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The Effects of Monetary Policy Shocks on Macroeconomic Variables: A Case for Turkish Economy

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Abstract:
The study analyzes the responses of macroeconomic variables to both monetary policy and external shocks in the small open economy. This study follows Structural Vector Autoregressive model (SVAR) with block exogeneity approach to identify these shocks in Turkey. Some previous studies which followed VAR approach to investigate the monetary policy shocks have produced price and exchange rate puzzles while using SVAR approach, this research does not produce such puzzles. The study finds that currency appreciates, and prices decrease in response totight monetary policy. The research discloses that prices are sticky in the short-run, which is in accordance with theoretical expectations. The output increases but it is not critical. This finding is not in accordance with theoretical expectations. The research reveals that trade balance shows somehow an Inverse J-curve trend in response to tight monetary policy. The study also finds that there is some deviation from Uncovered Interest party (UIP). Further, the study displays that external output shocks are not critical for domestic economic fluctuations in Turkey except some fluctuations in prices. The study reveals that transmission mechanism works better through the exchange rate.

Keywords: *Monetary policy, Monetary transmission mechanism, SVAR, Small open economy*

1. Introduction

Last two decades have been very important for emerging economies as these economies showed a consistent growth in economic activities. Central banks around the world use monetary policy to maintain high economic growth rates and to stabilize inflation rates. In order to identify the behaviors of economic activities and prices to monetary policy shocks, one needs to estimate these behaviors to monetary policy shocks accurately along with policy execution timings. There is no clear agreement among the researches that what is relationship between monetary policy and macroeconomic variables.

Researchers have been using "Choleski or Recursive approach" to investigate the responses of macroeconomic variables to monetary policy shocks. Recursive approach is a lower triangular matrix where the succeeding variable is affected by proceeding variable and not vice versa. This approach has produced "puzzles" the exchange rate puzzle and the price puzzle for small open economies. Exchange rate puzzle occurs when positive innovations in policy variable cause the domestic currency to depreciate rather than to appreciate. Price puzzle occurs when positive innovations in policy variable cause the prices to increase rather than to decrease (Sims1992) and (Grilli and Roubini 1995). Cushman and Zha (1997) suggest that this Choleski approach works better for a closed economy like U.S, where policy movements do not reflect any external shock. It does not work better for the small open economy, where policy movements do reflect external shocks. Christiano et al. (1996), Simms and Zha (1998), Kim and Roubini (2000) used VAR methodology to describe price puzzles while Grilli and Roubini (1995) tried to deal with the exchange rate puzzle.

There is also no consensus among researchers which is best monetary policy indicator. According to Bernanke and Blinder (1992), FFR (federal funds rate) is best indicator of monetary policy stance. Gordon and Leeper (1994) questioned the validity of FFR as well as of the monetary aggregates as they found some dynamic behaviors of macroeconomic variables (that are different from conventional monetary analysis) to monetary policy shocks. By using semi-structural VAR model, Bernanke and Mihov (1998) also recommend interest rate as an indicator of monetary policy stance. Eichenbaum (1992) and Strongin (1995) propose non-borrowed reserves as a better indicator of monetary policy while Cushman and Zha (1997) recommend that an exchange rate works better as a monetary transmission mechanism.

By following Structural vector autoregressive approach (SVAR) of Cushman and Zha (1997), this study contributes to the existing literature by analyzing the monetary policy shocks in Turkey. Turkey being an open economy is vulnerable to foreign shocks; from this point of view, we also consider some foreign variables, such as Y*,CPI*,FFR*, and OP*to separate any exogenous monetary policy movement. Fung (2002), Franken et al. (2006) also adopted SVAR approach to identify the monetary policy shocks. There are some Turkish studies which also use VAR approach to analyze the monetary policy shocks (Berument 2007) and (Ozdemir 2015). These studies also do not produce any price or exchange rate puzzle.

This study finds that contractionary monetary policy appreciates the currency and diminishes the prices. So, the study does not produce any exchange rate or price puzzle, but it can have puzzles if it uses Choleski decomposition. Further, the study also shows that external output shocks are not critical for a small open economy like Turkey except some changes in prices.
The rest of the study is arranged as follows. Section 2 presents data. In section 3, we outlined our VAR model and identification scheme. Section 4 display the results and finally, section 5 describes the conclusion.

2. Data

The study uses monthly data series from 2006:1 to 2015:12. The dataset starts from pure inflation targeting regime as this period has stable and low inflation trend. The model includes both domestic and foreign data sets. Data was collected from various sources. Monetary aggregate (M2), Real exchange rate (RER) got from Turkish Central Bank. Export (Expt), Import (Impt), Oil prices (OP*), Advance economies production index (Y*) and Advance economies price index (CPI*) obtained from International Financial Statistics (IFS). Overnight interest rate (R) came from Istanbul stock exchange. By following Kilinc and Tunc (2014), we also consider overnight rate as a benchmark rate for our model as they think that Turkish Central Bank not only uses different policy rates but also uses other monetary policy tools to control the economic activities across different time periods. Roush (2007) and Alper & Torul (2008) also consider overnight rate as policy rate in their studies. The consumer price index (CPI) and industrial production index (Y) are from Turk-Stat. The federal funds rate (FFR*) obtained from Federal Reserve System. All data are in log form except interest rates.

3. The Model and Its Specification

While identifying monetary policy shocks through VAR model, one should consider the choice of variables and its order especially for small open economies because it can have serious consequences. By following Cushman and Zha (1997), Giordani (2004), Raddatz (2007) and Kilinc and Tunc(2014), we also use structural vector autoregression (SVAR) model for the Turkish economy.
Let's start with simple SVAR equation

$$A(L)\, y(t) = \varepsilon(t)$$

Where A(L) is n x n matrix polynomial in the lag operator L, y(t) is an n x 1 vector of observations and ε(t) is an n x 1 vector of structural shocks.

$$Y(t) = \begin{pmatrix} y_d(t) \\ y_f(t) \end{pmatrix} \qquad A(L) = \begin{pmatrix} A11(L) & A12(L) \\ 0 & A22(L) \end{pmatrix} \qquad \varepsilon(t) = \begin{pmatrix} \varepsilon_d(t) \\ \varepsilon_f(t) \end{pmatrix}$$

$Y_d(t)$ contains domestic variables as n_1 x 1 and $Y_f(t)$ contains foreign variables as n_2 x 1.
The block exogeneity limit $A_{21} = 0$ explains that foreign variables will remain unaffected to monetary shocks in the domestic country contemporaneously and for lagged values of variables. The vector of structural shocks ε(t) is uncorrelated and satisfy the following equation;

$E[\varepsilon(t)\varepsilon(t)'l\, y(t - s), s > 0] = I \qquad E[\varepsilon(t)\, y(t - s), s > 0] = 0.$

The following domestic and foreign variables are used to analyze the monetary policy shocks in Turkey; Y_d = (Y, CPI, M2, RER, R, Impt, Expt) and Y_f = (Y*, CPI*, FFR* OP*). We do not put any restriction on domestic variables $Y_d(t)$. External variables follow simple Choleski decomposition (a lower-triangular matrix where each succeeding variable is affected by proceeding variable and not vice versa) as Y_f = (Y*, CPI*, FFR*, OP*). No other lagged restrictions are imposed on foreign variables block.
Since Turkey is an open economy, we considered that its monetary policy can have effect from exchange rate and it can also affect other domestic economic variables. This condition is not suitable for a large economy like U.S. Sims (1992), Bernanke and Blinder (1992) and Mihov (2001) suggest that interest rate; "a better channel for analyzing the monetary policy stance". By following the Cushman and Zha (1997), we also consider (M2) as our measuring tool for monetary policy stance.
The identification scheme can be defined by three equations; Money, information, and production. The money market equation consists of two equations, the demand and supply equations. The demand equation is simply a textbook equation. The money supply equation displays the monetary policy contemporaneously and consists of variables whose data are immediately available within a month. The monetary analysists have access to money supply, both interest rates (R & FFR*), exchange rates, and oil prices.

$d_{22}(M-P)-d_{22}Y+a_{23}R=\varepsilon_d$

$d_{33}R+a_{32}M+a_{31}RER+b_{33}FFR^*+b_{34}OP^*=\varepsilon_s$

The information equation consists of all variables contemporaneously.

$d_{11}RER+a_{12}M+a_{13}R+a_{14}CPI+a_{15}Y+a_{16}Expt+a_{17}Impt+a_{11}Y^*+a_{12}CPI^*+a_{13}FFR^*+a_{14}OP^*=\varepsilon_{info}$

The exchange rate reacts to all other variables within one month. It is very important because exchange rate can reflect other indirect information sources, which is not available within a month.
The production equation does not include other variables except import, export, prices, and output. Cushman and Zha (1997) suggest that other variables like exchange rate and foreign variables are not related to production but only with a lag. Therefore, they excluded them from production equation. The study also follows the same idea of Cushman and Zha(1997). The equation is arranged in this order; Impt, Expt, Y, and CPI.

The study uses RATS software of Cushman and Zha (1997) for monetary policy identification. Due to the small data set, 4 lags were chosen in the model.

4. The Results

In figure 1 and figure 2, we described the responses of Turkish economic variables to contractionary monetary policy and external output shocks respectively. We took money supply as one standard deviation monetary policy shock. External variables are immune to contractionary monetary policy shocks because we already have put block exogeneity condition on these variables in our model.

The monetary policy shock helps to reduce the price level and it can be seen in figure 1 (a). We do not see any price puzzle in our identification scheme. It can have price puzzle (a condition where price increases to monetary contraction rather than to decrease) if we use Choleski identification scheme (Carlstrom et al. 2009). This result is in accordance with the well-known theories.

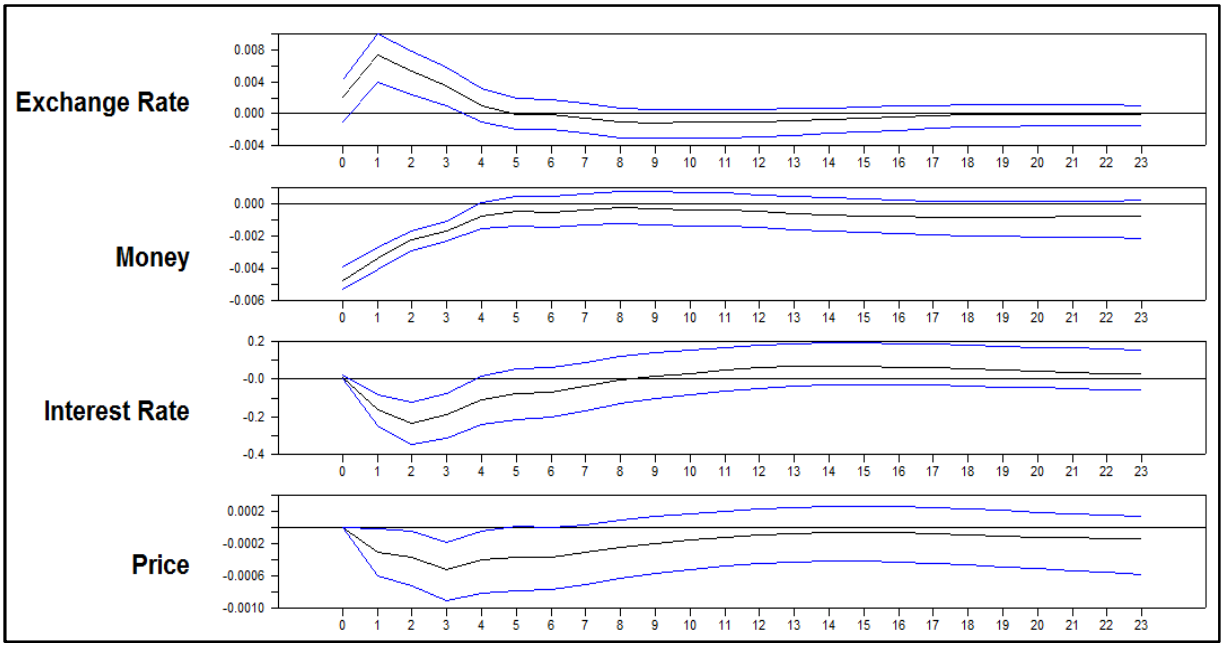

Figure 1 (a)

The exchange rate appreciates following the tight monetary policy, which is significant theoretically. These results can also be found in Faust et al. (2007), Pagan et al. (2008), and Kilinc and Tunc(2014). So, the research also does not produce any exchange rate puzzle (a condition where currency depreciates to tight monetary rather than to appreciate).

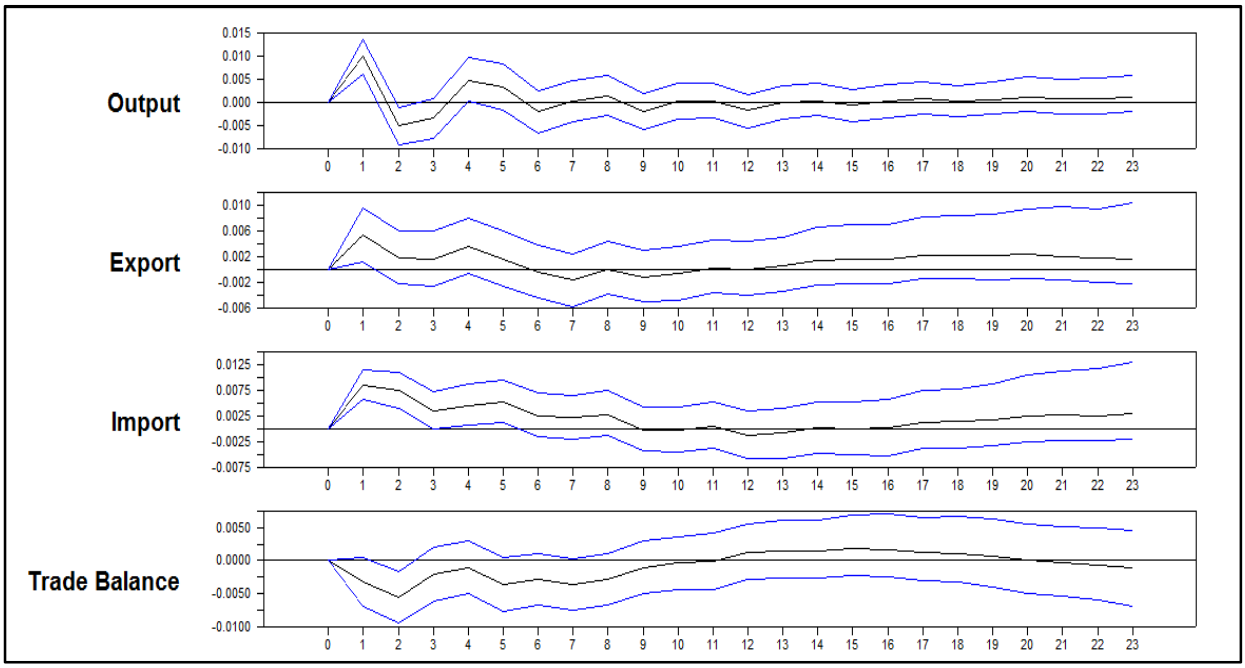

Figure 1 (b)

The nominal interest is not significant. The real interest rate looks fine regarding the theoretical framework. Output response to monetary policy shock is not significant but positive one (the response should be negative). This result is not in accordance with monetary theories. The money supply decreases following the contractionary monetary shock, which seems constant.
Exports are affected positively but are insignificant. The contractionary monetary policy shock affects the imports positively and these are statistically remarkable. Trade balance response to contractionary monetary policy depends on the effectiveness of switching expenditure and domestic income. The trade balance initially worsens & then improves in response to contractionary monetary policy. The trade balance displays somehow aninverse J-curve trend to monetary policy shock. This proves that switching effect is large than income effect.

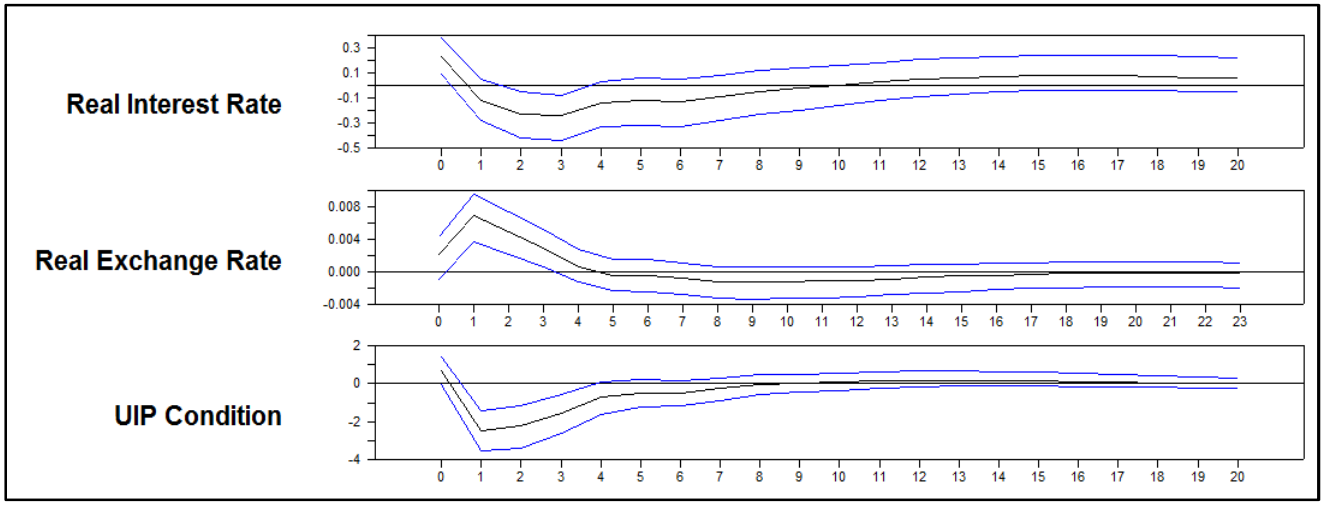

Figure 1 (c)

The study also calculates uncovered interestparity (UIP) by following Cushman and Zha (1997). The study analyzes the UIP by computing the response path of deviations from UIP. "This deviation can be defined D= R-FFR*+4 (excf-exc), whereasexcf is the forecasted three-month ahead exchange rate response". Figure 1 (C) displays that there are some deviations from zero only for three months. The study also shows that external output shocks are not critical for domestic economic fluctuations in Turkey except some fluctuations in prices. The domestic variables do not follow any pattern in response to external output shocks, and these results can be seen in figure 2. The study does not consider the new policy framework adopted by the Central bank of Turkey in 2010 in its analysis. Identification of new policy framework is a challenge because time-period is very short to investigate the monetary policy stance. Although, this study reveals the credible results for the Turkish economy.

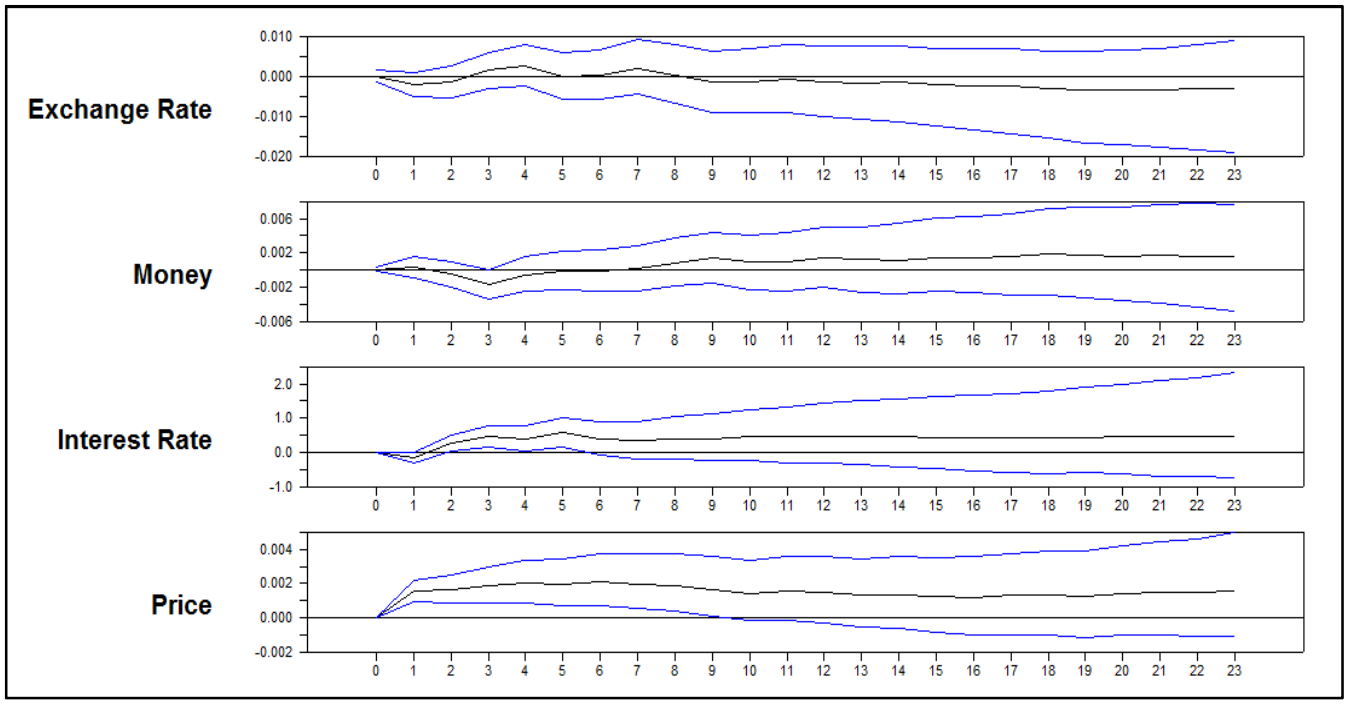

Figure 2 (a)

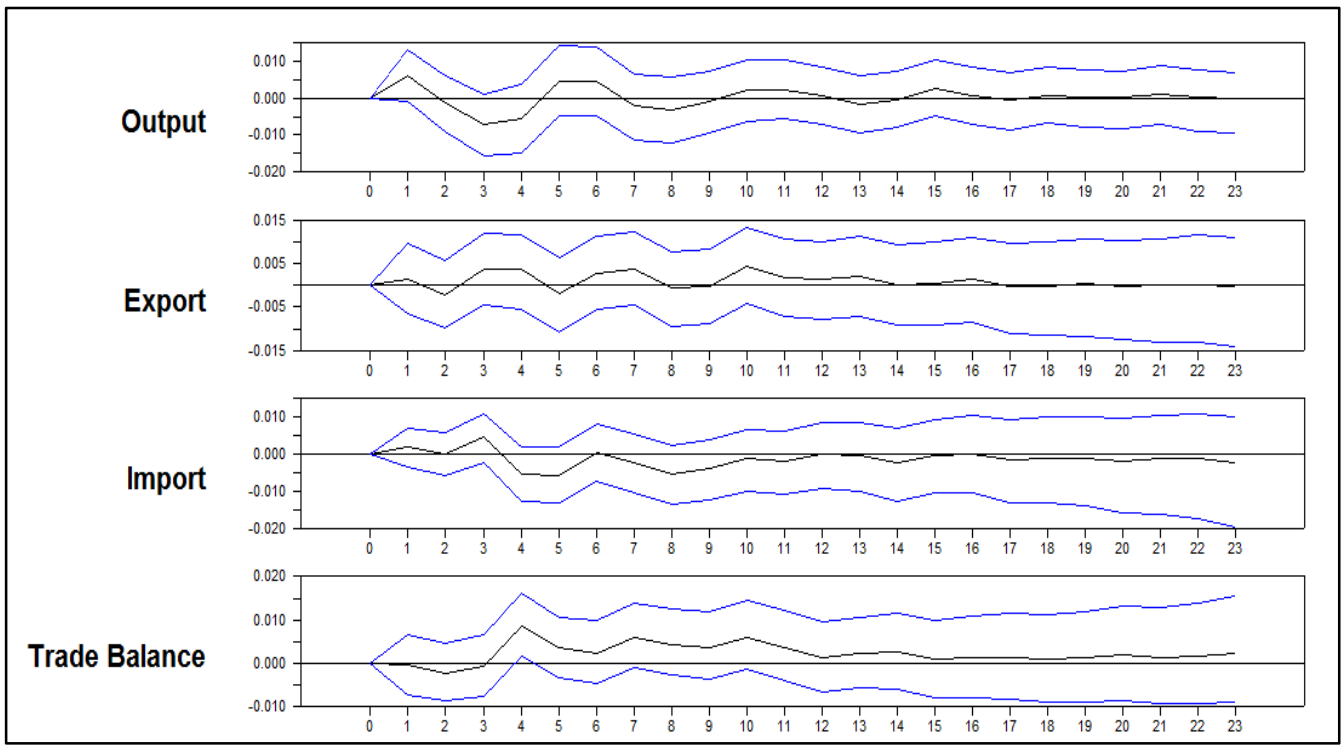

Figure 2 (b)

5. Conclusion

The study follows SVAR approach for analyzing the behaviors of macroeconomic variables to monetary policy shocks in Turkey. The study reveals that contractionary monetary policy helps to decrease prices and increase in exchange rates. There is no price or exchange rate puzzle in this study, which has been mostly founded in many studies regarding the analyses of monetary policy in a small open economy. These findings are same to well-known theories. Output does not decrease in response to tight monetary stance, but it is not significant. The contractioanry monetary policy also helps to decrease the money supply. The trade balance initially worsens, & then improves and the study reveals some violations of UIP as it deviates from zero in response to contractionary monetary policy but only for three months. Some other studies also revealed the same deviations from zero. The study also shows that foreign output shocks are not critical for Turkish domestic economy except some positive changes in prices. The research suggests that SVAR is a better approach to investigate the economic activities in a small open economy like Turkey.

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