TÜRKİYE CUMHURİYET MERKEZ BANKASI

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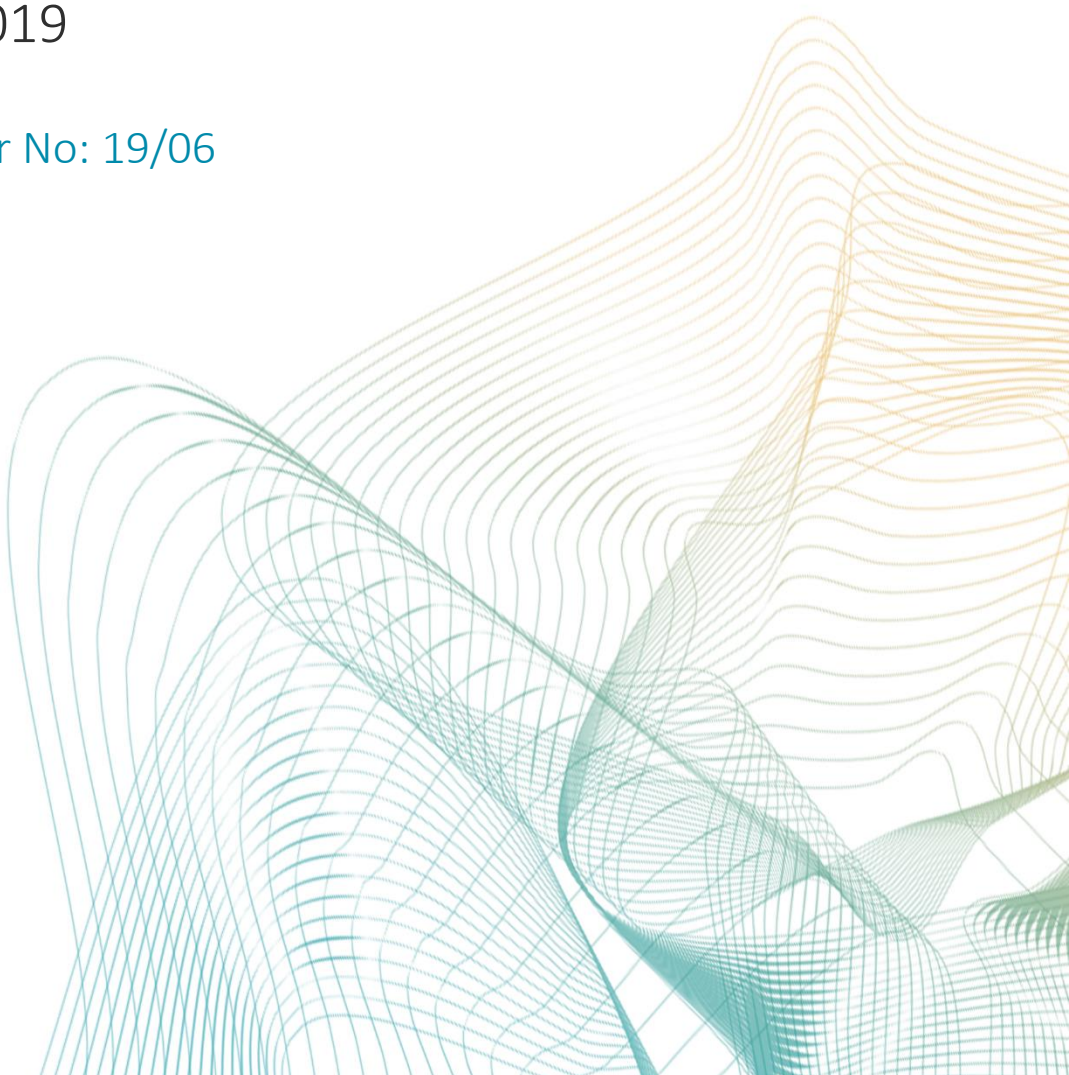

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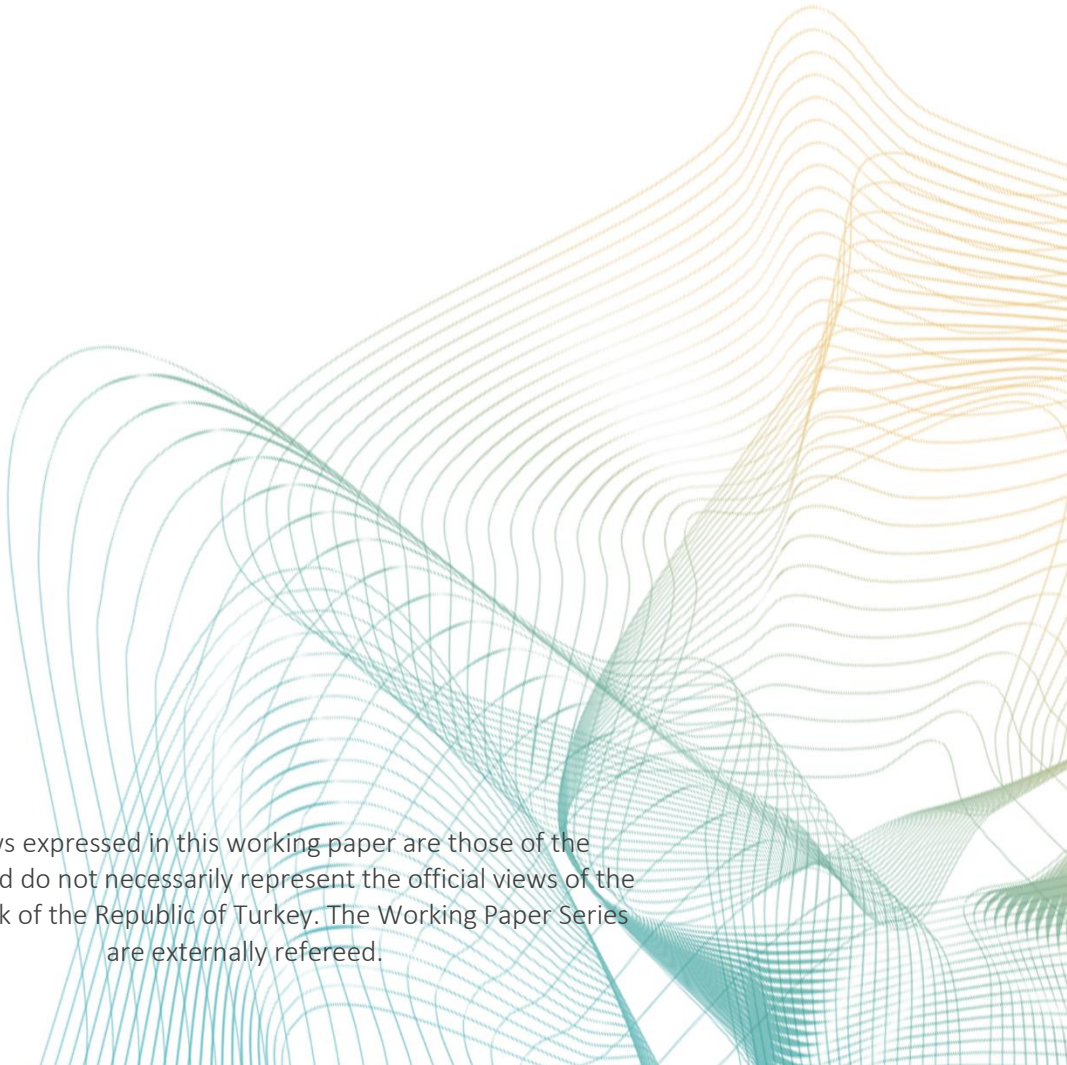

IDENTIFYING CREDIT SUPPLY SHOCKS IN TURKEY

Tayyar Büyükbaşaran, Gökçe Karasoy Can, Hande Küçük[1]

Abstract

This paper aims to identify credit supply shocks and analyse their macroeconomic effects in Turkey. For this purpose, we use a Bayesian Structural Vector Autoregression (SVAR) with sign and zero restrictions. We focus on the impact of credit supply shocks on real GDP growth and highlight how the size of this impact changes when we explicitly account for the effects of capital inflows on credit conditions. Hence, our results confirm the importance of external finance for credit supply in Turkey. Our main findings are robust to some alternative data choices, prior selections as well as some alternative identifying restrictions.

Keywords: Credit supply shocks, SVAR, Bayesian VAR, sign and zero restrictions

JEL Classification: C11, C32, E52, F41.

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Non-technical Summary

Turkey has experienced a notable credit deepening process since early 2000s thanks to the comprehensive structural reform agenda put in place after the 2001 financial crisis. Credit growth accelerated further due to strong capital inflows in the aftermath of the global financial crisis. The remarkable rise in credit depth and the synchronization between financial cycles and business cycles require a thorough understanding of the effects of credit market developments on the real economy. Accordingly, this paper aims to identify credit supply together with other macro shocks for Turkey and analyse their macroeconomic effects.

The identification strategy assumes that credit supply shocks lead to an opposite movement between credit spread and credit growth whereas credit demand shocks move credit spread and credit growth in the same direction. Results indicate that credit supply shocks have a significant effect not only on credit spread and credit growth but also on other macroeconomic variables. Accordingly, a credit supply shock has a significant but temporary effect on output growth whereas it has a more limited and uncertain effect on inflation. Moreover monetary policy responds to credit supply shock.

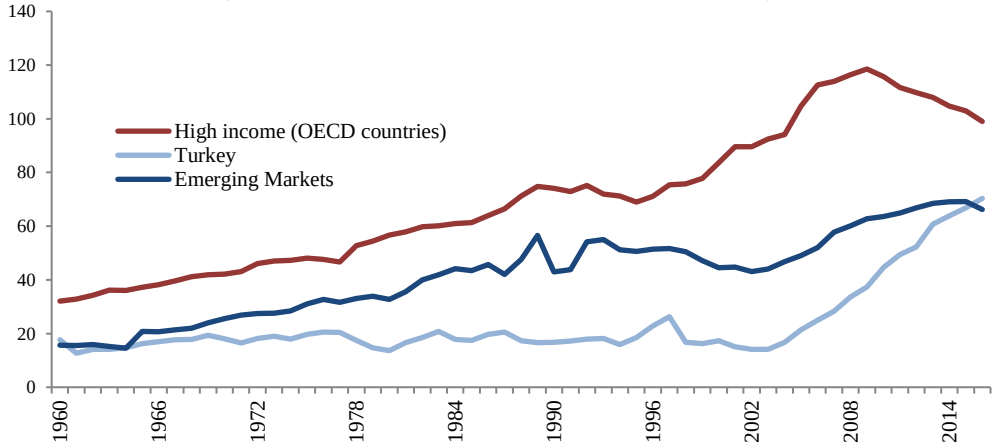
This paper also discusses the role of domestic and global financial conditions on credit supply in a small open emerging economy. We show that a broader definition of a credit supply shock which captures not only domestically driven changes in credit supply, but also the effects of global liquidity and capital inflows on credit conditions has a larger and more significant impact on growth compared to a narrower (more domestic) definition of a credit supply shock.

The identified credit supply shock seems to be compatible with major shifts in domestic financial conditions, e.g. macroprudential measures, and global financial conditions throughout the sample. For example, The Lehman crisis of September 2008 is reflected as large negative credit supply shocks in 2008Q4 and 2009Q1. Recently, the historical shocks show that the policies regarding to improve the access of corporate sector to finance (credit guarantee fund policy) contributed positively to both credit supply and credit demand shocks during the first and second quarter of the 2017.

I. INTRODUCTION

Turkey has experienced a notable credit deepening process since early 2000s thanks to the comprehensive structural reform agenda put in place after the 2001 financial crisis. Credit growth accelerated further due to strong capital inflows in the aftermath of the global financial crisis. As a result, Turkey's domestic credit-to-GDP ratio, which had been well-below the emerging market average for a long period of time, steadily increased at a faster pace throughout the 2000s, catching up with the emerging market average in 2015 (Figure 1).

Figure 1: Credit Deepening in Turkey relative to Advanced and Emerging Economies
(Domestic Credit Stock/GDP, Annual, Percent)



Source: World Development Indicators (WDI). High income (OECD) is original WDI classification, Emerging markets include Chile, Indonesia, Russia, Hungary, Mexico, India, South Africa, Brazil, Poland, Malaysia, Peru, Bulgaria, Colombia, Romania, Thailand.

The remarkable rise in credit depth and the synchronization between financial cycles and business cycles require a thorough understanding of the effects of credit market developments on the real economy. Given that credit growth and other macroeconomic variables such as output growth can be affected simultaneously by a variety of shocks that are exogenous to the credit market, identifying changes in credit growth that stem from credit supply developments is crucial. Accordingly, this paper aims to identify credit supply shocks for Turkey and analyse their macroeconomic effects using a structural VAR (SVAR) framework. For identification of shocks, we embed sign and zero restrictions consistent with economic theory and use Bayesian methodology to estimate the model (Arias et al, 2014 and Dieppe et al, 2016).

We work with a sample that covers the post-2001 crisis financial deepening period of the Turkish economy using quarterly data between 2003Q2 and 2018Q2 to estimate the model. Endogenous variables included in the SVAR are the growth rate of the real stock of credit extended by banks, credit spread defined as the spread between the commercial loan rate and

the deposit rate, real GDP growth, inflation, monetary policy rate and the exchange rate. Given that Turkey is a small open emerging economy, we also include data on capital inflows to emerging markets as an exogenous variable to control for the effects of global liquidity and global risk appetite.

We use a set of timing, zero and sign restrictions on impulse response functions to identify six structural shocks in the six variable SVAR system. These shocks include an aggregate demand shock, an aggregate supply shock, a monetary policy shock, a capital inflow shock, and finally a credit supply shock and a credit demand shock – the last two shocks constituting the focus of this paper. A *credit supply shock* is defined as a shock that moves credit-deposit rate spread and credit growth in opposite directions on impact, while a shock that affects these variables in the same direction on impact is defined as a *credit demand shock*. In line with the existing literature, both shocks are assumed to have no significant contemporaneous impact on macroeconomic variables such as inflation, economic growth and policy rate (Barnett and Thomas, 2014 among others).[2] Other structural shocks are defined by similar restrictions. Since we are imposing restrictions only on the initial quarter values of the impulse response functions, how these variables respond to these shocks in the consecutive quarters is obtained from the estimation of the SVAR.

Impulse response functions obtained from the estimated SVAR indicate that credit supply shocks have a significant effect not only on credit spread and credit growth but also on other macroeconomic variables. Accordingly, a credit supply shock has a significant but temporary effect on output growth whereas it has a more limited and uncertain effect on inflation. The identified credit supply shock seems to be compatible with major shifts in domestic financial conditions, e.g. macroprudential measures, and global financial conditions throughout the sample. The historical variance decompositions reveal that credit supply and credit demand shocks, which are the main drivers of the deviations of credit spread and credit growth from their historical trends, seem to have a smaller role in accounting for the historical deviations in GDP growth.

Similar analyses carried out for more advanced economies (such as Busch et al. (2010) for Germany, Barnett and Thomas (2014) for the UK, and Halvorsen and Jacobsen (2014) for Norway and the UK), find a much bigger role for credit supply shocks in accounting for the

[2] We allow for an alternative identification scheme that allows credit supply and demand shocks to affect macroeconomic variables on impact as a robustness check, which leads to similar impulses responses as in the baseline identification.

historical deviations of GDP growth from its trend – especially during (and after) the global financial crisis. Our results are more in line with Tamási and Világi (2011) where credit supply shocks did not play a dominant role in the 2008 recession in Hungary, which like Turkey, had a much lower credit-to-GDP ratio compared to advanced economies at the time.

Apart from being the first paper to identify credit supply shocks for Turkey from a macro perspective, i.e. differentiating credit supply shocks from credit demand shocks and other structural shocks, this paper also contributes to the empirical literature by discussing the role of domestic and global financial conditions on credit supply in a small open emerging economy. We show that a broader definition of a credit supply shock which captures not only domestically driven changes in credit supply, but also the effects of global liquidity and capital inflows on credit conditions has a larger and more significant impact on growth compared to a narrower definition of a credit supply shock.

The outline of the paper is as follows: Section II introduces the data and methodology. In section III, we present our main empirical findings including impulse response functions and historical variance decompositions. Section IV displays some additional specifications and robustness checks. Section V summarizes the findings and concludes.

II. DATA AND METHODOLOGY

To identify different shocks that shift the supply and demand for credit and to analyse their impact on other macroeconomic variables, we use a structural vector autoregression (SVAR) analysis applied to a small set of variables. In a general unrestricted VAR, each endogenous variable is regressed on the lagged values of itself and all the other endogenous variables as well as some exogenous variables. An unrestricted VAR can be represented as:

$$P(L)E_t = x + \varepsilon_t \qquad (1)$$

where E_t includes all endogenous variables, x (or in the case of exogenous time series x_t) includes all exogenous terms, and ε_t are multivariate normally $N(0, I)$ distributed unrestricted error terms or reduced-form residuals of the VAR. $P(L) = I + P_1 L + P_2 L^2 + \cdots + P_N L^N$ is a lagged polynomial, where N is the lag length of the VAR.

The underlying structural economic shocks are $\gamma_t = M^{-1}\varepsilon_t$ defined as a linear combination of unrestricted error terms. Therefore, reduced-form residual can be written as $\varepsilon_t = M\gamma_t$ where M is the impact matrix of each structural shock. In order to identify the structural macroeconomic

shocks one needs to identify each shock uniquely by applying a set of restrictions to the matrix M. The VAR specification and the identifying restrictions are discussed in more detail in Section II.2.

II.1. Data

We work with a sample that spans the period between 2003Q2 and 2018Q2, which is undoubtedly a much smaller sample compared to the samples used in similar studies for the US and other advanced economies. One of the main reasons for the use of this sample is that the Turkish economy has gone through a major structural change following the 2001 crisis, which transformed the banking sector as well as the fiscal and monetary policy frameworks. The financial intermediation capacity of banks was quite limited before this period given the high share of government debt in bank assets stemming from the high public borrowing requirement. Monetary policy was not oriented towards achieving an explicit inflation-target but instead involved intermediate targets on exchange rates and monetary base. Inflation targeting regime was adopted in 2002, with the official implementation of inflation targeting starting in 2006. Data limitations also play an important part in our choice of sample as we do not have detailed credit and credit spread data prior to 2002.

Given the short sample, we tried to build the most concrete model that can capture the effects of credit supply and demand shocks with a minimum number of variables. The endogenous variables included in the SVAR are the total stock of credit extended by banks, credit spread defined as the spread between the commercial loan rate and the deposit rate, real GDP growth, inflation, monetary policy rate and the exchange rate. Given that Turkey is a small open economy, international capital flows play an important part for macroeconomic dynamics. The exchange rate is included in the SVAR to capture the effects of capital inflows. We also include data on capital inflows to emerging markets as an exogenous variable in the SVAR to control for the effects of external factors such as global risk appetite towards emerging economies.

Details of the data are as follows:

- We obtain data on the total stock of credit extended by banks from the database of the Central Bank of the Republic of Turkey. Total credit stock includes credit extended to households and to non-financial firms by banks as well as total credit card expenditure.[3] The bulk of total loans are loans extended to firms, with an average share of 71 percent

[3] Non-bank financial intermediation is negligible in Turkey except for a few items such as loans for vehicles.

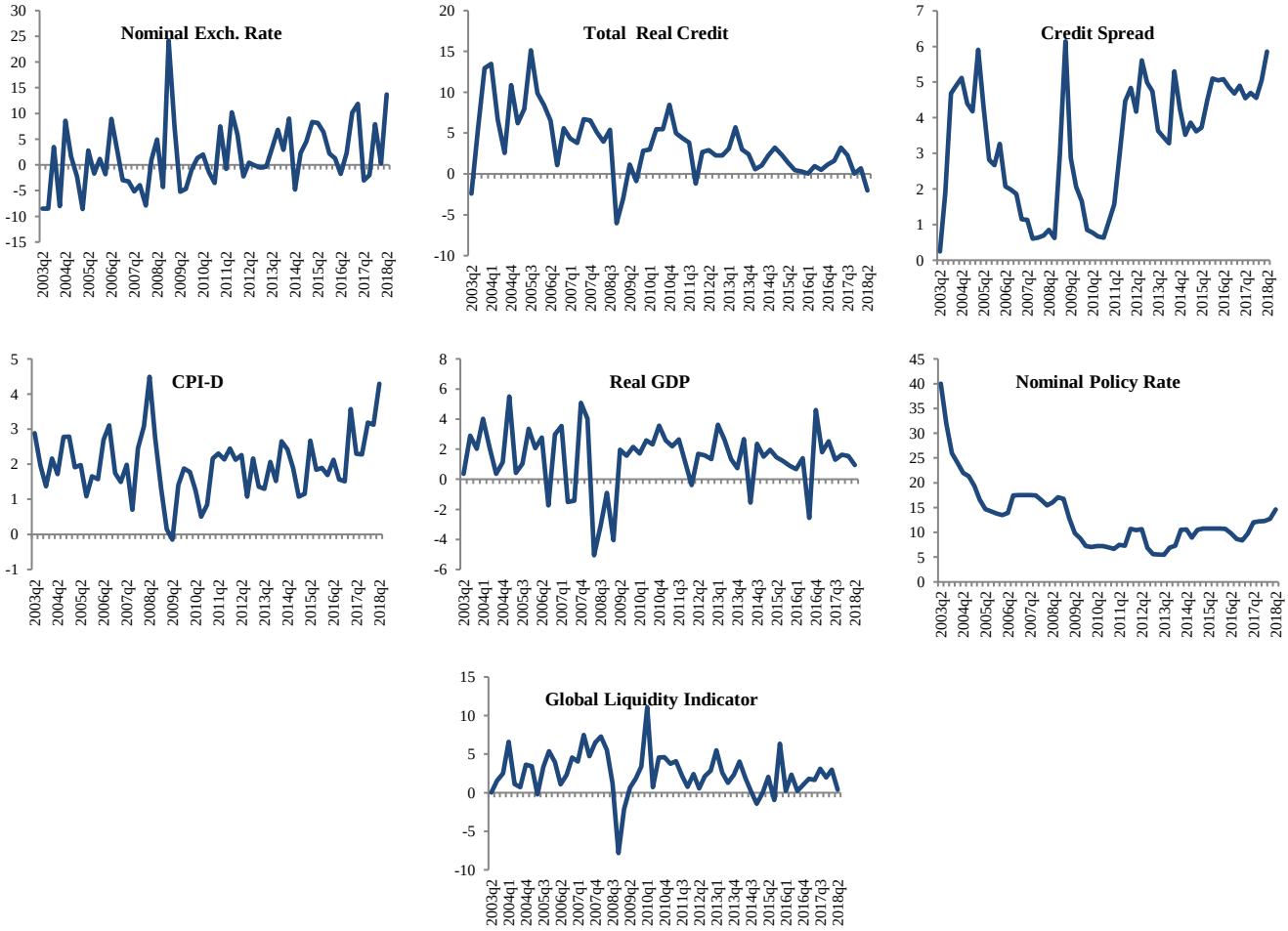
in total credit throughout the sample. Consumer loans are denominated mostly in Turkish lira due to regulations that prohibit household borrowing in FX[4], while a significant portion of firm loans are in FX, i.e. around 47 percent in total firm loans throughout the sample. When summing up domestic and foreign currency loans to arrive at the total credit stock figure, FX loans are converted into domestic currency using a fixed exchange rate to prevent changes in exchange rate to inflate the credit series and make them too volatile. [5] We deflate nominal credit data using the Consumer Price Index (CPI, 2003=100). The series are seasonally adjusted. Given that total real credit series has a unit root, we use the quarterly difference of logged total real credit in the SVAR.

- Credit spread is defined as the difference between the commercial loan rate and the deposit rate averaged over a quarter. This is an indicator that reflects the relative price of loans as well as being a measure of overall tightness in credit conditions.[6] The majority of commercial loans and deposits are of relatively short maturity in Turkey, while consumer loans are typically extended for longer maturity. Hence, the spread between the commercial loan rate and the deposit rate reflects less of a maturity mismatch compared to the spread between the consumer loan rate and deposit rate. Besides, commercial credit constitutes the largest part of total credit. We carry out robustness checks using a weighted average of consumer and commercial loan rates when calculating the spread. The credit spread series is stationary, hence no transformation is used when including in the SVAR.
- Given the change in the monetary policy framework in the aftermath of the global financial crisis, we combine different policy rates that were relevant in the pre- and post-2010 periods. Prior to 2010 the financial system was in a net liquidity surplus and the overnight borrowing rate was the policy rate. As of May 2010, the CBRT started providing weekly funding to the financial system through one-week repo auctions in addition to overnight lending. In this period, the amount of funding provided through each liquidity instrument varied according to the intended monetary policy stance, and the BIST overnight rate fluctuated within a wide interest rate corridor.[7] In order to account for the periods where the BIST overnight rate significantly differed from the

[4] By law in October 2009, household's foreign currency denominated credit usage is prohibited.
[5] The average exchange rate for the currency basket (weighted average of euro and USD credit, with 30 and 70 percent weights, respectively) is fixed at the average value of the currency basket between October 2008 and April 2011.
[6] See Box 5.2 in Central Bank of Turkey Inflation Report 2016 IV.
[7] See Küçük, Özlü, Talaslı, Ünalmış and Yüksel (2016) for a discussion about the role of liquidity policy in explaining the spread between the BIST overnight rate and the CBRT average funding rate in this period.

CBRT average funding rate due to the liquidity policy of the CBRT, we take the BIST overnight rate as the policy rate for the period after 2010Q2.[8]

Figure 2: Data used in the baseline analysis



Note: All series except for the credit spread and the nominal policy rate are logged and first differenced.

- Considering the sensitivity of financial and macroeconomic variables to capital flows and the exchange rate in Turkey, we include the nominal exchange rate in the SVAR. Nominal exchange rate is not only a broad proxy for capital inflows but also reflects the domestic component of the risk premium as well as the general sentiment in the economy.[9] We use quarterly average of USD/TRY exchange rate (a rise in USD/TRY exchange rate is a depreciation of Turkish lira) logged and first differenced to render a stationary series (Table 1). As a robustness check we also estimate the model using the CPI-based real effective exchange rate (2003=100) published by the CBRT.

[8] We carry out robustness checks using the CBRT average funding rate. Results are not much affected but the BIST rate provides narrower credibility intervals especially for impulse responses to a monetary policy shock.
[9] Karasoy and Yüncüler (2015) show that consumer confidence is strongly correlated with the USD/TRY exchange rate in Turkey.

- In addition, we added a global liquidity indicator as an exogenous variable to our SVAR model in order to control for the effects of global conditions (push factors) on capital inflows. This is important since we know that credit conditions in Turkey are closely linked to global liquidity conditions through their effects on capital flows. We used "Global Liquidity Indicators" dataset published by BIS to calculate the change in total US and euro credit flows to emerging countries. This variable is also logged and first differenced. As an alternative global liquidity indicator, we employed total balance sheet size of the Fed and the ECB and checked that the results are quite similar. We also carried out estimations with oil prices included as an exogenous variable but the results were affected only very little. Given the short sample, we decided not to include this variable in the baseline SVAR.
- The source of real GDP (2009=100) and the CPI (2003=100) is Turkstat. We use a measure of core CPI, i.e. CPI excluding unprocessed food, alcoholic beverages and tobacco (CPI-D), which accounts for nearly 84 percent of the headline CPI. This choice is due to the fact that unprocessed food and tobacco prices exhibit short-term noisy movements and have the highest unexpected volatility among the CPI subcomponents in Turkey. Both series are seasonally adjusted, logged and first differenced.

The data we have used in the analysis can be seen in Figure 2.

II.2. Identification of Structural Shocks

A set of timing, magnitude (zero) and sign restrictions is used to identify six structural shocks in the six variable SVAR system. As for the timing of the restrictions, all restrictions apply to the initial period, the quarter in which the shock occurs. Shocks are identified with the zero and sign restrictions imposed within the initial quarter. Where there are no contemporaneous restrictions imposed (where the cells in Table 2 are left blank), impulse responses are determined agnostically, i.e. determined by the estimated model. This is also true for all impulse responses following the initial quarter.

Four of these shocks, aggregate supply, aggregate demand, monetary policy and capital inflow (exchange rate) shocks are the standard aggregate shocks for a small open economy. Additional two shocks, credit supply and credit demand shocks, are the shocks related with the credit market and financial system. Special focus will be given to these last two shocks in this paper. The underlying restrictions, which are summarized in Table 2, can be described as follows:

- An *aggregate supply shock* is assumed to be a shock which moves inflation and real GDP growth in opposite directions within the same period. For example, a negative aggregate supply shock might reflect a fall total factor productivity or a rise in oil prices.

- An *aggregate demand shock* is assumed to be a shock which moves inflation and real GDP growth in the same direction contemporaneously. Moreover, it is assumed that monetary policy responds to an aggregate demand shock within the same quarter, i.e. policy rate is raised following a positive aggregate demand shock that raises both inflation and output growth.

- A negative *shock to the policy rate* (a surprise fall in the policy rate) is a shock that depreciates Turkish lira, leads to a rise in inflation and a fall in real GDP growth within the same quarter.

- A negative (positive) *capital inflow shock* is a shock that depreciates (appreciates) the Turkish lira, reflected as a rise (fall) in USD/TRY exchange rate. Furthermore, in light of the evidence regarding the exchange rate pass-through to inflation in Turkey (Kara and Öğünç, 2005) it is assumed that a nominal depreciation (appreciation) leads to a rise (fall) in inflation within the same quarter.

- A *credit supply shock* would typically lead to an opposite movement between credit spread and lending. Thus, a negative credit supply shock rises the credit spread while reducing credit growth within the same quarter. Moreover, it is assumed that the contemporaneous effect of the credit supply shock on inflation, growth and policy rate are negligible within the same quarter. In other words, the identification given in Table 2 imposes that credit supply shocks affect inflation, growth and policy rate with a one-quarter lag. A negative credit supply shock may be due to an unanticipated fall in lending appetite, which may result from tighter macroprudential policies that increase the cost of lending for banks, or banks' heightened risk perceptions regarding the economic outlook or collateral values, or higher liquidity constraints of banks etc.

- A *credit demand shock* is assumed to move credit spread and credit growth in the same direction, i.e. a positive credit demand shock leads to a rise in credit spread as well as an increase in credit growth. As in the case of the credit supply shock, it is assumed that a credit demand shock affects inflation, growth and policy rate with one-quarter lag. Given that we have separate shocks like aggregate demand and aggregate supply which

might also affect credit demand; it might not be easy to imagine what would constitute a credit demand shock. Given that Turkey is still in a relatively early phase of financial development, we interpret this shock as a change in credit seekers' access to credit. This might stem from changes in the search technology of credit seekers (e.g. increase in the number of people that have a credit card) or macro-micro financial regulations that affect access to credit (e.g. reduction in the penalty rate of overdue credit payments or an increase in the number of instalments on a credit card) may increase credit demand. Search technology and financial regulations may also affect credit supply as well. This is one of the reasons why we identify both credit supply and credit demand shocks.

Table 2: The shocks and restrictions in SVAR

Shocks / Variables*	Capital Inflow shock	Credit demand shock	Credit supply shock	Aggregate supply shock	Aggregate demand shock	Monetary policy shock
Exchange Rate	-					+
Credit		+	-			
Spread		+	+			
Inflation	-	**0**	**0**	+	+	+
Growth		**0**	**0**	-	+	+
Policy Rate		**0**	**0**		+	-

- *Exchange Rate: Quarterly change in USD/TRY (negative implies nominal appreciation of Turkish lira). Credit: Quarterly growth rate of real, seasonally adjusted total credits. Spread: Quarterly average spread between the commercial loan rate and deposit rate. Growth: Quarterly GDP growth. Policy Rate: CBRT Policy Rate
- All restrictions apply to initial period of the shock (t=0). (+) values imply that shock will affect the corresponding variable positively, (-) values imply that shock will affect the corresponding variable negatively. (0) means there will be no simultaneous effect of the shock on the corresponding variable. Blank cells imply that there are no restrictions for the particular shock-variable combination.

The baseline restrictions in Table 2 may be challenged on various grounds, in particular on the assumptions required to identify the credit market shocks, which are the focus of this paper. One issue is about our assumptions regarding the effects of capital inflow shocks on the credit market. Given that external finance is an important source for the banking sector in Turkey, it might be reasonable to assume that a capital inflow shock that appreciates the nominal exchange rate lowers credit spreads and expands credit growth at the same time, as would a positive shock to credit supply do. However, imposing these extra sign restrictions on credit variables would imply that the capital inflow shock would also act as a credit supply shock and that the definition of the credit supply shock would be narrowed down to a "domestic credit supply shock". Our view is that both identifications offer interesting insights. We prefer to stick to the "broader definition" of credit supply shocks in the baseline identification depicted in Table 2, which would include the effect of capital flows on credit conditions as well. There is an even broader definition than we provide in the baseline, where we remove the exogenous global liquidity variable from the model, which in turn implies that changes in global liquidity are also attributed

to a credit supply shock. We explore this alternative identification of 'narrower' and 'broader' credit supply shocks in more detail in Section III.2 to highlight the role of external financing conditions on credit supply.

A second challenge to the set of restrictions in Table 2 might be related to our assumption of no contemporaneous effect of credit market shocks on real GDP, inflation and policy rate. These identification restrictions are widely used in this line of research as in Barnett and Thomas (2014). These contemporaneous zero restrictions are critical to identify credit supply and demand shocks in a way that differentiates them from aggregate demand and supply shocks which might affect credit spread and credit growth for reasons unrelated to the credit market. Although crucial for identification, these contemporaneous zero restrictions might also imply that we are identifying credit supply and demand shocks that are not large enough to trigger a financial accelerator mechanism as in Bernenke, Gertler and Gilchrist (1999). In that sense the identified credit market shocks in this set-up do not capture large credit market shocks that have an immediate significant effect on the total number of credit restricted firms or households and hence on growth, inflation and policy rate.[10]

II.3. Some Details of the Methodology

In order to impose a combination of zero and sign restrictions necessary to identify the shocks, we use standard and well-established techniques and employ the BEAR toolbox (Dieppe et al 2016).

In particular, the procedure introduced by Arias, Rubio-Ramirez and Waggoner (2014) is used. Briefly[11], this methodology first picks an impact matrix M_0 from the posterior of structural parameters conditional on the zero restrictions. Then they pick a particular QR decomposition of the M_0 in which each column of Q matrix is selected recursively by standard normal distribution on R^n. By this recursive procedure of selection on Q matrix they prove that Q matrix is selected from a uniform distribution[12] from the posterior of structural parameters

[10] Nevertheless, we follow Barnett and Thomas (2014) and carry out a sensitivity analysis whereby we remove the zero restrictions on the credit supply and demand shocks and place them on aggregate supply and demand shocks, which implies that real shocks do not have any contemporaneous effect on financial variables. This identification assures that the number of zero restrictions are roughly the same across the two alternative identification schemes and facilitates the comparison between the models. This identification also implies that the contemporaneous median responses of inflation, output and policy rate to a negative credit supply shock are around zero. Results are available upon request.

[11] All the technical details and formal treatment of the methodology is in Arias, Rubio-Ramirez and Waggoner (2014).

[12] In fact, Arias, Rubio-Ramirez and Waggoner (2014) also claim that without this recursive selection of Q matrix, an appropriate randomized draw from the posterior of structural parameters conditional on the zero restrictions is not possible. They also show that how the median response can be affected and how the credibility intervals can be inflated using the well known application of sign and zero restriction of Mountfold and Uhlig (2009).

conditional on the zero restrictions. Then they keep the candidate draw if the sign restrictions are satisfied with the new candidate. They continue this procedure until the required number of draws is satisfied. In their paper, Arias, Rubio-Ramirez and Waggoner (2014) show that this methodology may produce wider credibility interval than some other techniques such as penalty function approach of Uhlig (2005).

The Arias, Rubio-Ramirez and Waggoner (2014) method in BEAR toolbox depends on Bayesian VAR techniques. Therefore, prior selection is an important part of the analysis. Given that credit supply and demand conditions for Turkey are not an area of detailed previous research, we do not have an a priori analysis such that the user specified priors can be justified upon. Therefore, we employ the following strategy: using grid search, optimum hyper-parameters are found for the standard classes of priors in BVAR such as Minnesota prior, Normal-Wishart Prior, Independent Normal- Wishart Prior which maximizes the posterior log likelihood of the data. Then using these optimum priors, sign and zero restricted VAR analysis is conducted. The results presented here are based on optimum Minnesota priors.[13]

III. EMPIRICAL FINDINGS

This section presents our main empirical findings. First, we describe the impulse response functions of credit supply and credit demand shocks as well as other structural shocks in the baseline SVAR model identified using the restrictions given in Table 2. Then, in III.2, we provide a discussion on the importance of external financial conditions on credit supply by changing the definition of the identified credit supply shock using different identifying restrictions and excluding the exogenous control for global liquidity conditions. Finally, in III.3, we conduct a historical variance decomposition analysis and provide some discussion on the plausibility of our identified credit supply shocks in view of major domestic and global developments that are expected to have an effect on credit supply such as major changes in domestic macroprudential policies or episodes of global financial stress such as the Lehman crisis and the Euro-debt crisis.

III.1. Impulse Response Analysis

Impulse response functions to a negative *credit supply shock* (a surprise rise in credit spread and decrease in credit growth) are presented Figure 3. In the figure, solid blue lines are the

[13] We check that the estimation results are robust to prior choice. Results with different type of priors are available upon request.

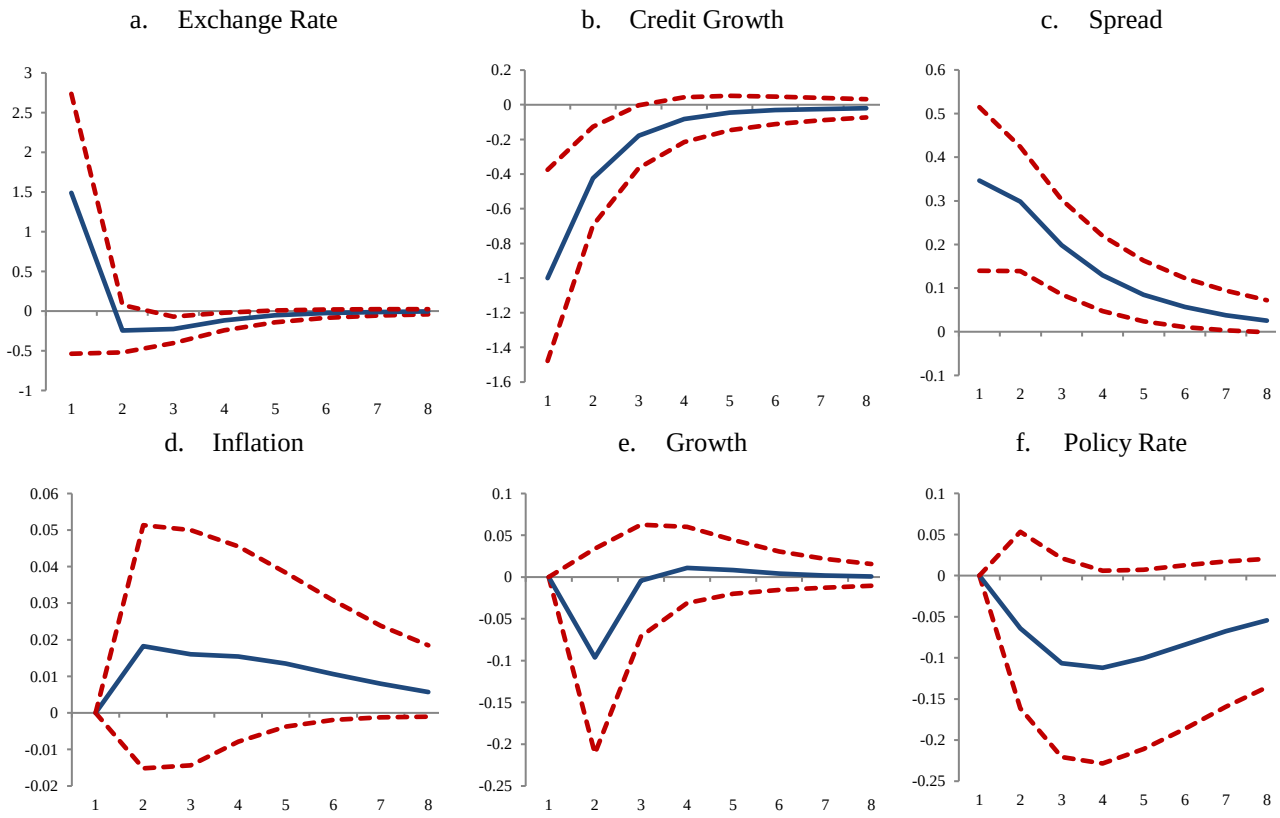
median responses of relevant variables to a negative credit supply shock, while dashed red lines are the 16th and 84th percentile of responses to the same shock. Hence, the area between the two dashed red lines is 68 percent credibility interval of the response. In that sense, it is important to note that the upper and lower bounds in the figures do not correspond to error bands and what we are plotting in the figures is not a significance interval. Credibility intervals are just depicting summary information about the distribution of impulse responses to a particular shock.

In order to discuss the effects of the credit supply shock on other variables in terms of elasticities to credit growth, the shock is rescaled such that the median response of real credit to a negative credit supply shock is -1 percent in first period as shown in Panel b of Figure 3. Therefore, median responses of relevant variables are responses to a credit supply shock that decreases real credit stock by 1 percent and increases credit spread by about 0.35 percentage points. The effects of the credit supply shock on the credit spread and on credit growth persist for over a year.

Panel e of Figure 3 presents the impulse response function of the real GDP growth. After a zero effect (driven by the zero restriction) in the first (initial) quarter, the median response of real GDP growth is -0.10 percentage points in second quarter. The effect of the shock on GDP is short-lived; the median response comes close to zero in the third quarter and stays at zero afterwards.

Notably, real GDP growth falls despite the fact that monetary policy responds to the negative credit supply shock by lowering the policy rate. Note that the credibility interval provides strong evidence in favour of a monetary policy loosening against a negative credit supply shock. The cumulative fall in the policy rate in response to a normalized negative credit supply shock is 28 basis points at the end of the fourth quarter.

Figure 3: Impulse Responses to a Negative Credit Supply Shock (Baseline BVAR)



The effect of credit supply shock on inflation seems negligible (panel d of Figure 3). The sign of the response is not as clear as the response of GDP and the magnitude of the response is much smaller. The posterior of the response function places a bigger mass on the positive response of inflation probably due to the exchange rate response to a credit supply shock. A negative credit supply shock implies a considerable depreciation in domestic currency in the first period (panel a of Figure 3), although there is a large credibility interval surrounding the median response. This might be reflecting the fact that periods where credit conditions are tightened largely correspond to periods where capital inflows are weak. Hence, the inflationary effect coming from the exchange rate and the disinflationary effect coming from lower output growth go in opposite directions, but the former effect seems to be stronger.

Figure 4: Impulse Responses to a Credit Demand Shock (Baseline BVAR)

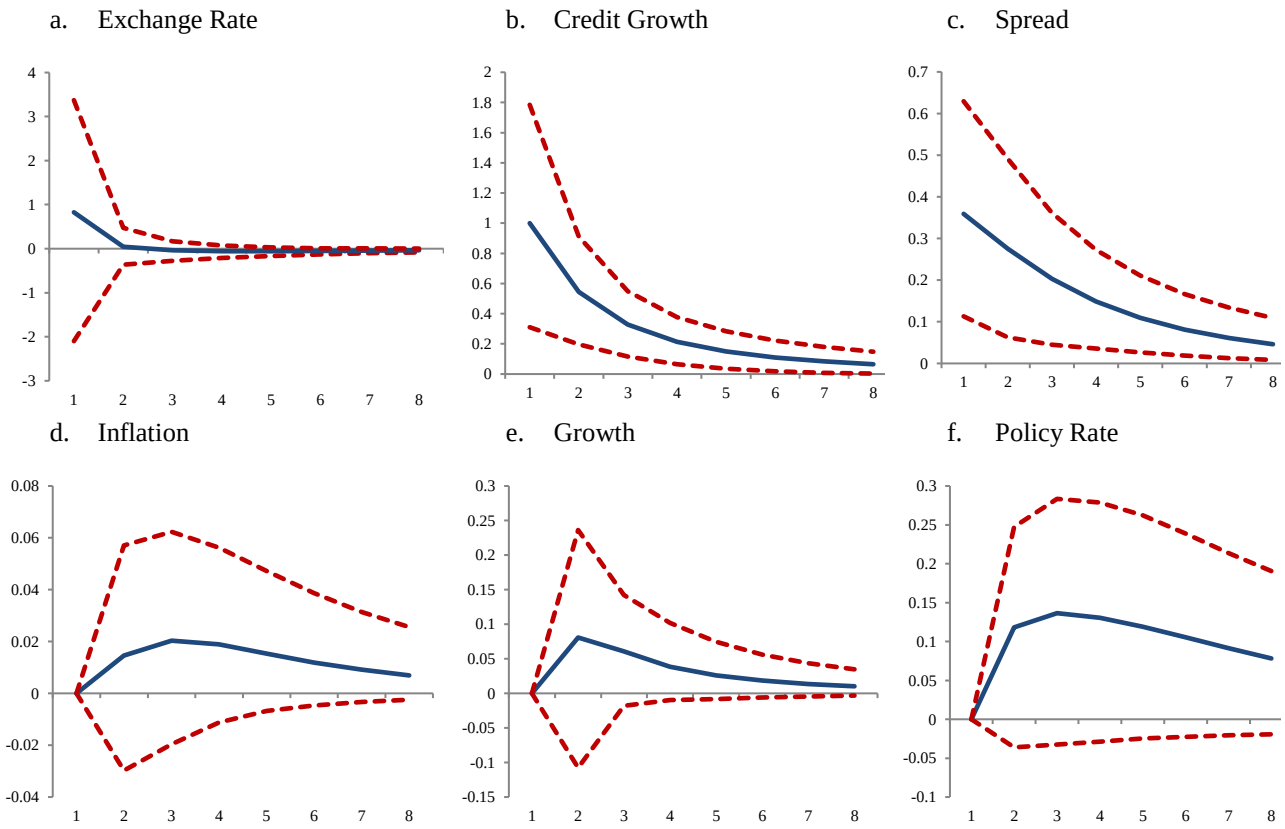


Figure 4 depicts impulse response functions to a positive *credit demand shock* normalized to generate a 1 percent rise in real credit on impact. In line with our identifying restrictions, credit spread also increases on impact. As one would expect a positive credit demand has an expansionary effect on the economy, showing its maximum impact on GDP growth in the second quarter. Cumulative response of real GDP growth to a 1 percent rise in real credit stemming from a positive credit demand shock is 0.18 percentage points as of the end of fourth quarter. The increase in growth rate causes inflation to rise but the effect is small. The policy rate is tightened in response to a credit demand shock. The exchange rate response associated with a credit demand shock is more ambiguous compared to the one associated with a credit supply shock.

Impulse Responses to Other Shocks

Impulse responses to other shocks in our baseline model are in line with economic theory (Figure A1 in Appendix). Even though we did not impose any sign restrictions on the response of credit market variables to a *capital inflow shock*, we observe that the median response and most of the associated credibility interval is positive for credit growth. The credit spread

displays a small decline in response to a capital inflow shock in the quarter following the shock. However, the credibility interval is quite wide, indicating an ambiguous response. On the other hand, the median response of real GDP growth to a capital inflow shock, which appreciates the nominal exchange rate, is positive on impact probably due to the credit channel while the credibility interval shows that the model does not rule out a negative contemporaneous impact. The impact of the capital inflow shock on real GDP growth dies within three quarters. Monetary policy response to a capital inflow shock provides evidence in favour of loosening.

Credit growth and credit spread both display a fall following a negative *aggregate supply shock* that raises inflation and lowers GDP growth at the same time. This might be due to the fall in the demand for firm credit related to the fall in production. Monetary policy responds to higher inflation by a hike in the policy rate. Despite the policy response, the negative effect of the shock on GDP growth only lasts for about three quarters.

Credit growth and credit spread do not respond significantly to a positive *aggregate demand shock* that raises output and inflation at the same time. This might be partly related to the monetary policy tightening in response to an aggregate demand shock. It might also be due to the presence of a separate credit demand shock that resembles an aggregate demand shock in terms of its effects on output, inflation and the policy rate. In the presence of credit demand shocks, aggregate demand shocks might be capturing periods where inflation and growth rose together for reasons that are not related to the credit market, e.g. an unexpected temporary rise in government expenditures, front-loaded demand for certain consumer goods due to temporary incentives, etc.

Finally, following an expansionary *monetary policy shock* (a fall in the policy rate), Turkish lira depreciates, inflation and GDP growth both increase in the first quarter in line with the imposed sign restrictions. Spread increases significantly while the effect of monetary policy shock on credit growth is ambiguous. The increase in spread might be related to the FX-indebtedness of the corporate sector, which might imply higher risk aversion by banks upon domestic currency depreciation. This might also reflect a fall in the collateral value of FX-denominated assets of the firms (See Figure A1 in the Appendix).

III.2. Identifying the role of Global Financial Conditions on Credit Supply

In this section, we present a discussion on the role of domestic and global factors on credit supply. For reasons discussed above, we did not impose any restriction on credit-related

variables in response to a capital inflow shock in our baseline identification scheme given in Table 2. This assumption is plausible in the sense that not all capital inflow shocks that appreciate the nominal exchange rate would necessarily generate a loosening in credit conditions. Accordingly, in the baseline SVAR, the identified credit supply shock captures not only domestically driven changes in credit supply, i.e. changes in credit supply due to domestic macroprudential regulations for e.g., but also the effects of capital inflows on credit conditions. The effect of global liquidity is controlled by including a measure of capital inflows to emerging economies, as an exogenous variable in the SVAR.

Table 3: Alternative Identifying Restrictions in SVAR

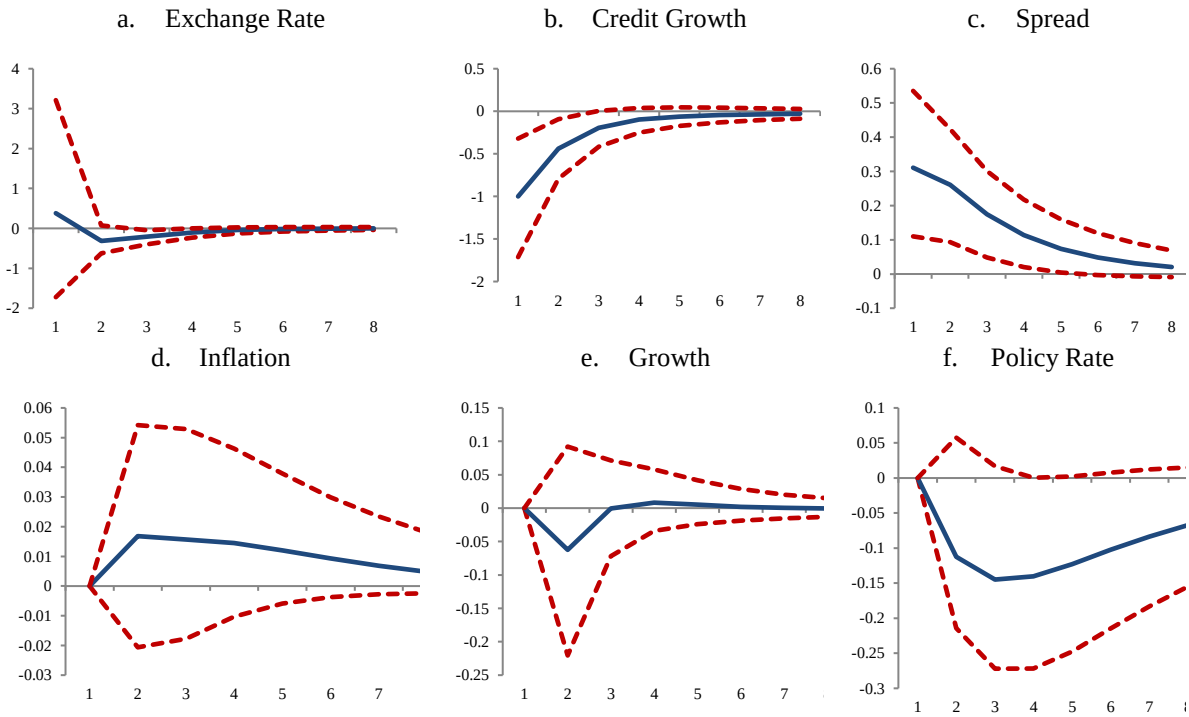
Shocks / Variables*	Capital Inflow shock	Credit demand shock	Credit supply shock	Aggregate supply shock	Aggregate demand shock	Monetary policy shock
Exchange Rate	-					+
Credit	+	+	-			
Spread	-	+	+			
Inflation	-	0	0	+	+	+
Growth		0	0	-	+	+
Policy Rate		0	0		+	-

*Exchange Rate: Quarterly change in USD/TRY (negative implies nominal appreciation of Turkish lira). Credit: Quarterly growth rate of real, seasonally adjusted total credits. Spread: Quarterly average spread between the commercial loan rate and deposit rate. Growth: Quarterly GDP growth. Policy Rate: CBRT Policy Rate All restrictions apply to first period. (+) values imply that shock will affect the corresponding variable positively, (-) values imply that shock will affect the corresponding variable negatively. (0) means there will be no simultaneous effect of the shock on the corresponding variable. Blank cells imply that there are no restrictions for the particular shock-variable combination.

To identify a narrower definition of a credit supply shock, we impose additional sign restrictions in Table 3 such that a positive capital inflow shock would imply a contemporaneous fall in credit spread as well as a rise in credit growth. This assumption implicitly assumes that capital inflows ease the financing conditions for banks. The complete set of identifying restrictions in this alternative specification is given in Table 3.

According to the identification given in Table 3, the definition of a credit supply shock is now more of a domestic one, since the effects of capital inflows on credit supply are now more likely to be captured by the capital inflow shock at least for the first quarter. Figure 5 presents impulse responses to a credit supply shock in this alternative model.

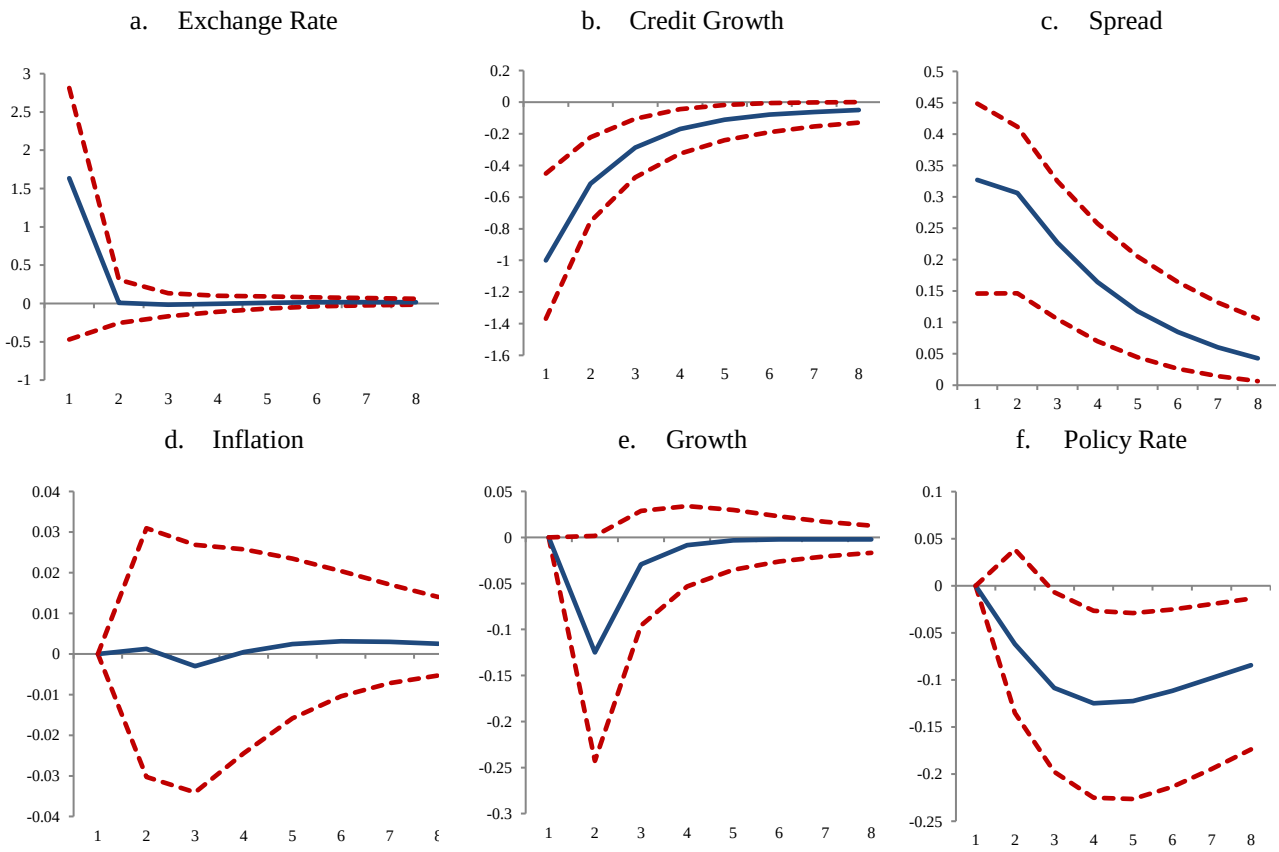
Figure 5: Impulse Responses to a Negative Credit Supply Shock
(BVAR with additional sign restrictions, 'narrower' definition of Credit Supply shock)



The most striking observation is that the effect of a negative credit supply shock on GDP growth becomes smaller and lies within a wider credibility interval compared to the baseline model. The cumulative effect on real GDP of a credit supply shock that reduces real credit by 1 percent on impact becomes -0.06 percent as of the third quarter instead of -0.10 as in the baseline model. The contemporaneous depreciation in the nominal exchange rate (Panel a in Figure 5) is also much smaller compared to that in the baseline model (Panel a in Figure 3). This is plausible given that this alternative identification distinguishes between credit supply shocks and capital inflow shocks. In other words, since the credit supply shock is no longer strongly associated with capital flows, a tightening in credit supply is not necessarily driven by a fall in capital inflows, explaining the lack of a meaningful exchange rate response.

Another important implication of this alternative identification scheme is that the effects of a capital inflow shock on credit growth and credit spread are now much more precise compared to the baseline model. However, the GDP response to a capital inflow shock is not much affected. The responses to other shocks under this alternative model specification are presented in Figure A2 in the Appendix.

Figure 6: Impulse Responses to a Negative Credit Supply Shock
(BVAR, global liquidity removed, 'broader' definition of credit supply shock)



As another exercise, we can make the definition of credit supply even 'broader' by removing the exogenous global liquidity variable from our baseline model. Now credit supply shock embeds the effects of all global and domestic factors on credit conditions. Figure 6 presents impulse responses pertaining to the baseline identification in Table 2 when the exogenous global liquidity variable is excluded from the SVAR. The effect of a negative credit supply shock on GDP growth now becomes larger, more significant and much more persistent. The cumulative effect on real GDP of a credit supply shock that reduces real credit by 1 percent on impact now becomes -0.15 percent as of the third quarter instead of -0.10 as in the baseline model. Nevertheless, a capital inflow shock still implies an increase in credit growth although the effect on credit spread remains ambiguous as in the baseline model.

These analyses confirm that global liquidity conditions and international capital flows play an important role for credit supply in Turkey. The definition of the identified credit supply shock can be varied by changing the identifying restrictions and including global liquidity as a control variable. This makes it possible to examine the macroeconomic effects of domestically driven credit supply shocks and externally driven credit supply shocks separately. The cumulative impact of a negative credit supply shock that reduces real credit by 1 percent on impact on real

GDP varies from -0.06 percent to -0.15 percent within three quarters according to how narrowly the credit supply shock is defined. Both the size and significance of the macroeconomic effects of credit supply shocks are lower in the more narrow definitions of a credit supply shock. The responses to other shocks under this alternative model specification are presented in Figure A3 in the Appendix.

III.3. Historical Variance Decompositions

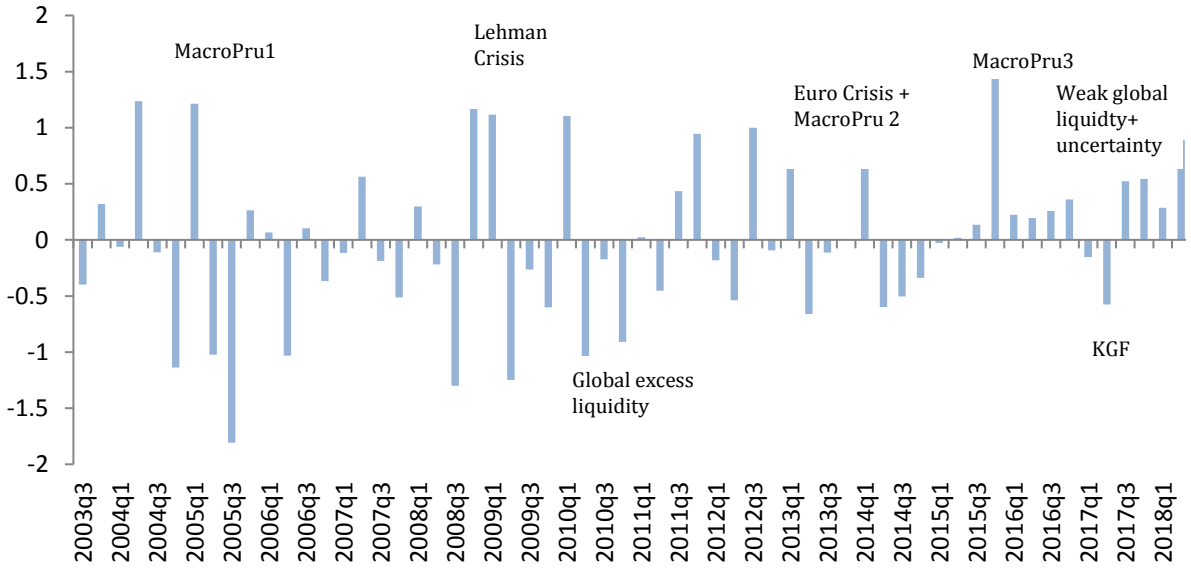
We plot the series of credit supply shocks identified by our baseline BVAR model in Figure 7. Some of the largest positive credit supply shocks[14], shown as negative values in Figure 7, are observed between 2003 and 2006 thanks to the restructuring of the banking sector and the implementation of a wide range of structural reforms in the aftermath of the 2001 financial crisis, which enhanced the financial deepening process in Turkey.[15] On the other hand, this period is also subject to some negative credit supply shocks, shown as positive values in Figure 7), the largest one occurring in 2005Q1, which is likely to be associated with the macroprudential measures that were put in place in November 2004 with the aim of restricting the rapid growth in consumer loans and credit card debt.[16]

The Lehman crisis of September 2008 is reflected as large negative credit supply shocks in 2008Q4 and 2009Q1. However, the period that followed was subject to persistent positive credit supply shocks on the back of strong capital inflows and subsequent easing in financial conditions up until the third quarter of 2011, during which the euro debt crisis intensified. Negative credit supply shocks observed in the second half of 2011, especially in the last quarter of 2011, are likely to be related to the macroprudential measures against consumer loans that included higher risk weights and general provisions for consumer loans, higher minimum payments for credit card debt, and loan-to-value (LTV) caps for housing loans.[17] Macroprudential policy was tightened further in late 2013-early 2014 through further caps, limits and higher risk weights on credit cards, LTV ceilings for vehicle loans, and maturity restrictions for uncollateralised consumer loans.[18] In addition, there was a strong front-loaded

[14] We refer to an unexpected fall (rise) in credit spread as a positive (negative) credit supply shock considering the expansionary (contractionary) impact on credit growth. Hence negative (positive) values in Figure 7 are referred to as positive (negative) credit supply shocks.
[15] See CBRT (2001) and CBRT (2002) for the economic program and the structural reform agenda that was put in place after the financial crisis in 2001.
[16] Capital provisions for credit card debt was increased in November 2004.
[17] There is a large negative credit supply shock in 2011Q4 also in the model that identifies "domestic" credit shocks, which supports the view that the tightening in macroprudential measures were influential on credit supply in this period as well as external financing restrictions that might be related to the euro debt crisis.
[18] See Kara (2016) for an overview of the macroprudential policies implemented in Turkey between 2011 and 2015.

tightening in monetary policy in 2014Q1 as all policy rates were hiked by more than 500 bps at the end of January 2014. These measures seem to have had a large negative impact on credit supply in the first of 2014Q1. Hence, the credit supply shock series that we identify seem to be compatible with major changes in macroprudential policies implemented in 2011 and 2014.

Figure 7: Series of Credit Supply Shocks (Baseline BVAR)



Note: A negative (positive) value in the Figure denote an increase (decrease) in credit spread, hence referred to as positive (negative) credit supply shocks in the text.

The period that covers 2015 and 2016 is subject to persistent negative credit supply shocks. This is due to a combination of persistently weak capital inflows to emerging markets and elevated uncertainty regarding the global economy and the domestic economic outlook.[19]

In the first quarter of 2017, several measures were implemented to improve the access of corporate sector to finance. Mainly, the Treasury supported credit guarantee fund (KGF) guarantee limit was increased from 20 billion Turkish lira to 250 billion Turkish lira. Moreover, the Portfolio Guarantee System (PGS) developed within the KGF speeded up the credit utilization process[20], which increased credit supplied by the financial sector. Furthermore, by making it possible for collateral-constrained firms to access credit and by decreasing the non-pecuniary cost of applying for credit (probability of getting credit per application increased and credit utilization process speeded up), the KGF measure also increased credit demand. In line

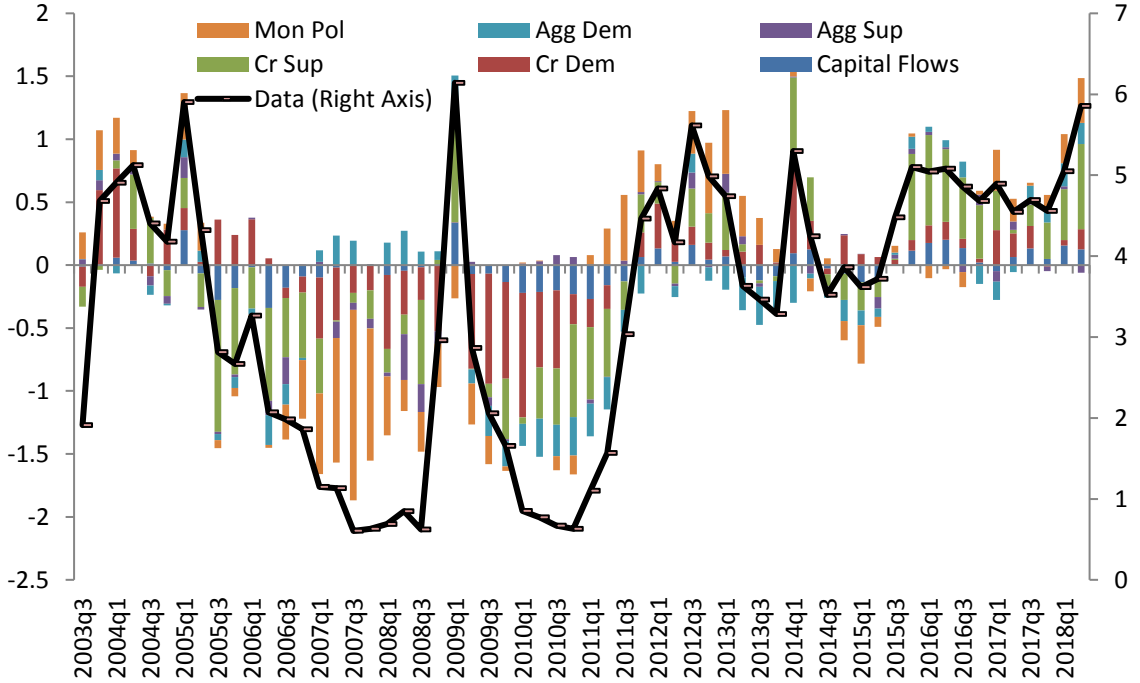
[19] The negative effect of the uncertainty regarding the economic outlook on credit standards is confirmed by the Bank Loans Tendency Survey in this period. See Box. 5.2 in Inflation Report 2016-IV.
[20] For details the Treasury supported KGF guarantee limits and PGS, pp 71-74 of CBRT Financial Stability Report May-2017.

with this intuition, our identification yields positive credit supply shocks and positive credit demand shocks during the first and second quarter of the 2017. [21] Hence, the identified credit supply shock seems to be compatible with major shifts in domestic and global financial conditions throughout the sample.

How Important are Credit Supply Shocks for Credit Spread and Credit Growth?

Figures 8 and 9 show historical decompositions of credit spreads and real lending growth throughout the sample. In the figures, each bar at a particular quarter shows the cumulative effect of a structural shock on the variable of interest up to that quarter. The sum of the shock contributions (the sum of the each bar at a particular quarter) do not add up to the actual data because of the deterministic components of the data (constant and exogenous trend). Hence, for ease of display the cumulative effect of each structural shock is plotted on the left axis, while the actual historical data is shown on the right axis.[22]

Figure 8: Historical Decomposition of Credit Spreads (Baseline BVAR)



[21] By construction, Treasury backed KGF credits are designed for the firms that are credit constrained. In fact, the effect of the KGF measure on credit spread and credit growth varied with respect to the firm size. Credit spreads for small and medium size firms (SMEs) fell significantly, while credit spreads for larger size firms did not change much in this period, making it harder for our aggregate measure of credit spread to reflect the easing in credit conditions that mostly applied to the SMEs. Moreover, as explained in Section III, our framework is not designed to capture large credit supply shocks that might invoke nonlinear effects on the economy due to the relaxation in credit constraints of firms. Still, the SVAR presented here identifies credit supply and credit demand shocks that support credit growth during the period where KGF credits were utilized.

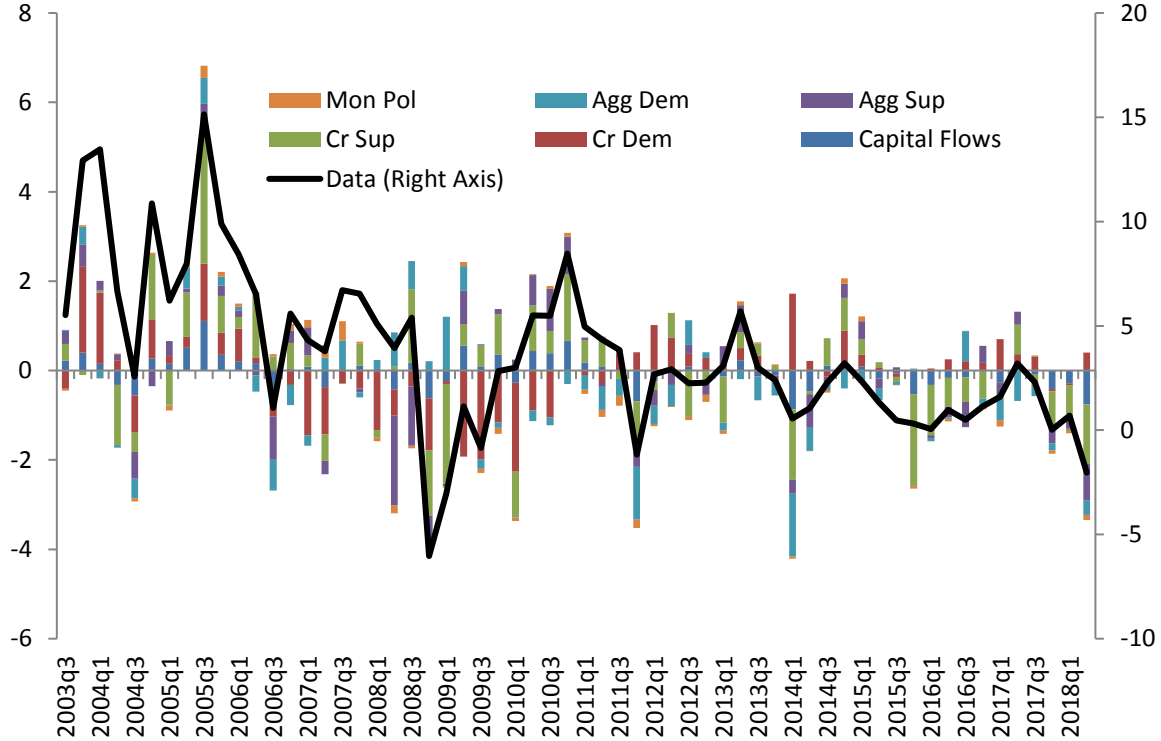
[22] The difference between the sum of the shocks and the data series is partly related to the fact that we are not using demeaned variables in the VAR due to ease of interpretation. Hence the deterministic part in the historical decomposition remains large. Moreover, as explained in Kilian and Lütkepohl (2016), historical decompositions involve an approximation error, which tends to be large when the data is short as in our case.

Putting aside the exogenous component related to the deterministic part of the series, *credit spread* is driven mainly by credit supply and credit demand shocks as expected. Positive credit supply shocks were important in pushing down credit spreads in the financial deepening phase in 2005-2006, while the further fall in credit spread to its historically low levels in 2007 was mainly stemming from the fall in credit demand and easing in monetary policy.

The rapid rise in credit spread during the Lehman crisis was mainly driven by credit supply shocks. The monetary policy response somewhat eased the pressure on the credit spread in this period. Credit spread quickly fell down to pre-Lehman levels in 2010 on the back of positive credit supply shocks, favourable capital inflow shocks and weak credit demand. Since the last quarter of 2011, credit spreads have reached a new plateau with credit supply shocks driving up the spreads more than any other shock.

Credit supply and demand shocks are also important in accounting for the historical deviations of *credit growth* from its historical trend (Figure 9). Periods where credit spreads declined due to positive credit supply shocks coincide with periods where real lending growth similarly rose and vice versa.

Figure 9: Historical Decomposition of Credit Growth (Baseline BVAR)



The historical decomposition of real credit growth show that credit supply and demand shocks do not always work in the same direction. The drastic fall in quarterly real credit growth during the Lehman crisis was driven by negative shocks to both credit supply and demand. However, credit supply shocks turned positive within two quarters' time, while credit demand shocks continued to drag down the recovery in credit growth almost until the second half of 2011.[23] Aggregate demand shocks also restricted the real lending growth in this period probably reflecting the historically high levels of unemployment in the period between 2009 and 2011.

In line with the findings on the determinants of the credit spread, the fall in lending growth due to various episodes of macroprudential tightening (including the measures taken at the end of 2011 and at the start of 2014) are mainly attributed to negative credit supply shocks. The slowdown in credit growth starting in the second half of 2015 until the end of 2016 is related to a series of negative credit supply shocks, while credit demand shocks take small positive values, providing evidence that credit demand was probably stronger than credit supply during this period.

In the first half of 2017, supportive financial policies, credit guarantees provided by the KGF in particular, were instrumental in driving up credit growth. The effects of these policies are reflected in the contributions of credit demand and credit supply shocks. The negative impact of credit supply shocks to credit growth that persisted throughout 2016 ceased in 2017Q1 and the impact of credit supply turned positive in 2017Q2. The easing in macroprudential measures that apply to consumer loans, which took effect as of September 2016, as well as the KGF guarantees, also contributed to credit growth through positive credit demand shocks.

How Important are Credit Supply Shocks for GDP Growth?

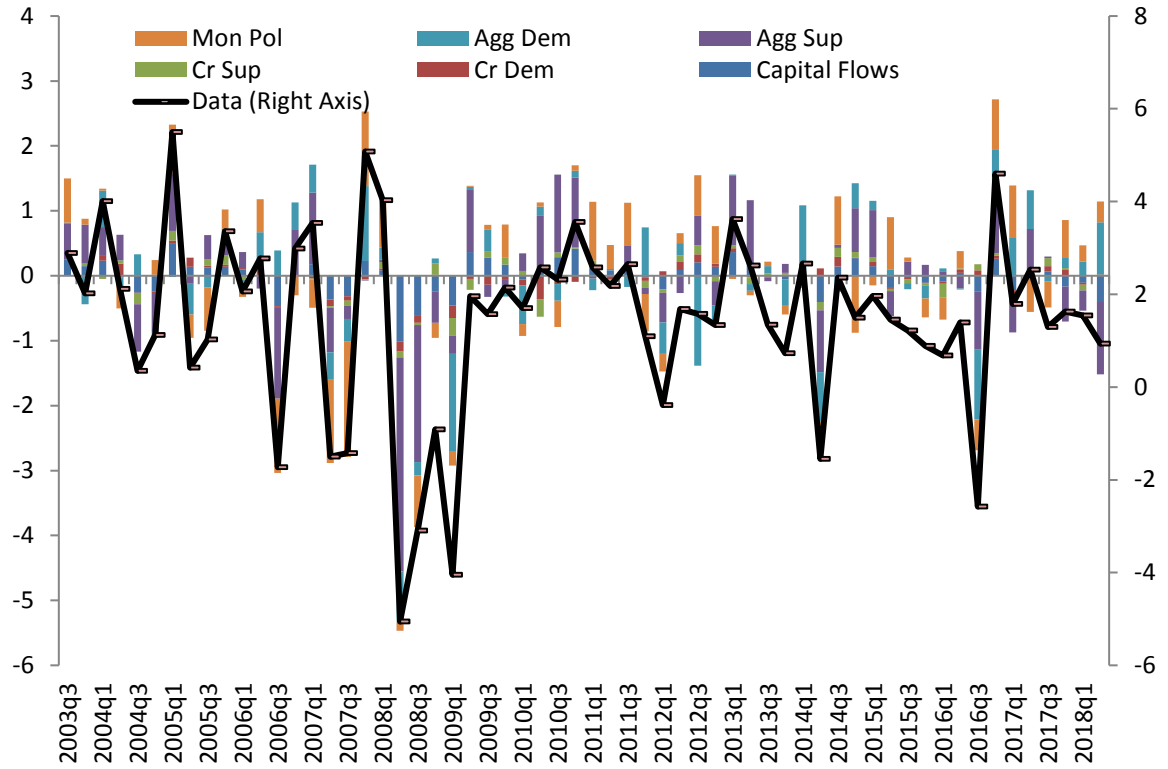
Credit supply and credit demand shocks which are the main drivers of the deviations of credit spreads and credit growth from their historical trends, seem to have a smaller role in accounting for the GDP growth, which is affected more by shocks to aggregate supply, aggregate demand, capital inflows and monetary policy (Figure 10).

Through most part of 2003-2006 credit supply shocks were adding to the GDP growth thanks to enhanced financial intermediation capacity of the banking sector following the successful

[23] Positive credit supply shocks partly reflect the rise in capital inflows to emerging economies. Indeed, in the BVAR where capital inflow shocks are assumed to result in a contemporaneous fall in credit spreads as well as a rise in credit growth, the identified credit supply shocks are still positive, but are smaller. The remaining positive effect can be attributed to positive capital inflow shocks.

implementation of public sector and banking sector reforms in the aftermath of the 2001 financial crisis. The impulse response analysis (Figure 3) shows that the maximum impact of a credit supply shock on GDP occurs one quarter after the shock and dies in three quarters.

Figure 10: Historical Decomposition of GDP Growth (Baseline BVAR)



Historically one of the largest negative contributions of credit supply shocks to GDP growth is observed in 2009Q1, one quarter after the large negative credit supply shock that occurred in 2008Q4 due to the Lehman crisis (Figure 10). However, the contribution of credit supply shocks to the 2008-2009 recession was small compared to other shocks.[24] Negative aggregate supply shocks (probably related to the sharp rise in oil prices) made the largest contribution to the fall in quarterly GDP growth during 2008Q2 and 2008Q3. Other shocks that were important in explaining the fall in GDP growth this period were negative shocks to capital inflows, credit supply and demand. On the other hand, the biggest contribution to the output contraction in 2009Q1 came from the sharp fall in aggregate demand related to the rapid contraction in foreign demand which was followed by negative shocks to capital inflows, credit demand and credit supply. The recession ended in 2009Q2 despite the ongoing negative effects coming from the lagged effects of the negative shock to the credit supply that occurred in 2008Q4-2009Q1.

[24] While similar analyses applied to developed economies find a major role for credit supply shocks in accounting for the output drop during the global financial crisis (e.g. Barnett and Thomas (2014) among others), papers that identify credit supply shocks for emerging or transition economies such as Tamasi and Vilagi (2011) show that credit supply shocks play only a minor role in explaining the contraction in output during this period, which is in line with our findings.

Other periods where credit supply shock affected GDP growth negatively are 2012Q2, right after the credit supply shock related to the macroprudential tightening against consumer loans; and 2014Q2, which came after the second phase of macroprudential tightening and the strong monetary tightening in January 2014 that might have had an impact on credit supply through the credit channel. The slowdown in credit growth starting in 2015Q2 also seem to have a negative impact on GDP growth until 2016Q1 through credit supply shocks. In 2017, the strong growth performance in real GDP is mostly attributed to what we identify as capital inflow shocks and an aggregate supply shock while credit supply and credit demand shocks seem to have contributed to a smaller extent.[25]

Overall, credit supply and demand shocks seem to play less of a role in explaining historical GDP growth, but periods where credit supply shocks had a positive or negative impact on GDP growth seem to be compatible with major developments related to the credit market.

IV. SENSITIVITY AND ROBUSTNESS ANALYSIS

We carried out a wide range of sensitivity and robustness checks with respect to alternative i) data choices, ii) prior selection, iii) lag length. This section reports the results of some of these robustness checks.

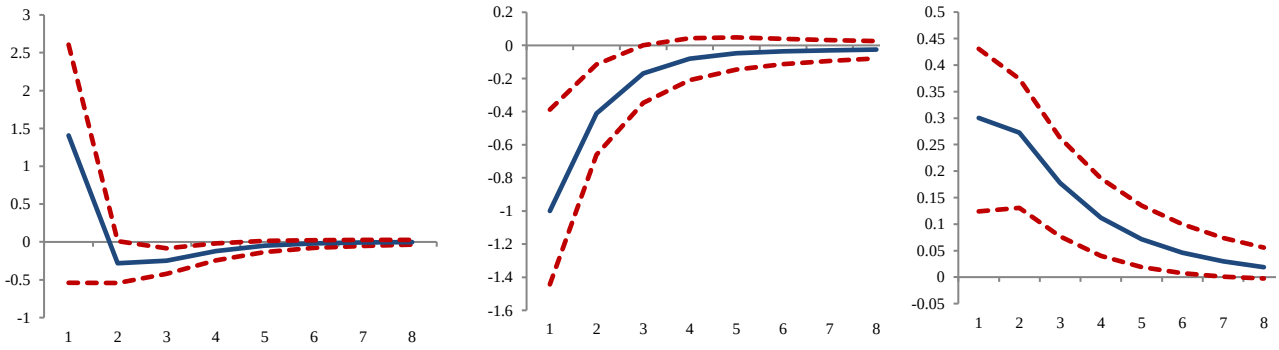
Sensitivity of Impulse Response Functions with respect to Alternative Data Choices:

In the baseline model, we use data on the difference between commercial loan rate and deposit rate as our credit spread measure. Given that our credit measure is total credit, which includes both household and firm loans, we check whether using the weighted average of commercial and consumer loan rates to calculate the spread (as a difference from the deposit rate) matters for the transmission of credit supply shocks. Figure 11 shows that the impulse responses to a credit supply shocks are not sensitive to the use of this alternative spread measure.

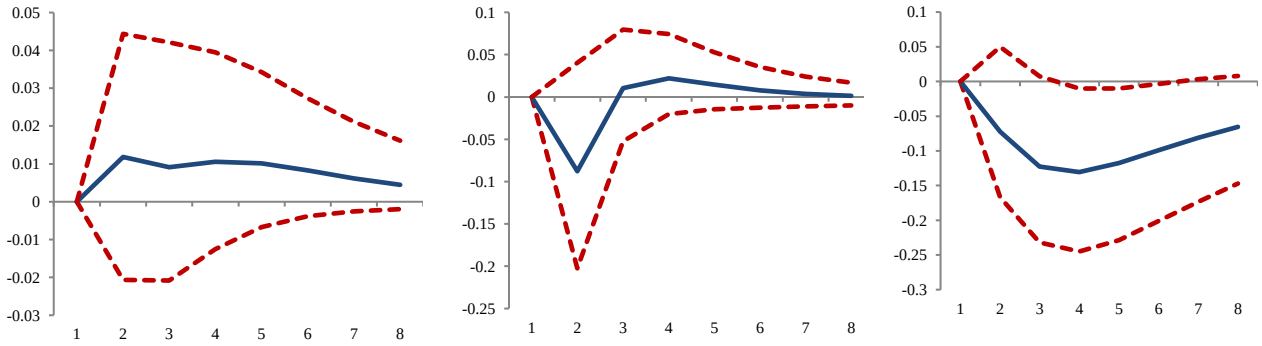
[25]As we noted before, the framework presented here is not suitable to capture the effects of large shocks in the credit market, hence we think that the positive effect of the supportive financial measures including KGF on real GDP growth here might be underestimated.

Figure 11: Responses to Credit Supply Shock
(Using weighted average of Commercial and Consumer Loan Spreads)

a. Exchange Rate b. Credit Growth c. Spread



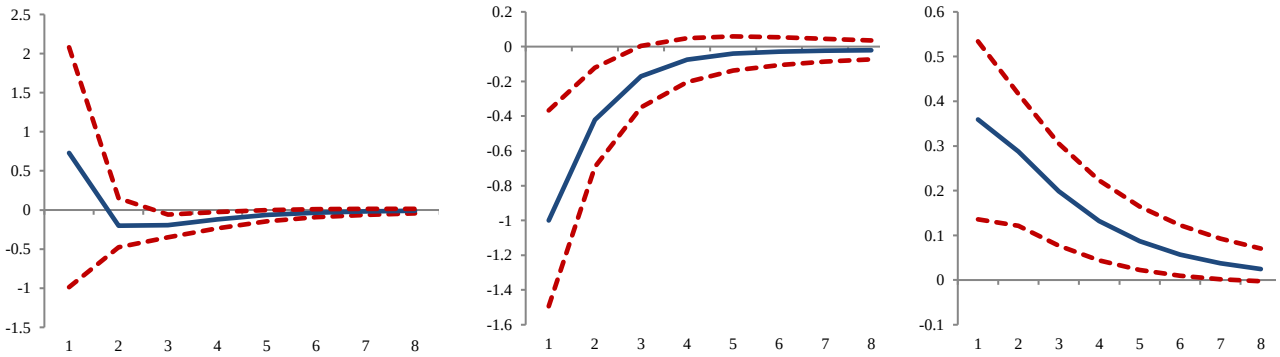
d. Inflation e. Growth f. Policy Rate



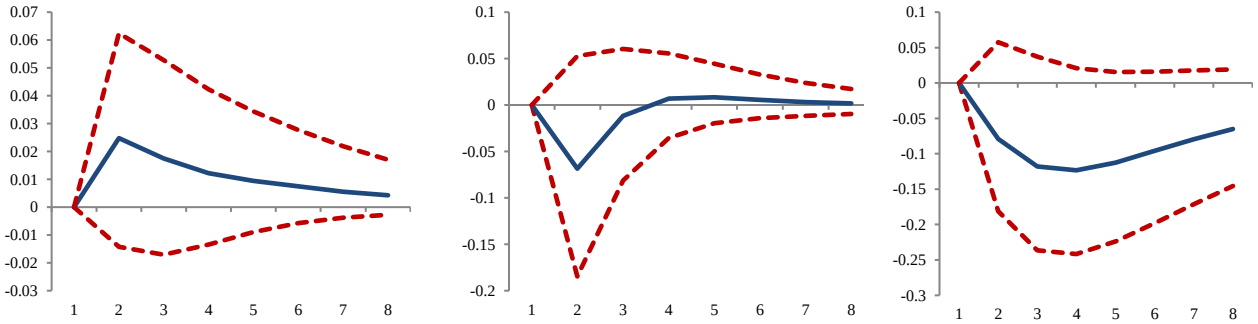
We also estimate the baseline model using the real effective exchange rate (calculated based on CPI, 2003=100) instead of the nominal USD/TRY rate. A fall in the real effective exchange rate implies a real depreciation vis-à-vis our trade partners, hence the sign of the response of the exchange rate goes in the opposite way compared to the baseline (Figure 12). The real exchange rate also depreciates on impact in response to a negative credit supply shock but to a smaller extent. The effect on real GDP growth is also somewhat reduced. The cumulative impact of a negative credit supply shock that reduces credit growth by 1 percentage point on impact on GDP growth in this case is around -0.08 percentage points within two quarters, quite close to the value in the baseline model, which is -0.10 percentage points.

Figure 12: Responses to Credit Supply Shock (with real exchange rate)

a. Exchange Rate b. Credit Growth c. Spread



d. Inflation e. Growth f. Policy Rate



Sensitivity of IRFs with respect to alternative prior selection

We use optimum Minnesota priors in our estimations.[26] In order to check for robustness to alternative priors, the baseline model is also estimated using optimum Normal-Wishart, and Normal Diffuse priors.[27] The results of these robustness analyses as well as (non-rescaled) results of baseline results are available upon request.

Sensitivity of IRFs with respect to alternative lag length

Different lag length criteria show that optimum lag length for the analysis is 1 or 2. Given the short sample we take the BVAR lag length as 1. In order to check robustness of the baseline results with respect to lag length, we estimate the baseline model using a lag length of 2.The results which are available upon request, appear to be robust both qualitatively and quantitatively to different lag lengths.

[26] We choose the Minnesota priors (full VAR estimates) option in BEAR toolbox.

[27] The impulse responses with optimum independent Normal Wishart priors also available upon request.

VI. CONCLUSION

This paper investigates the role of credit supply shocks in explaining the macroeconomic fluctuations in Turkey using a Bayesian Structural Vector Autoregression (SVAR) model with sign and zero restrictions. We find that credit supply shocks have a significant but temporary effect on real GDP growth whereas they do not significantly affect inflation. The effect of credit supply shocks on growth is stronger if the credit supply shock is identified in a way to include the effects of capital inflows on credit conditions. Hence, our results confirm the importance of external finance for credit supply in Turkey.

Historical series of the identified credit supply shock seem to be compatible with major shifts in domestic and global financial conditions throughout the sample. While credit supply and demand shocks are important in accounting for historical credit spread and credit growth data, they play less of a role in explaining historical GDP growth. This finding is line with the literature that analyses the effects of credit supply shocks in emerging economies that are in relatively early phases of financial deepening.

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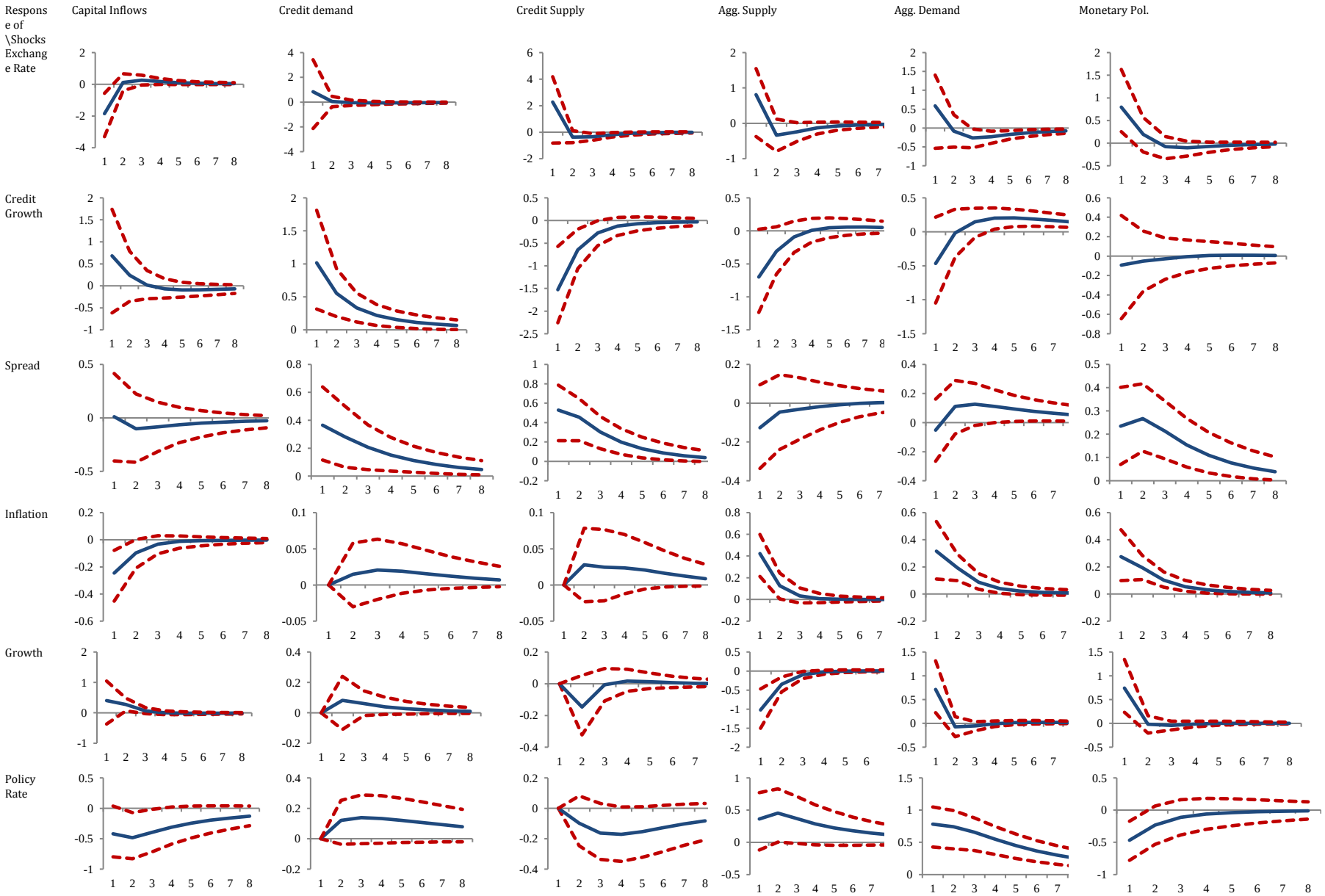
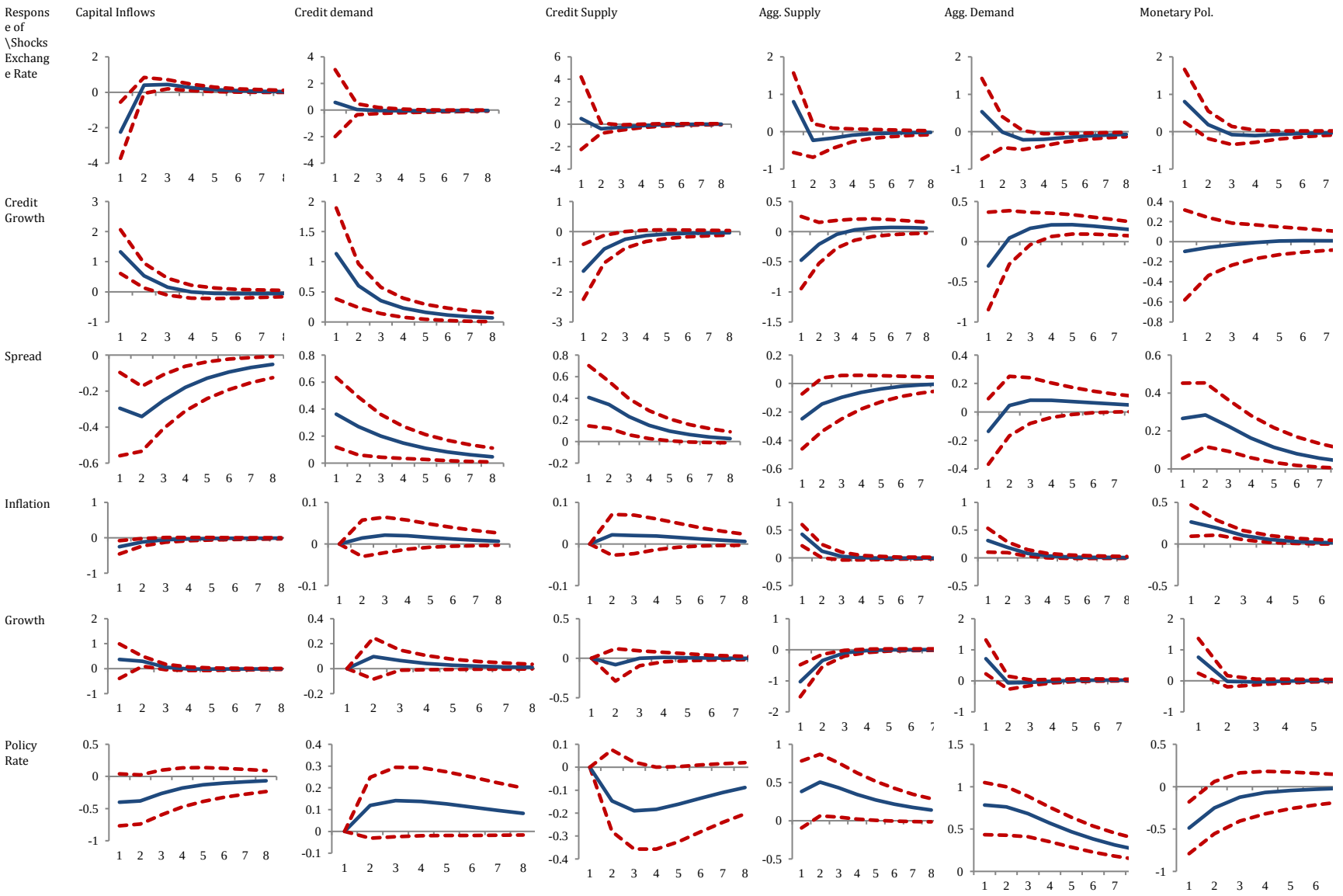
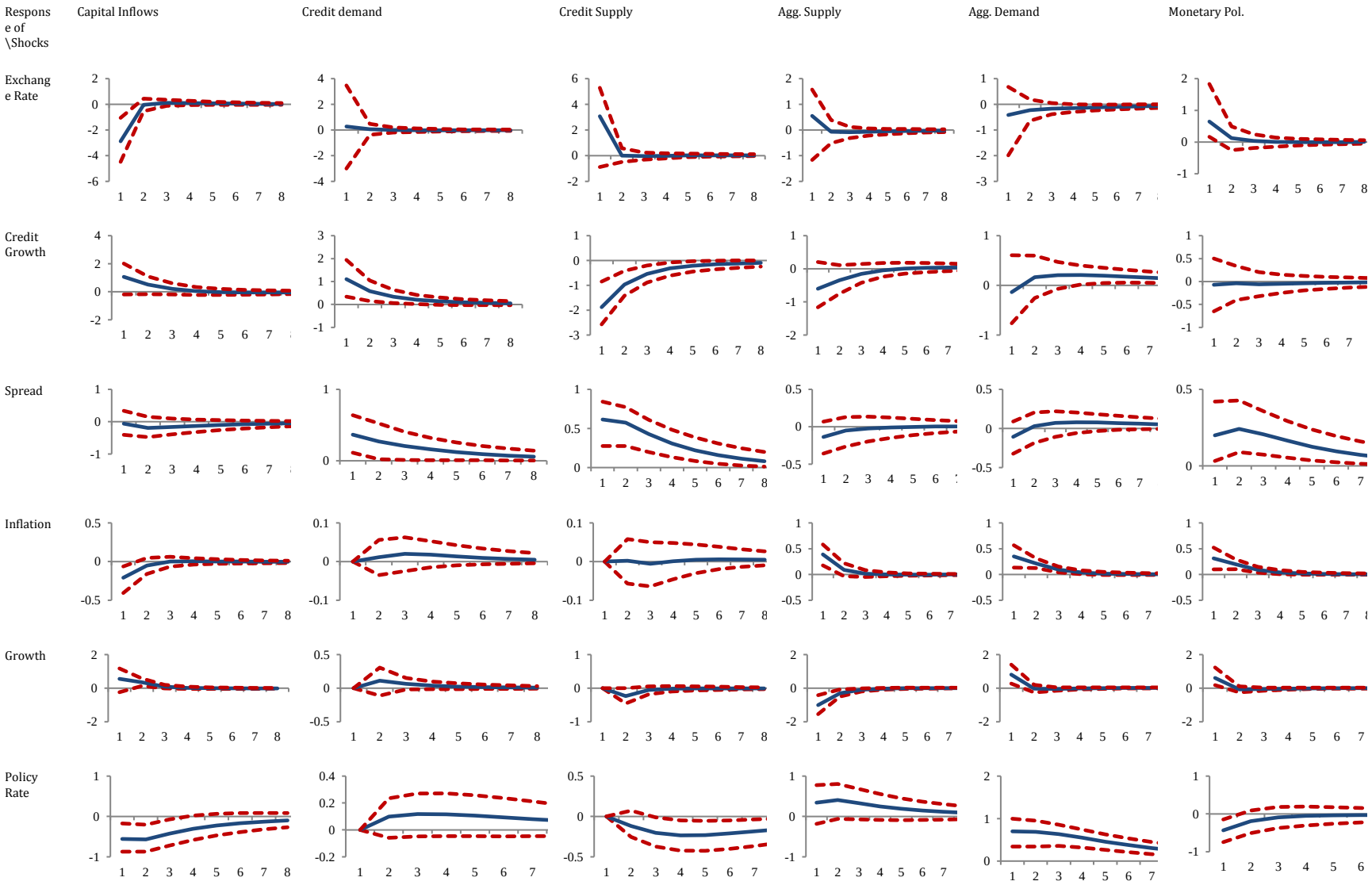
APPENDIX Figure A1. Baseline IRF results (optimum Minnesota priors and non-rescaled)



APPENDIX Figure A2. IRF results for 'narrow' definition of credit supply shock with restrictions in Table 3 (optimum Minnesota priors and non-rescaled)



APPENDIX Figure A3. IRF results for 'broad definition of credit supply shock with restrictions in Table 3 (optimum Minnesota priors and non-rescaled)



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