POLICY SHOCKS IN TURKIYE

TAYFUN KURTINI

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Thesis Supervisor: Prof. Mehmet Baç

Keywords: Monetary Policy Shock, Structural VAR Model, Local Projection Model, Block Exogeneity, Transmission Mechanism

This paper, tries to identify the monetary policy shocks in Türkiye, and empirically analyzes the impact of them on main macroeconomic indicators for the period 2006M1-2023M8, specifically focusing on two external shocks of consumer prices and global demand, and two domestic shocks of interest rate and risk premium. For this purpose, I first employ structural VAR model with block exogeneity notion, and I distinguish the surprise component of monetary policy generated from SVAR model to analyze its impacts through local projection model. Results imply a positive interest rate shock decreases the prices, appreciates the domestic currency, and reduces the output slightly. Türkiye, being a small open economy is significantly affected by world indicators. An increase in world consumer price and world output increases domestic inflation and domestic output, respectively. Lastly, monetary policy shocks affect consumer credits negatively as expected, while unexpectedly increasing the stock market.

ÖZET

TÜRKİYE'DE PARA POLİTİKASI ŞOKLARININ AKTARIM MEKANİZMASI

TAYFUN KURTİNİ

EKONOMİ YÜKSEK LİSANS TEZİ, TEMMUZ 2024

Tez Danışmanı: Prof. Dr. Mehmet Baç

Anahtar Kelimeler: Para Politikası Şoku, Yapısal VAR Modeli, Yerel Projeksiyon Modeli, Blok Dışsallık, Aktarım Mekanizması

Bu çalışma, 2006M1-2023M8 dönemi için Türkiye'de para politikası şoklarının belirlenmesini hedeflemekle birlikte bu şokların ana makroekonomik göstergeler üzerindeki etkisini özellikle iki dışsal şok olan dünya tüketici fiyatı ve küresel talep ile iki yerel şok olan faiz oranı ve risk pirimi şoklarına odaklanarak ampirik olarak analiz etmektedir. Bu amaçla, ilk olarak blok dışsallık kavramını kullanarak yapısal VAR modelini kullanıyorum, ve bu modelden türetilen para politikasının sürpriz bileşenini yerel projeksiyon yönteminde etkilerini incelemek üzere ayırıyorum. Sonuçlar, faiz oranı şokunun fiyatları düşürdüğüne, yerel döviz kuruna değer kazandırdığına, ve üretimi hafif düşürdüğüne işaret etmektedir. Küçük açık bir ülke olarak Türkiye küresel göstergelerden önemli ölçüde etkilenmektedir. Küresel fiyatlardaki ve üretimdeki artış, sırasıyla yerel fiyatları ve üretimi düşürmektedir. Son olarak, para politikası şokları beklenmedik bir şekilde hisse piyasasında artışa sebep olurken, tüketici kredilerini beklendiği gibi negatif yönde etkilemektedir.

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To my family

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1. INTRODUCTION

The question of how monetary policy impacts real macroeconomic variables has been glowingly debated in the existing literature. Monetary policy, executed by a country's central bank is basically a mechanism that serves to manage the real economy while influencing critical economic indicators such as inflation, output, and employment, along with the consumer prices, asset valuations, exchange rates, and consumption - investment decisions of people. Nonetheless, the direct control over those critical indicators is beyond the central bank's reach, and it can indirectly affect those indicators, which is accomplished by either adjusting short-term interest rates or by altering the money supply through open market operations. The individual pathways through which changes in the monetary policy decisions mentioned above exert an influence over economic activities are known as transmission channels. The main monetary policy transmission channels are comprised of interest rate channel, asset price channel, and exchange rate channel which can be classified under neo-classical channel. Additionally, credit channel under non-neo classical channel and expectations channel are other components of monetary policy transmission channels (Cambazoglu and Karaalp (2012)). We will particularly analyze interest rate and exchange rate channel of the transmission mechanism along with the asset price channel through stock market responses and consumer credit reaction under credit channel.

The main focus of this paper is to examine the impacts of monetary policy shocks on key macroeconomic variables of a small open and emerging economy, Türkiye, for the period between 2006M1 and 2023M8. The impact of domestic and external shocks for the emerging markets has been widely analyzed as those countries are more integrated with rest of the world and established trade linkages with them (see Neumeyer and Perri (2005), Maćkowiak (2007)). Identification of domestic and external shocks in emerging countries is crucial to understand the transmission mechanism of monetary policy, yet it could be challenging due to the complex characteristics of those countries. Several methods have been developed to understand the impact of those shocks in emerging markets. In this paper, we employ the structural VAR approach with block exogeneity notion from Cushman and Zha (1997). There exists some restrictions of studying on small open economies. While external shocks can influence the macroeconomic variables of small open economies, the domestic shocks of those countries do not have a power to affect other economies, which we address the issue with block exogeneity notion. To identify the monetary policy shocks more properly, we utilize structural VAR approach of Kilinc and Tunc (2014) instead of using standard recursive Cholesky decomposition in which the ordering of the variables changes the results. Under Cholesky decomposition, the first variable is assumed to be not affected contemporaneously by other variables, i.e the most exogenous one, and the second variables is supposed to be affected by the first variable, not by subsequent variables, and the procedure goes on. On the other hand, the structural VAR approach allows for rich and flexible identification of the system by imposing some restrictions, and the identification is not sensitive to the ordering of the variables. After we identify monetary policy shocks from SVAR model, we utilize the shock to see its impacts on main economic indicator through local projection model, which provides us to make a comparative analysis between the models.

We find that a positive interest rate shock decreases the consumer prices as expected, appreciates the domestic currency and causes a temporary slight decline in economic activity whose impact disappears immediately in both models. Our results validate there is no price or exchange rate puzzle even though there exists some papers finding price or exchange rate puzzle in emerging economies. On the other hand, we examine a positive shock to reel exchange rate unexpectedly decreases consumer prices. Furthermore, we find that an increase in risk premium, for which we use emerging market bond index variable, causes a decline in output similar to interest rate shocks, yet depreciates the domestic currency contrary to interest rate shock. Türkiye, being a net importer of energy-related commodities, is expected to be affected negatively from a positive shock to world consumer prices. Our results are in line with these expectations. Also, a positive shock to world industrial production boosts the domestic output and appreciates the domestic currency. Local projection model assists us to discover that there exists a negative relationship between consumer credits and monetary policy shocks. Lastly, in contrast to expectations, stock market in Türkiye positively responds to monetary policy shocks.

Our paper extends the analysis of the identification of monetary policy transmission in the existing literature in two directions. First, we investigate the impact of monetary policy shocks through the empirical SVAR model by focusing on interest rate and exchange rate channel of the transmission mechanism and we distinguish the monetary policy shocks from the interest rate change to utilize it on local projection model. Second, we employ local projection model through the monetary policy shocks generated by SVAR model by adding credit and asset price channel, which ensures a comparative analysis between two models.

The rest of the paper is organized as follows: In the following section, we explain the existing literature regarding the impact of monetary policy shocks. In section 3, we present the data used in the model. In section 4, we introduce our identification structure of structural VAR and local projection model. In the following section, we present the results from impulse response functions. In section 6, we narrate our concluding remarks.

2. LITERATURE REVIEW

Romer and Romer (2004) highlight that conventional measures of monetary policy may result in biased results, entailing the identifying of a new measure of monetary policy shocks. They claim the conventional monetary policy indicators, such as federal funds rate, are influenced not only by monetary policy decisions, but also by forecasts that contain information about future economic developments, which might lead to biased results while predicting the effects of monetary policy. The new measure of monetary policy suggested by Romer and Romer (2004) consists of two crucial elements. First, to mitigate the issue of forward-looking behavior, they incorporate Federal Reserve's inflation and output forecasts prepared for scheduled FOMC meetings. Second, they consider only changes in the Federal Reserve's intentions for the federal funds rate around scheduled FOMC meetings to tackle the endogeneity problem and ensure that the forecasts reflect the main information available to the Federal Reserve at the time decisions are made. They analyze the changes in the federal funds rate and their relationship with economic forecasts through regression analysis. The residuals derived from the analysis represent changes in the intended funds rate, which is used for measuring monetary shocks. Using the new shock measure, they analyze the impacts of monetary policy shocks on industrial production and price levels through VAR model and find that five months after a contractionary shock, industrial production starts to decrease, reaching its minimum after 22 months. On the other hand, their finding indicates that in response to 100 basis point shock, the price level remains nearly constant for the first 18 months and subsequently, it starts to decline steadily relative to its expected course. In this paper, we employed a similar approach, using the residuals of interest rates in the SVAR model to measure monetary policy shocks.

Miranda-Agrippino and Ricco (2021) address the ongoing uncertainties on the empirical impacts of monetary policy shocks, criticizing existing models to be lack of robustness due to the misspecified modellings with unrealistic assumptions of full information between market agents. They propose a new identification that accounts for informational rigidities robust to misspecified models and that serves as a bridge between VARs and Local Projections. Using Bayesian Local Projection (BLP), they estimate the impact of monetary shocks on economic variables, private sector forecasts, and interest rates. They observe that monetary tightening is unequivocally contractionary resulting in the decline of output and prices. Another crucial finding of them is the extent of economic contraction is amplified through credit channel, and expectations of agents for economic variables are revised in accordance with deteriorating fundamentals. In this paper, we adopt a similar methodology by analyzing the monetary policy shocks derived from SVAR model through the local projection (LP) approach, enabling a comparative assessment between the two methodologies.

Kuttner (2001) examines the impact of changes in monetary policy on bill, note, and bond yields within a regression model through the futures market of Federal Reserve funds by decomposing the changes into anticipated and unanticipated components. They utilize Fed funds futures rates to measure anticipated interest rate changes, as those prices reflect the forecasts of the market for Fed funds rates in the future. They find the changes in unexpected funds rate target have enormous impacts on market interest rates, especially in short-term interest rates, and their results are consistent with the expectations hypothesis.

In terms of modelling, Plagborg-Møller and Wolf (2021) construct a comparative analysis between local projections (LPs) and Vector Autoregressions (VARs), as in our model of which we particularly use the structural VAR. The main result of the paper is that the VARs and local projections give the same responses at short horizons when the lag length is finite, which means it is possible to obtain the LP impulse response function by constructing appropriately ordered recursive VARs. Similarly, structural identification schemes employed in VARs can be applied to LPs. The only requirement for the nonparametric result is unrestricted lag structures in the two specifications. They also find that linear VARs are as robust to nonlinearities as linear local projections.

In the context of Türkiye, the empirical literature predominantly uses the VAR method to investigate the effects of monetary policy shocks, which can be categorized into two groups. While some of the papers employ the conventional VAR approach to analyze the effects of monetary shocks, some of the papers utilize SVAR analysis. For the first group, Berument (2007) uses the spread between the Central Bank's interbank interest rate and the depreciation rate of the local currency as the monetary policy tool through VAR analysis. He finds that positive innovation in the spread results in the appreciation of the local currency and a decline in income and prices. He also demonstrates monetary tightening has transitionary effect on income while it has a permanent impact on prices and exchange rate. Cambazoglu and Karaalp (2012) examine the effects of monetary policy shocks, especially the narrow credit view, on employment and output for the period of 2005-2010 by using VAR model. In their model they include monthly variables of money supply, total loans, employment rates and industrial production index. They observe one standard deviation shock in money supply (M2) negatively affects credit, employment and industrial production index. Ülke and Berument (2016) investigate the impacts of different stances (tight or loose) and different sizes (small or large) of monetary policy shocks on exchange rate, output and inflation for a small and open economy – Turkey – by including monthly data for the period of 1990-2014. Nonlinear vector autoregressive model of Kilian and Vigfusson (2011) is employed in their analysis. They conclude that a tight monetary policy, a positive interest rate shock, decreases the exchange rate (appreciation of domestic currency), whereas a loose monetary policy has the opposite effect, the latter of which has a weaker impact. They further find that the asymmetric impacts of the shock is more evident as the magnitude of a shock increases.

The second group analyses the impact of monetary policy shocks by using SVAR model instead of conventional VAR models. Kilinc and Tunc (2014) identify the monetary policy shocks using SVAR approach by modelling Türkiye as an open and small economy, where external variables affect domestic variables, but not vice versa. They find that positive interest rate shocks lead to appreciation in domestic currency and decline in inflation while decreasing domestic activity, which is consistent with the existent literature. They also observe that a positive innovation in risk premium causes a depreciation of the currency and increment in inflation. Lastly, an increase in the global demand stimulates the domestic activity resulting in increased inflation. Bulut (2023) extends the structural vector autoregressive (SVAR) methodology with structural breaks by using monthly data spanning the period 2011M01–2022M12. In parallel to the literature, they find that a positive shock to interest rates decreases the consumer prices and appreciates the domestic currency, while an exchange rate shock increases interest rates and consumer prices. By employing SVAR model for the 2006-2018 period, Can, Bocuoglu, and Can (2020) validate the interest rates and the nominal exchange rates are decisive factors of output and the consumer prices, respectively. They find that a monetary policy shock decreases the output and prices, and federal funds rate has a significant impact on domestic output.

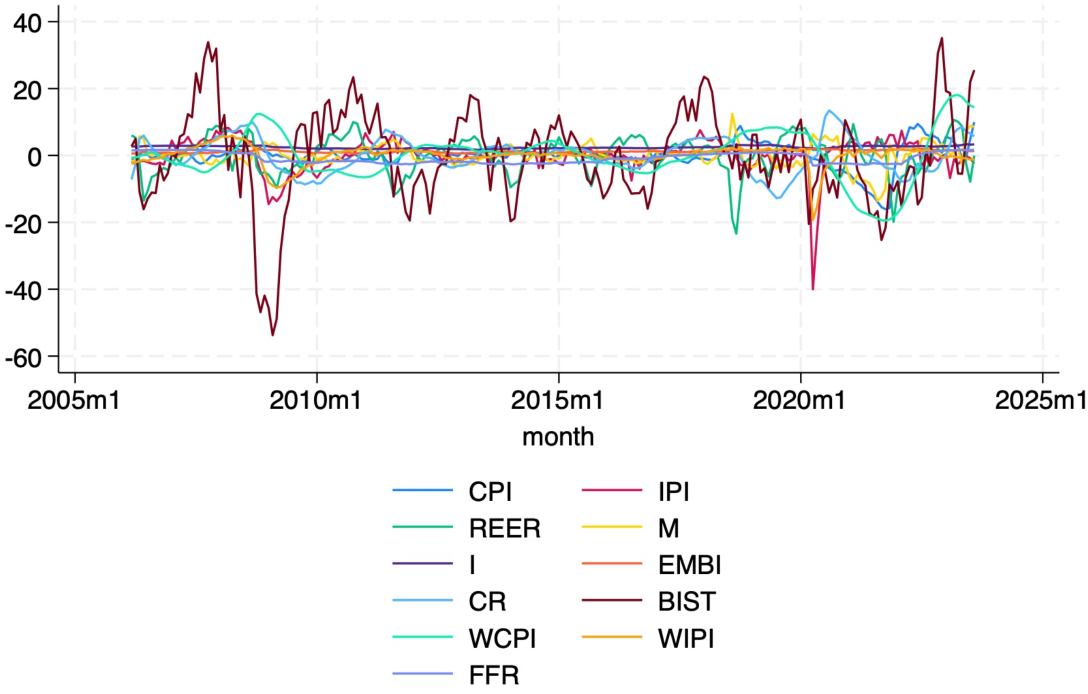
3. DATA

We utilize monthly data spanning from January 2006 to August 2023. Employing monthly data for Structural Vector Autoregression (SVAR) models offers several advantages over quarterly data. First, high-frequency monthly data provides a better capture of the data along with improving the statistical properties of the model. It also helps to monitor the timing of the shocks more accurately. There are significant reasons for commencing our observations in 2006. Notably, Central Bank of the Republic of Türkiye has adopted an explicit inflation targeting framework since 2006. Owing to a variety of policy frameworks performed in earlier periods, focusing on a period with more stable economic dynamics is more favorable and ideal for analyzing the effects of monetary policy shocks. Our sample period concludes in August 2023.

Following Kilinc and Tunc (2014), our dataset is structured into two primary segments: external (or exogenous) and domestic variables. Whilst external data comprises of construction-excluded world industrial production index (WIPI), world commodity price index (WCPI), and US Federal Funds rate (FFR), domestic data includes industrial production index (IPI), consumer price index (CPI), the monetary aggregates (M3), real effective exchange rate (REER), emerging market bond index for Türkiye (EMBI), and weighted average interest rates for deposits (I). Building upon Leu and Mark (2004) approach, we use HP filter to decompose each variable into trend and cyclical components after taking natural logarithm of WIPI, WCPI, IPI, CPI, M3, and REER. For these variables, we utilize the deviations of the cyclical component from the trend component. On the other hand, we take the natural logarithm of I, EMBI and FFR variables. Figure 3.1 demonstrates the dataset intended for utilization in the model following these transformations.

The monthly industrial production index (IPI) which is our measure of domestic demand, and consumer price index (CPI) data come from the Turkish Statistical Institute (TurkStat). The monetary aggregates (M3), real effective exchange rate (REER) and our measure of policy rate that we use as weighted average interest

Figure 3.1 Data After Transformations



Note: All variables are logged, seasonally adjusted, and HP-filtered with smoothing parameter 14400 except EMBI, I and FFR, which are logged only. Cyclical components of the HP-filtered series are shown.

rate for TRY up to 1 month data are obtained from the CBRT. Our measure of risk premium data, the emerging market bond index (EMBI), comes from Bloomberg. The inclusion of this variable is crucial for emerging markets like Türkiye. The spread between the emerging markets and advanced countries assists to monitor the risk premium of the related country. The data for consumer credits (CR) and Istanbul Stock Exchange Index (ISE or BIST) that we include in the local projection model come from Banking Regulation and Supervision Agency (BRSA) and CBRT, respectively. The construction-excluded monthly world industrial production index (WIPI) data comes from the OECD. We use OECD to demonstrate world demand as it shows similar pattern of economic policy and directly affects Turkish economy. Moreover, we include OECD inflation to represent world consumer price index (WCPI) since Türkiye is a net importer of natural gas and energy. By having huge trade linkages with OECD, Türkiye is substantially affected by the change in OECD prices. Lastly, federal funds rate (FFR) is included in the model due to its possible impacts on Turkish economy through exchange rate and interest rate channel.

4. MODEL

Following Cushman and Zha (1997), we construct a structural VAR (SVAR) approach with block exogeneity notion to identify monetary policy shocks in Türkiye, which reduces the number of estimated parameters and is appropriate for small open economies. The identification structure used in this model is more flexible and realistic compared to the standard Cholesky method. To illustrate, the strict ordering of variables is not a criterion in the model, contrary to the Cholesky method. On the other hand, the identification model allows for concurrent interactions between variables reflecting real-world economic dynamics and enables the integration of theory-based restrictions, providing a more accurate identification of structural shock. Upon completion of the SVAR model analysis, the residuals of the interest rate variable will be evaluated as the indicator of monetary policy shock. Subsequently, the impact of the shock on real economic variables will be investigated through the local projection method, providing comparative analysis between the models.

4.1 Structural Vector Autoregression Model

To construct a general specification, assume the structural system is of a linear, stochastic dynamic form (omitting constant and other deterministic term), as in Cushman and Zha (1997). Using the structural form equation of Kilinc and Tunc (2014), the economy is characterized as follows:

$$A(L)\ y(t) = \epsilon(t) \tag{4.1}$$

where $y(t)$ is an $m \times 1$ vector of observations at time t, $A(L)$ is a non-singular $m \times m$ matrix in lag operator L, and $\epsilon(t)$ is $m \times 1$ structural disturbances. Within the framework of block exogeneity, the partitioned matrices are as indicated below:

$$y(t) = \begin{bmatrix} y_d(t) \\ y_e(t) \end{bmatrix}, \tag{4.2}$$

$$A(L) = \begin{bmatrix} A_{11}(L) & A_{12}(L) \\ A_{21}(L) & A_{22}(L) \end{bmatrix}, \tag{4.3}$$

and

$$\epsilon(t) = \begin{bmatrix} \epsilon_d(t) \\ \epsilon_e(t) \end{bmatrix}, \tag{4.4}$$

where $y_d(t)$ is m_1 x 1 vector of domestic variables, and $y_e(t)$ is m_2 x 1 vector of external variables at time t. The dimension of $A_{11}(L)$ is m_1 x m_1, $A_{12}(L)$ is m_1 x m_2, $A_{22}(L)$ is m_2 x $m2$, $\epsilon_d(t)$ is m_1 x 1, and $\epsilon_e(t)$ is m_2 x 1 where $m_1 + m_2 =$ m. A_0 is non-singular and there is no correlation between the structural shocks at time t and the past values of y(t - s) for s > 0. Ultimately, structural distributions satisfy the following conditions:

$$E[\epsilon(t)\epsilon(t)'|y(t-s), s>0] = I, \quad E[\epsilon(t)|y(t-s), s>0] = 0. \tag{4.5}$$

If we define the reduced form equation (VAR) as

$$B(L)\ y(t) = u(t), \tag{4.6}$$

then the structural disturbances are related to the reduced form equation (VAR) residuals by $\epsilon(t)$=$A_0 u(t)$. The equation in the matrix form can be written as:

$$\begin{bmatrix} \epsilon_{ipi_t} \\ \epsilon_{cpi_t} \\ \epsilon_{m3_t} \\ \epsilon_{reer_t} \\ \epsilon_{embi_t} \\ \epsilon_{i_t} \\ \epsilon_{wcpi_t} \\ \epsilon_{wipi_t} \\ \epsilon_{ffr_t} \end{bmatrix} = \begin{bmatrix} a^0_{1,1} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & a^0_{2,2} & 0 & a^0_{2,4} & 0 & 0 & a^0_{2,7} & 0 & 0 \\ 0 & 0 & a^0_{3,3} & 0 & 0 & a^0_{3,6} & 0 & 0 & 0 \\ a^0_{4,1} & a^0_{4,2} & a^0_{4,3} & a^0_{4,4} & a^0_{4,5} & a^0_{4,6} & a^0_{4,7} & a^0_{4,8} & a^0_{4,9} \\ a^0_{5,1} & a^0_{5,2} & 0 & a^0_{5,4} & a^0_{5,5} & a^0_{5,6} & 0 & 0 & a^0_{5,9} \\ 0 & 0 & 0 & a^0_{6,4} & a^0_{6,5} & a^0_{6,6} & 0 & 0 & a^0_{6,9} \\ 0 & 0 & 0 & 0 & 0 & 0 & a^0_{7,7} & a^0_{7,8} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & a^0_{8,8} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & a^0_{9,7} & a^0_{9,8} & a^0_{9,9} \end{bmatrix} \begin{bmatrix} u_{ipi_t} \\ u_{cpi_t} \\ u_{m3_t} \\ u_{reer_t} \\ u_{embi_t} \\ u_{i_t} \\ u_{wcpi_t} \\ u_{wipi_t} \\ u_{ffr_t} \end{bmatrix} \tag{4.7}$$

Incorporating the approach of Özdemir (2015), u(t) in reduced VAR form represents the white noise disturbances with the covariance matrix

$$E(u_t u_s') = \Sigma$$

if t = s and 0 otherwise. It is required for identification to find a lower triangular matrix A converting the disturbance vector to a vector of orthogonal structural innovations,

$$Au_t = \Lambda \epsilon_t,$$

which can be achieved by solving k equations of the following system,

$$A^{-1}\Lambda\Lambda' A^{-1'} = \Sigma$$

where Λ is the diagonal matrix with elements $\sigma_{i,t}$ and ϵ_t are normalized errors with $\epsilon_t \sim N(0, I)$. Since Σ is a symmetric matrix, the necessary condition for the solution of the simultaneous relationships requires $\frac{k^2-k}{2}$ restrictions in the system for the exact identification. There exists nine variables in our model, implying the model is over-identified.

Under favour of block exogeneity restriction, $A_{21}(L)$=0, it is constrained for domestic variables to affect external variables both contemporaneously and for lagged forms. This is particularly valuable for emerging economies whose real economic dynamics are sensitive to global fluctuations. In this way, it is allowed to include large set of exogenous variables for correct specification of the model.
Our identification structure enables variables to respond contemporaneously to other domestic and external variables, providing flexibility compared to standard Cholesky decomposition, which makes rich simultaneous relations between variables difficult to achieve.
Following Kim and Roubini (2000) Peersman and Smets (2001) Pagan, Catão, and Laxton (2008), our initial assumption is that shocks to output can only affect exchange rate and EMBI in that month. On the other hand, we assume no domestic or external variable has an immediate impact on domestic output within the same month, indicating the delayed response of real economic activity to other shocks at that period.
We further assume shocks to our benchmark interest rate has contemporaneously influence money aggregates, the real effective exchange rate, and EMBI. We claim the response of output and price to monetary policy decisions take some time (Sims and Zha (2006) and Peersman and Smets (2001)).
In parallel with the existing literature, exchange rate is assumed to be contemporaneously affected by all the variables in the model, while it can only affect CPI,

EMBI and interest rate contemporaneously.
With the approach of Kilinc and Tunc (2014), while the improvements in EMBI positively affect the exchange rate and interest rate in the same month, changes in IPI, CPI, REER and I contemporaneously affect EMBI.
As for external variables, we include OECD industrial production index for world industrial production index to measure the external demand. Since exchange rate is assumed to instantly respond to the domestic and external information contrary to other variables which have lagged reaction, we assume WIPI can only influence exchange rate in the same month. We do not expect WIPI has contemporaneous impact on other variables since the reactions to the shocks to WIPI take some time. Any changes in WCPI, which we considered as OECD CPI, has contemporaneous impact on domestic inflation even in the same month (Kim and Roubini (2000) and Cushman and Zha (1997)). Since any hike in world inflation promote external demand, implying increased demand for foreign currency, local currency is assumed to be negatively affected by WCPI. Due to the fact that supply-side effect take time to realize, domestic output is assumed to be not affected by WCPI contemporaneously. By Maćkowiak (2007), FFR is included in the model since any change in foreign interest rate affects the real economic dynamics of emerging economies. It is assumed that FFR has contemporaneous impact on exchange rate, EMBI, and interest rate of the domestic country.

According to Akaike Information Criteria (AIC), I include two lags in the estimation equation.

4.2 Local Projection Model

Upon completion of the SVAR model analysis, we analyze the impact of monetary policy shocks taken by the residuals of the interest rate variable in SVAR model on real economic variables through the local projection method. The residuals of the interest rate from SVAR model will be called as mps (monetary policy shock) in the rest of the paper.

$$\Delta log(Y_{t+h}) = \alpha_h + \beta_h \Delta log(B_{t-1}) + \Psi_h(L)\Delta log(X_t) + \epsilon_{Y,t+h} \tag{4.8}$$

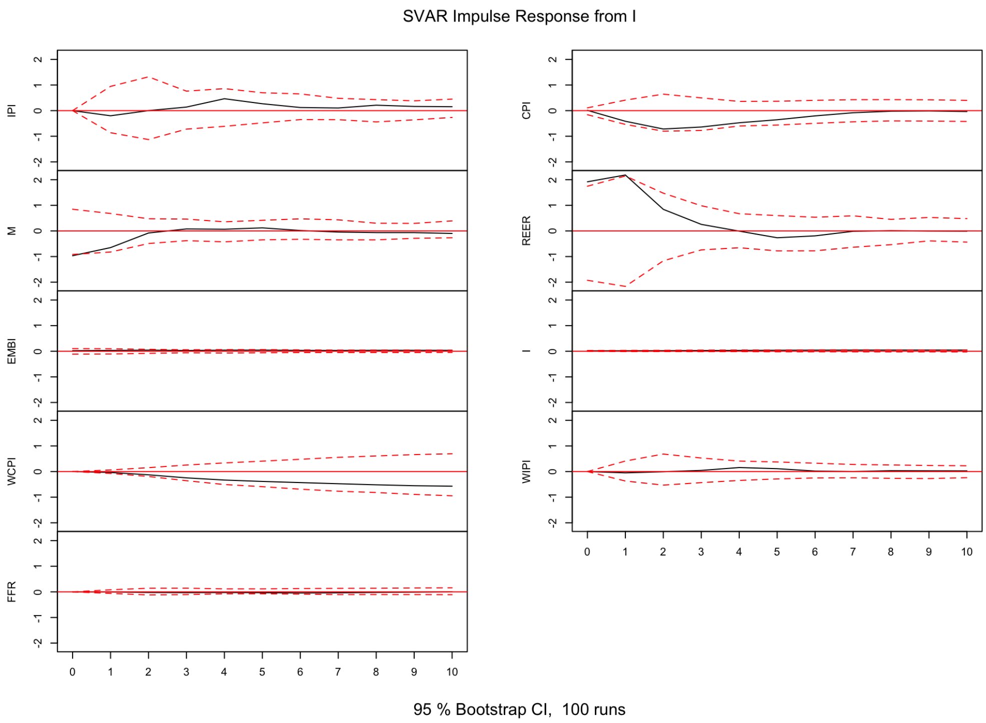
where h specifies the horizon, Y_t is the variable of interest, X_t is the vector of control variables that also includes the other lags of the variables apart from the monetary policy shock, $\Psi_h(L)$ is polynomial in the lag operators, B_{t-1} is the first lag of the mps, β_h is our coefficient of interest. All endogenous variables are included as a control. Regarding the serial correlation issue in the error terms triggered by the successive leading of the endogenous variable, I utilize the Newey-West correction for the standard errors. We include one lag of each variable in the estimation equation to be consistent with the literature.

5. RESULTS

In this section, I discuss the impact of the monetary policy shocks on real economic variables through the impulse response functions of the SVAR model, specifically focusing on two external shocks of consumer prices and world demand, and two domestic shocks of interest rate and risk premium. After discussing the impulse responses of the shocks, I distinguish the surprise component of monetary policy from interest rate changes by taking the residuals of domestic interest rate from SVAR model. Finally, I investigate the impact of the monetary policy shocks on real variables including consumer credits and ISE variables through LP model.

Figure 5.1 indicates the impulse response of the variables in the model to a 1% shock to domestic interest rate, which is our main concern. In line with the literature, this shock decreases consumer prices, having the strongest impact in the second period. Namely, we do not observe a price puzzle, in which monetary tightening increases prices. Cushman and Zha (1997) indicates in their analysis that the problem of price puzzle might be overcome by a proper identification of the model instead of misleading models such as standard Cholesky decomposition as in Carlstrom, Fuerst, and Paustian (2009), which shows the importance of using SVAR model. In response to monetary tightening shock in interest rate, the economic activity slightly decreases in the first period, and the effect disappears in the second period. The reason might stem from the selection of the variable representing economic activity. The inclusion of GDP variable would generate stronger reaction compared to the Industrial Production Index, but we use the latter since we focus on monthly data. Moreover, the particular effect of interest rate shock is on reel effective exchange rate. The results are in line with the economic theory that suggests a tight monetary policy appreciates the domestic currency (see Kim and Roubini (2000) and Berument (2007)). Hence, a price puzzle do not emerge under favour of proper identification of SVAR model (Kim and Roubini (2000)). Lastly, the external variables do not respond to the domestic interest rate shock by construction of the model.

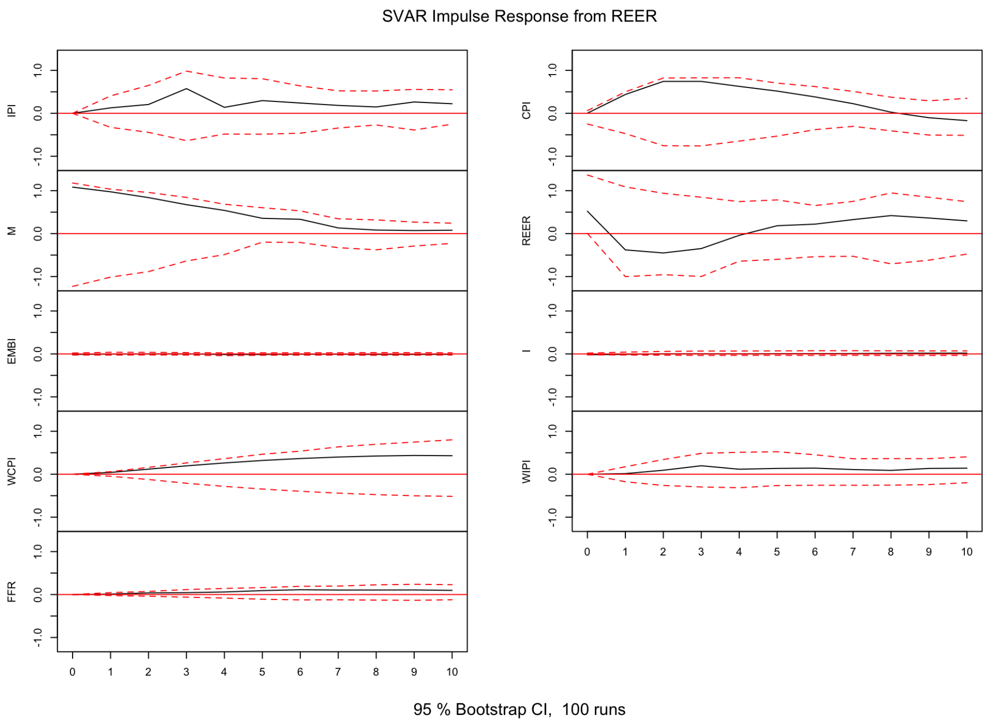
Figure 5.1 Impulse Responses to 1% Shock to I



Note: The red dashed lines represent the 95 percent confidence bands. All variables are logged, seasonally adjusted, and HP-filtered with smoothing parameter 14400 except EMBI, I and FFR, which are logged only. The Y-axis indicates the percentage deviations from the steady state and the X-axis indicates the months.

Figure 5.2 demonstrates the impulse responses to a 1% shock to reel effective exchange rate. The results are not in line with the existing literature that a depreciation in REER leads to an increase in the prices due to the higher costs of imported goods. (Aslan and Ozgur (2024)). On the contrary, a positive shock to REER increases domestic inflation in our model. There could be several reasons behind it. Even with the cheaper imports owing to an appreciation in REER, if it is accompanied by increasing wage costs because of higher living costs, production costs increases resulting in rising inflation. Another reason might stem from the future inflation expectations. If businesses expect the appreciation in REER is temporary and anticipate future depreciation of the domestic currency, then they increase the prices. For other economic variables, we do not observe substantial reaction to a positive shock to REER.

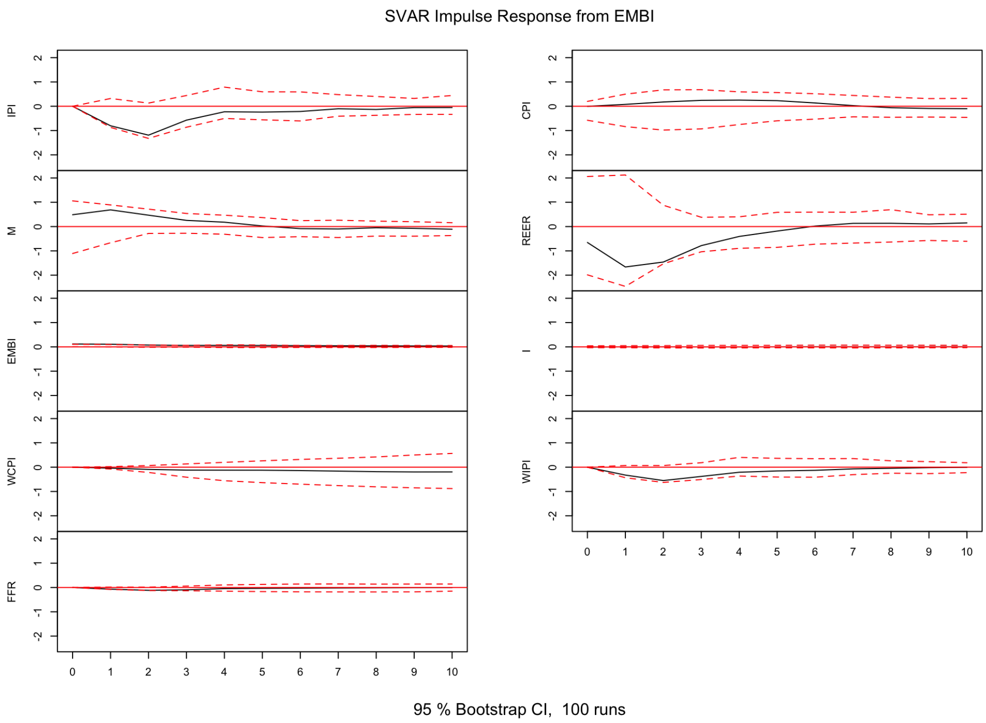
Figure 5.2 Impulse Responses to 1% Shock to REER



Note: The red dashed lines represent the 95 percent confidence bands. All variables are logged, seasonally adjusted, and HP-filtered with smoothing parameter 14400 except EMBI, I and FFR, which are logged only. The Y-axis indicates the percentage deviations from the steady state and the X-axis indicates the months.

Figure 5.3 demonstrates the impulse responses to a 1% shock to risk premium variable of EMBI. Even though the impact of domestic interest rate and EMBI on industrial production is similar by reducing the economic activity as a result of increased borrowing costs, their effects differ on REER. While a positive shock to domestic interest rate stimulates capital inflows resulting in an appreciation of reel exchange rate, an increase in EMBI causes a depreciation of REER by worsening the risk premiums. While comparing the impacts of domestic interest rate and EMBI, the larger effect is observed in response of the latter, which is supported in the existing literature highlighting the importance of risk premium shocks in emerging countries (Neumeyer and Perri (2005) in Argentina and Tiryaki (2012) in Türkiye).

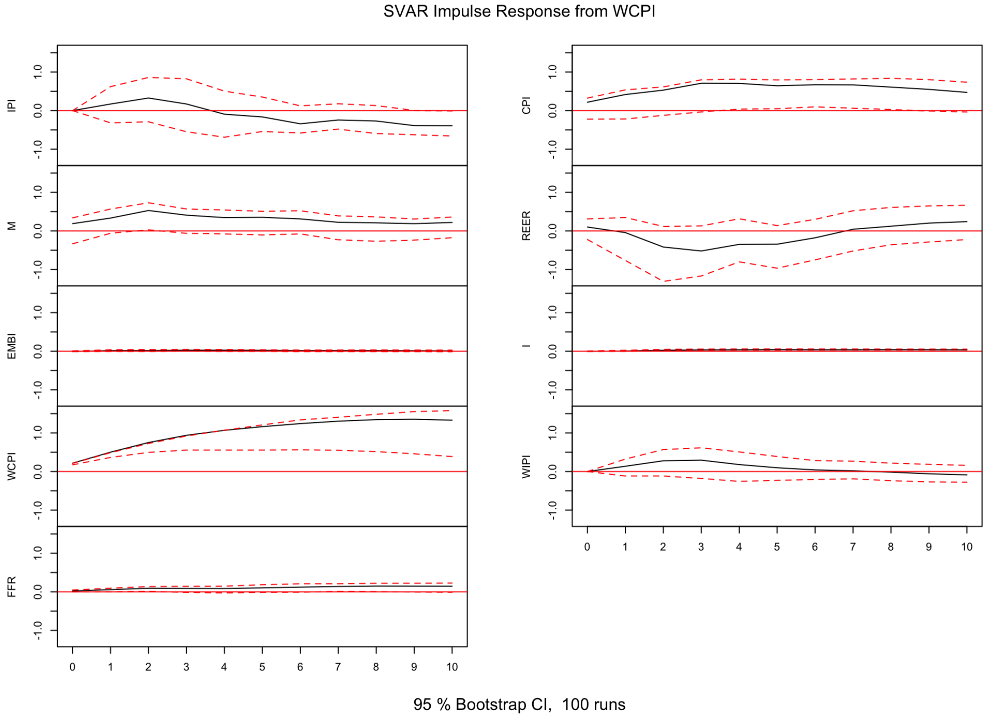
Figure 5.3 Impulse Responses to 1% Shock to EMBI



Note: The red dashed lines represent the 95 percent confidence bands. All variables are logged, seasonally adjusted, and HP-filtered with smoothing parameter 14400 except EMBI, I and FFR, which are logged only. The Y-axis indicates the percentage deviations from the steady state and the X-axis indicates the months.

Figure 5.4 demonstrates the impulse responses to a 1% shock to world commodity price. Türkiye, being a net importer of commodities, especially energy-related goods (oil and natural gas), is expected to be negatively affected by a positive shock to world commodity price shock. As expected, domestic prices increase in all periods, yet the rise in commodity import triggers the negative risk regarding current account deficit to increase. Hence, risk premium for Türkiye starts to inflate, which pave the way for a depreciation in real exchange rate. The prominent negative impact on REER is observed particularly thereafter second period, being consistent with the worsening of risk premiums as for EMBI in Figure 5.3.

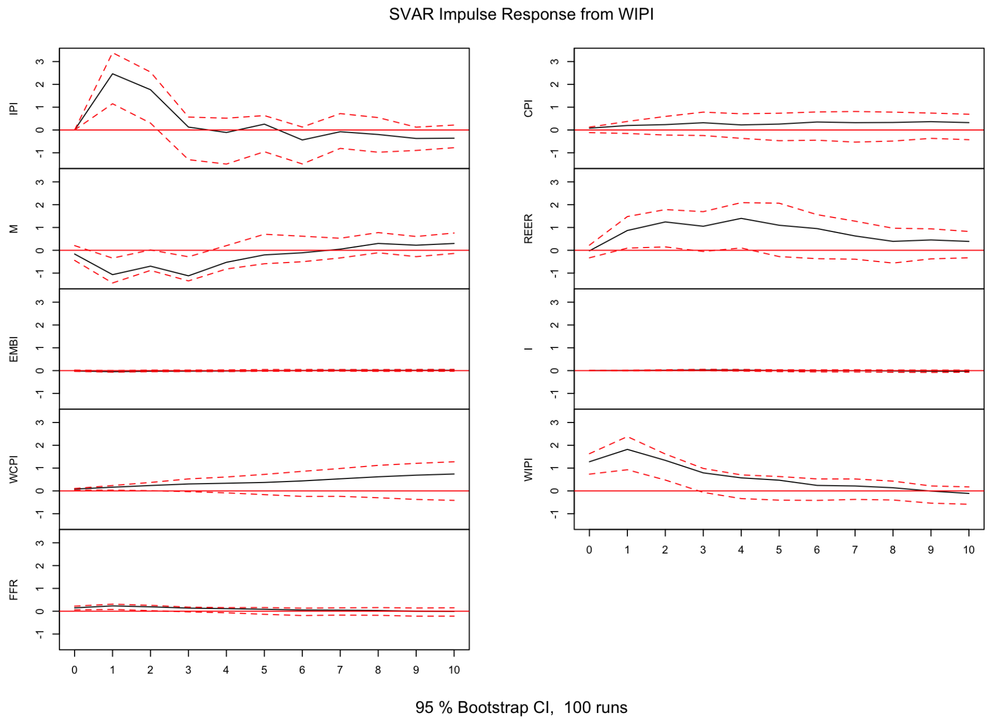
Figure 5.4 Impulse Responses to 1% Shock to WCPI



Note: The red dashed lines represent the 95 percent confidence bands. All variables are logged, seasonally adjusted, and HP-filtered with smoothing parameter 14400 except EMBI, I and FFR, which are logged only. The Y-axis indicates the percentage deviations from the steady state and the X-axis indicates the months.

Figure 5.5 demonstrates the impulse responses to a 1% shock to world industrial production shock, which can be associated with an increase in world demand. To meet higher demand, the domestic industrial production increases as expected, having the strongest impact in the first period. The results are consistent with the empirical studies of Sousa and Zaghini (2007), Utlaut and Van Roye (2010) and Franken et al. (2006). On the other hand, an increase in the world demand is expected to appreciate the domestic currency. As expected, the reel exchange rate is appreciated as a result of increase in global demand, which lead to raise in exports boosting the demand for domestic currency. The impact for domestic inflation is not obvious in any period.

Figure 5.5 Impulse Responses to 1% Shock to WIPI



Note: The red dashed lines represent the 95 percent confidence bands. All variables are logged, seasonally adjusted, and HP-filtered with smoothing parameter 14400 except EMBI, I and FFR, which are logged only. The Y-axis indicates the percentage deviations from the steady state and the X-axis indicates the months.

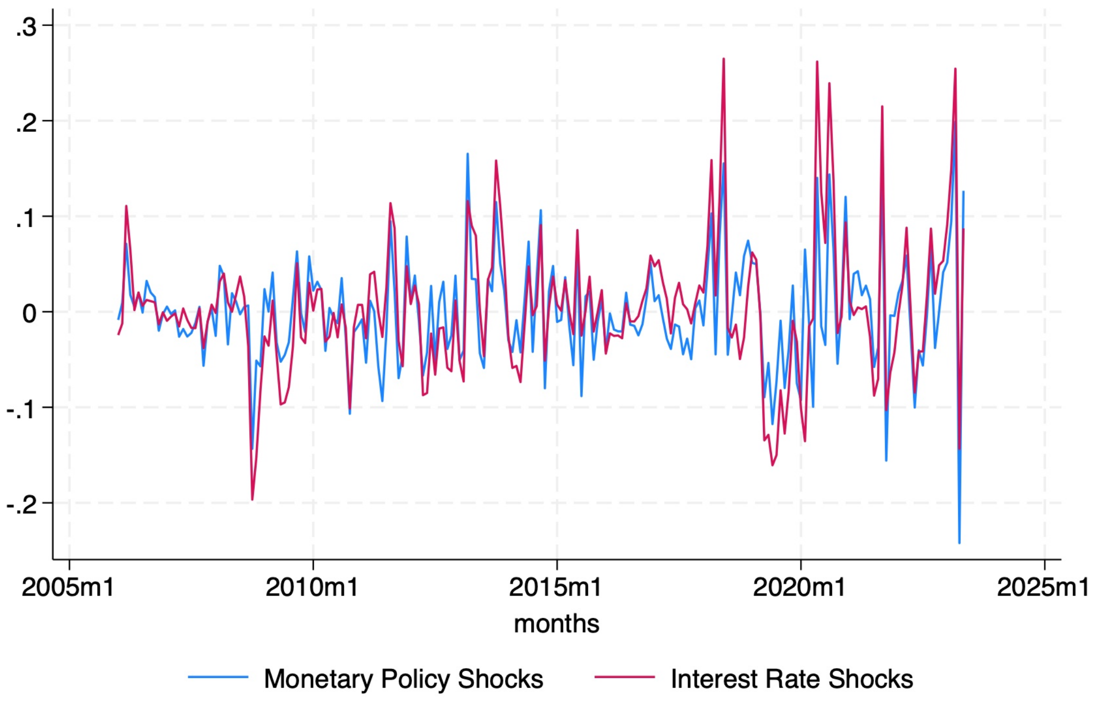
In the second part, we focus on the impact of monetary policy shocks instead of interest rate changes through local projection model. We add domestic consumer credit and Istanbul Stock Exchange (ISE) variables to the model. Figure 5.6 demonstrates the interest rate shocks generated from SVAR model, namely monetary policy shocks, and first difference of logged interest rate variable. Expectedly, not all interest rate changes are monetary policy shocks.

Figure 5.7 displays the responses of the domestic variables to one-standard deviation of monetary policy shocks. The responses of domestic inflation, industrial production and reel effective exchange rate are very similar between SVAR and LP model. In terms of consumer prices, both interest rate shocks and monetary policy shocks have negative impacts, but the size of the impact is larger in LP model. With regards to industrial production, both models generate similar result that the negative impact disappears thereafter first period. This might stem from the selection of industrial production instead of GDP as an indicator of economic activity.

Reel effective exchange rate is positively affected from the monetary policy shock, as expected. A tightening in monetary policy increases the return of domestic currency increasing the demand for it, which lead to an appreciation in REER. On the other hand, we observe consumer credit substantially decreases in response to positive monetary policy shock. There could be several reasons of the decrease in credits. First, as a result of increase in the cost of borrowing, consumers tend to use less credit. Also, higher interest rates are usually associated with the effort to control the inflation, that creates economic uncertainty, leading consumers to be more prudent in their economic decisions.

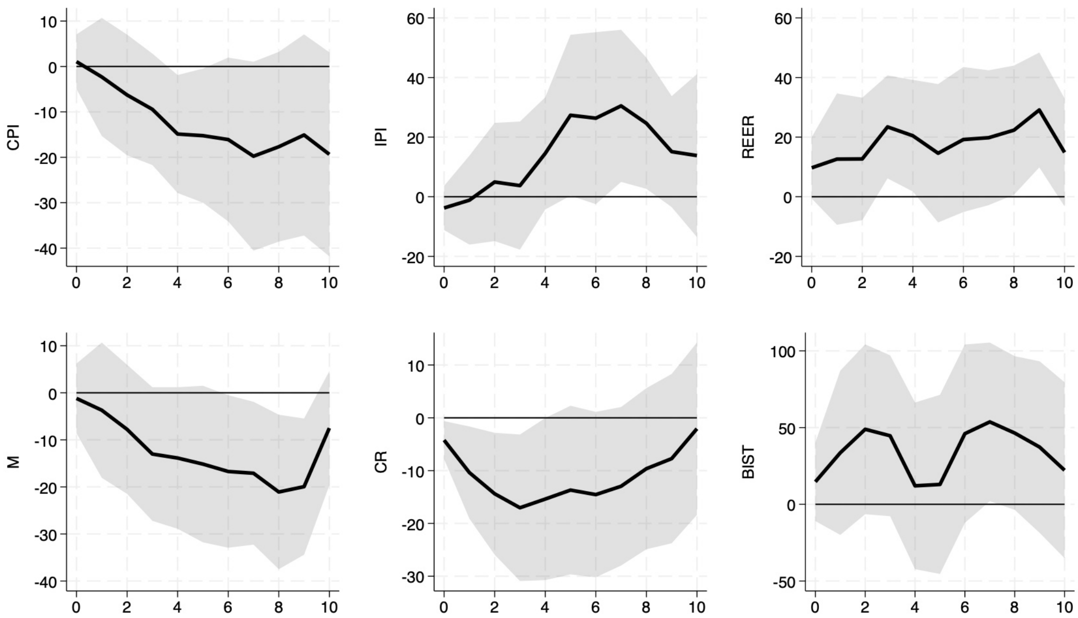
Lastly, the existing literature claims that an increase in interest rate negatively affects stock market returns due to higher discount rate reducing the present value of stocks. (Bernanke and Kuttner (2005)). In contrast, Istanbul Stock Exchange (ISE) index is positively affected by monetary policy shock. In emerging markets like Türkiye, an increase in interest rates might seem as a positive indicator to control inflation, stabilizing the economy and creating more favorable environment for businesses leading to increase in capital inflows, which in turn stimulates the demand for stocks and increases the stock prices.

Figure 5.6 Changes in Short-term Interest Rates and Surprise Component of Monetary Policy



Note: Interest rate shocks generated from the SVAR model and first difference of logged interest rate variable.

Figure 5.7 LP Model Impulse Response Functions



Note: The grey shaded areas represent the 95 percent confidence bands. All variables are logged, seasonally adjusted, and HP-filtered with smoothing parameter 14400. The Y-axis indicates the percentage deviations from the steady state and the X-axis indicates the months.

6. CONCLUSION

In this paper, I empirically analyze the impact of domestic and external shocks on real economic variables, particularly focusing on monetary policy shocks. To examine the transmission mechanism of the shocks, I initially utilize the SVAR model with the block exogeneity notion that while external variables can affect domestic variables, the latter has no impact on the former. Six endogenous variables (IPI, CPI, M, REER, EMBI, and I) and three external variables (WCPI, WIPI, and FFR) are included in the model with monthly frequency for the period between 2006M1 and 2023M8. As the measure of monetary policy rate, I use the weighted average interest rate for TRY up to 1 month. Even though the results of the model have aspects that align with and diverge from the literature, the consistent aspects predominantly stand out. The results from SVAR model indicates that a monetary tightening causes the decline in consumer prices, which align with the existing literature. It also decreases the economic activity slightly, but the impact disappears immediately. A positive interest rate shock appreciates the domestic currency, as expected. The findings verify that price and exchange rate puzzles are not evident. An important indication of the model which contradicts with the literature is of the shock to reel exchange rate. A positive shock to REER decreases CPI unexpectedly. The result might stem from increasing wage costs and future inflation expectations. Furthermore, we find that an increase in EMBI decreases economic activity similar to interest rate shock. However, the impact differs on reel exchange rate. A positive shock to EMBI causes a depreciation of REER by worsening the risk premiums.

Moreover, Türkiye, being a net importer of commodities, especially energy-related goods (oil and natural gas), is negatively affected by a positive shock to world commodity price shock. Another particular result of the model is a positive shock to world industrial production increases the domestic industrial production, and appreciates the REER as a result of the raise in exports boosting the demand for domestic currency.

In the second part, I employ the local projection model by using monetary policy shocks generated from SVAR Model and add consumer credit and Istanbul Stock Exchange variables. As expected, the results of domestic inflation, industrial production and reel effective exchange rate are similar to SVAR model. Both models result in diminishing of consumer prices in response to increase in interest rate shocks. Also, in both models the negative impact on industrial production disappears thereafter first period. Besides, a monetary policy shock appreciates the domestic currency. In terms of consumer credits, we observe a negative relation with monetary policy shocks, which might arise from increase in cost of borrowing. Lastly, stock market is positively affected from the monetary policy shock in contrast to existing literature. In emerging markets, the increase in interest rate might be perceived as a positive indicator to control the economy, resulting in increase in investment decisions of the people.

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APPENDIX A

Data Description

The dataset includes six endogenous and three exogenous variables. All monthly series between 2006M1-2023M8 are seasonally adjusted by the source taken.

Endogenous (domestic) variables include Industrial Production Index (IPI), Consumer Price Index (CPI), Monetary Aggregates (M3), Reel Effective Exchange Rate (REER), Domestic Interest Rate (I), and Emerging Market Bond Index for Türkiye (EMBI). Exogeneous (external) variables consist of World Consumer Price Index (WCPI), World Industrial Production Index (WIPI) and Federal Funds Rate (FFR).

Industrial Production Index (IPI): To measure domestic economic activity, we use industrial production index instead of GDP, because the latter is reported quarterly. The monthly IPI data is taken from Turkish Statistical Institute (TurkStat). The base year is 2021.

Consumer Price Index (CPI): The monthly data is obtained from the TURKSTAT. The base year is 2003.

Monetary Aggregates of Türkiye (M3): The data is from the Central Bank of the Republic of Türkiye (CBRT - EVDS.)

Reel Effective Exchange Rate (REER): The CPI based data comes from the CBRT.

EMBI for Türkiye (EMBI): The EMBI data retrieved from the Bloomberg with JPSSGTUR Ticker. Monthly data is calculated through the averages of each month.

Domestic Interest Rate (I): We use weighted average interest rate for TRY up to 1 month as the measure of monetary policy rate. The monthly data comes from CBRT.

World Consumer Price Index (WCPI): Since Türkiye has significant trade relations with OECD countries, which often follow similar economic policies, and direct and immediate impact on Turkish economy through trade links, we use OECD CPI to measure world inflation. The monthly dataset comes from OECD ((CPIs, HICPs), COICOP 1999).

World Industrial Production Index (WIPI): We obtained the construction-excluded monthly WIPI data from the OECD.

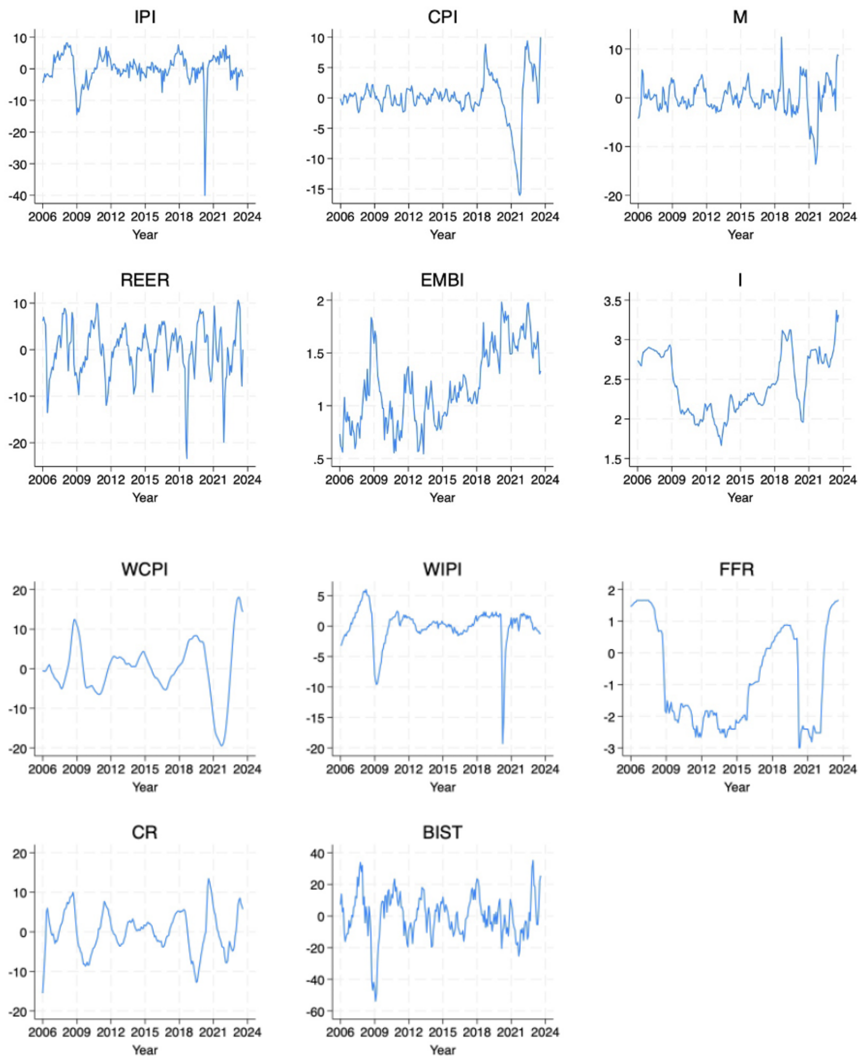
Federal Funds Rate (FFR): The monthly data on FFR is retrieved from the Federal Reserve.

Consumer Credits (CR): The monthly data on consumer credit is obtained from the Banking Regulation and Supervision Agency (BRSA).

Istanbul Stock Exchange Index (BIST): To measure the stock exchange, we use ISE1OO data. The monthly data is from CBRT.

APPENDIX B

Figure B.1 Data



Note: Data (Percent Log Deviations from HP Trend, except for EMBI, I and FFR, which are logged only.)