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Monetary Policy Transmission and Credit Cards: Evidence from Indonesia

K.P. Prabheesh¹, R. Eki Rahman²

ABSTRACT

This paper empirically tests the dynamics of credit cards and monetary policy in the context of Indonesia. Using monthly data from 2006 to 2018, and structural vector autoregressive model, our findings indicate that the credit card usage is mainly driven by Indonesia's high economic growth over the last decade, which indeed signifies the role of credit cards on consumption smoothing. The study also found that the monetary policy transmission through the lending channel is weak. However, the role of the exchange rate and global oil price in the transmission process being more prevalent.

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Keywords: Monetary Policy, SVAR, Credit Card

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I. INTRODUCTION

The technology has digitalized transactions across the world. The referred transactions include payment mechanisms such as debit and credit cards and online payments. The benefits of these payment mechanisms are varied such as smooth, transparent, quick and efficient. Along with uplifting the merits and efficiency in the digitized transactions, it also poses many challenges to policymakers as well. One of such challenges is the smooth conduction of monetary policy. In this paper, we explore the possible interactions between credit card usage and monetary policy in the Indonesia context.

Indonesia, one of the growing emerging economies in the world, experienced a rise in credit card usage considerably since the past decade³. Fig.1 shows that the volume of transactions with credit cards has increased significantly from 113 million to 338 million during 2006-2018. The growth in both volume and transaction is found to be high during 2006-2010. Where annual compound average annual growth of volume and value of transactions are found to be 12.5% and 24.5%, whereas, during 2011-2018, the growth rates are found to be 6% and 7.5% for the same (Fig. 2). As credit card can be used for purchase as well as withdrawing the cash, the use of credit card for withdrawing cash is too small, around 3% in 2018, out of total value of transactions and, the rest 97% is for purchase out of total value of transactions (See Fig. 3). These observations are the clear indication of an upsurge in credit card usage on the overall consumer credit market. This is the period in which the country experienced high growth trajectory. Apparently, the excessive use of credit card is one of the clear indications of less money in the transaction, as individual holds less money for transactions. However, it is also argued the excessive use of credit cards leads to higher spending and hence higher prices. The Bank of Indonesia (BI) adopts inflation targeting framework (ITF) as the primary objective of monetary policy, the extensive use of credit cards will have a significant implication on the effectiveness of monetary policy. Hence the study

³ The credit card ownership is low in Indonesia as compared to other emerging economies. As per Global Findex database, World Bank (2017), the credit card ownership in Indonesia among people above age 15 is around 2% in 2017, whereas in India (3%), China (31%), Brazil (21%), Malaysia (21%).

is warranted in the present context of high usage of credit cards in Indonesia. The rest of the paper is organized as follows. Section 2 presents the review of literature, hypothesis and approach of the paper. Section 3 and 4 discuss econometric framework and data. Section 5 presents empirical findings and section 6 concludes.

INSERT FIG 1, 2, and 3

II. REVIEW OF LITERATURE, HYPOTHESIS AND OUR APPROACH

According to Fulford and Schuh (2018), the availability of credit card helps individuals to make three important decisions. First, credit card helps to smooth their consumption when there is fall in income and hence it is considered as a precautionary liquidity. Second, it can be used to revolve their debt over the short and long-term and hence credit cards are a way of allocating life-cycle consumption. Finally, as a means of payment, spending on credit cards forms part of consumer expenditure. Therefore, the economic implications credit card become more prevalent as its usage increases.

The literature on credit cards, especially related to monetary policy, broadly looks from the following perspectives. 1) the role of central banks in the digital money and its independence in the conduct of monetary policy. 2) the implications of the credit card on the monetary policy transmission. Regarding the first view, studies suggest that substitution of money with any alternative payment options such as credit cards, debit cards, digital currencies leads to a reduction in overall demand for money in the economy (Akhand and Milbourne 1986; Yazgan and Yilmazkuday, 2009; Yilmazkuday and Yazgan, 2011). The usage of the credit card reduces the demand for money for transaction purpose as it can be used as a medium of exchange in transactions (Mandell, 1972). Hence the traditional approach to conduct monetary policy based on changing the monetary base may not be effective, for instance, the possibility of raising seigniorage (income from printing money) using monetary policy would be limited. As a result, central banks may be forced to depend on the financial support of governments for their operational needs, and therefore, that affects the independence of their monetary policy decisions (Friedman, 1999; Freedman 2000; Goodhart, 2000; and Woodford, 2000).

Regarding the second view, credit card and monetary transmission, discusses various challenges posed by credit cards while conducting monetary policy. The usage of credit cards doubles the velocity of money, as the cash proceeds from the sale of goods can be used again to pay the debt on credit card purchases. Theoretically, the velocity of money inversely proportional to money demand and hence the lower money demand due to the usage of credit cards leads to high velocity of money (Geanakoplos and Dubey, 2010). High velocity of money rises the inflation, which may deviate from the central bank's inflation target. Similarly, the lower money demand reduces the demand for central banks reserves balance, which in turn shrink the size of the balance sheet of the central bank. Therefore, it reduces the central bank's ability to influence the short-term interest rate through open market operations, (Friedman 1999; 2000). Moreover, the evidence suggests that the balance sheet of the central bank is potentially reduced with increased use of electronic money and this has serious implications on the bank's ability to effectively manage monetary policy and achieve its lender of last resort functions (BIS, 2015).

It is also argued that inflation in the United States in the 1970s and early 1980s coincided with the introduction of credit cards (Geanakoplos and Dubey, 2010). The credit card usage may stimulate spending as consumers underestimate or forget credit card purchases because the act of paying by credit card is less painful than paying by cash or check (Soman, 2001). Moreover, interest rates charged on credit cards are sticky and do not change with the monetary policy and complicates the implication of monetary policy through credit card channel (Calem and Mester, 1995). If credit card interest rates were elastic in response to changes to policy rate, monetary policy would have a multiplier effect in the consumption level through credit card funds availability. Further, Yilmazkuda (2011) argued that a contractionary monetary policy forces commercial banks to restrict lending through credit card and hence the credit (or lending) channel of monetary policy transmission would be more effective in the presence of credit card, as compared to other channels monetary transmissions such as through interest rate and exchange rate. Moreover, the external risk factors such as oil price fluctuations, exchange rate further complicates the monetary transmission mechanism. Hence it would be interesting to analyse role

of credit cards in monetary policy transmission, along with other global risk factors such as exchange rate and oil price shocks.

Given this background, the present paper tries to examine the following questions in the context of Indonesia: 1) Does credit card usage play any role in the monetary policy transmission? 2) Does lending channel is prevalent in the monetary policy transmission due to the credit card usage as compared to other channels? Does credit card play consumption smoothing role in the monetary policy dynamics? As studies related to the impact of credit cards on monetary transmission is relatively scarce, our paper marks an essential contribution to the existing literature in the following ways: 1) this is the first study that understand the monetary policy transmission by including global risk factors such as oil price shocks in the presence of credit card usage 2) this is one of the first attempt to examine the empirical relationship between credit card usage and monetary policy transmission using structural vector autoregressive approach. 3) This is the first attempt to understand the dynamics of monetary policy in the presence of credit card usage in the context of Indonesia.

In this paper, we hypothesize that 1) the credit card usage reduces the effectiveness of monetary policy transmission as it raises the price level due to the high velocity of money (Friedman 1999; 2000). 2) the credit card usage positively affected by income level as higher income or output encourages the consumer to spend more on consumption using credit cards. This indicates the consumption smoothing role of credit card (Fulford and Schuh, 2018; Yilmazkuday and Yazgan, 2011)⁴. Similarly, credit card usage is negatively affected by interest rate as it represents the opportunity cost of credit card usage especially which credit card debt is not paid on time (Yilmazkuda (2011). Also, the exchange rate and global oil price affects the domestic price level through international trade as in the is context, we assume Indonesia is a

⁴ The level of income is an important indicator of consumers' repayment patterns. Households with high liquid assets or income are more likely to use credit card for transaction frequently and pay their credit card debt in time (Canner and Cynak, 1985; Zhang and DeVaney, 1999).

small open economy (Basnet and Upadhyaya, 2015). Finally, the central bank alters the policy rate to curb inflation as BI officially adopt inflation targeting framework.

Our approach towards testing the above interlinkage is as follows. We use monthly data from 2006 to 2018 and structural vector autoregressive (SVAR) model. We use impulse response function analysis and the forecast error variance to analysis the monetary transmission. Further, we include the commercial banks' lending in the analysis to account for lending channel of monetary policy. Accordingly, monetary policy actions affect lending capacity of the commercial banks and hence affects the monetary policy target. Similarly, we also incorporate, exchange rate and global oil price into the analysis to account for external shocks. Our empirical findings suggest the following. First, the credit card usage is significantly explained by output, which indicates the consumption smoothing role of credit cards. Second, the usage of credit card is not affected by the interest rate, indicates the stickiness of interest rate charged on credit card. Fourth, the variations in policy rate are significantly determined by the variations in inflation, which support the inflation targeting objective of monetary policy of Bank Indonesia. Fifth, the global oil price plays a significant role in explaining domestic inflation, indicating external shocks pass-through to domestic inflation. Finally, the impact of policy rate on inflation is not strong through the lending channel, however, the role of the exchange rate in the transmission process being more prevalent as exchange rate variations affects the liquidity conditions of the commercial banks.

III. ECONOMETRIC FRAMEWORK

The paper employs a SVAR model to analysis the dynamics of credit card usage and monetary policy⁵. The SVAR model is an alternative to simultaneous equation models, which was originally proposed by Sims (1980). The following form shows a standard SVAR model

⁵ In the literature, most of the studies used SVAR to analyze the monetary policy transmission mechanism due to its dynamic nature as compared to other econometric techniques. For a survey on the use of SVAR models in the monetary transmission mechanism see Christiano et al. (1999).

$$A_0 X_t = A_1(L)X_t + B_t \quad (1)$$

Where X_t represents is an $n \times 1$ vector of variables at time t , A_0 and B are $n \times n$ matrices of coefficients, $A_1(L) = \sum_{i=1}^{\rho} A_{1i}L^i$ indicates the matrices polynomial in the lag operator. Matrix B contains the structural form parameter of the model and ε_t is an $n \times 1$ vector of serially uncorrelated and zero mean structural shocks with an identity covariance matrix $\sum \varepsilon = (\varepsilon_t \varepsilon_t') = I$. The reduced form of the model can be expressed as

$$X_t = C(L)X_t + u_t \quad (2)$$

Where $C(L)X_t = A_0^{-1}A_1(L)$ with $A_0 u_t = B_t$

The residuals u_t from the reduced VAR model are also assumed to be white noise, but can be correlated with each other due to the contemporaneous effect of the variables across equations. Therefore, to identify the structural shocks, the restrictions have to be imposed in the equation. The present paper employs the identification strategy by applying short-run restrictions on contemporaneous coefficients in A_0 . More precisely, to exactly identify the structural shocks we need to impose $n(n - 1)/2$ restrictions.

In order to address the research issue, we estimate three separate SVAR models⁶. In the Model 1, we include four variables in the SVAR system i.e., output, inflation, credit card transaction and domestic policy interest rate.

The identification strategies for the model 1 are as follows.

$X_t = (\text{Output}, \text{Inflation}, \text{Credit}, \text{Interest rate})$

$$\begin{bmatrix} a_{11} & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 \\ 0 & a_{42} & a_{43} & a_{44} \end{bmatrix} \begin{bmatrix} u_t^{\text{Output}} \\ u_t^{\text{Inflation}} \\ u_t^{\text{Credit}} \\ u_t^{\text{Interest rate}} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 \\ 0 & b_{21} & 0 & 0 \\ 0 & 0 & b_{31} & 0 \\ 0 & 0 & 0 & b_{41} \end{bmatrix} \begin{bmatrix} e_t^{\text{Output}} \\ e_t^{\text{Inflation}} \\ e_t^{\text{Credit}} \\ e_t^{\text{Interest rate}} \end{bmatrix} \quad (3)$$

⁶ We closely follow SVAR approach adopted by Prabheesh and Vidya (2018)

Here, output is assumed to be contemporaneously exogenous to other variables in the system as the SVAR literature on monetary policy indicates that real variable, such as output, responds with a lag to monetary variables' exogenous shocks (Abouwafia and Chambers, 2015; Sims, 2007). Similarly, inflation is also assumed to be contemporaneously exogenous to credit card transactions and interest rates due to the delay in changes in prices (Friedman, 1961). Similarly, we assume credit card transactions (credit) do not respond contemporaneously to the changes in interest rate, due to the sticky nature of interest rate charged on credit card (Calem and Mester, 1995). Finally, the policy rate (Interest rate) is contemporaneously exogenous to output as the information related to output would not be available to the policy makers within the same month, and hence interest rate only is set after observing the output information from the previous month (Leigh, 2005).

In Model 2, we expand the above model by including information related to commercial banks' lending and exchange rate⁷. The inclusion of these variables would be able to help us to identify the interaction of credit card effect on monetary policy transmission through lending and exchange rate channel.

The identification strategies for the model 2 are as follows.

$X_t = (\text{Output}, \text{Inflation}, \text{Credit}, \text{Lending}, \text{Interest rate}, \text{Exchange Rate})$

$$\begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 0 & 0 \\ 0 & a_{52} & a_{53} & a_{54} & a_{55} & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} \end{bmatrix} \begin{bmatrix} u_t^{\text{Output}} \\ u_t^{\text{Inflation}} \\ u_t^{\text{Credit}} \\ u_t^{\text{Lending}} \\ u_t^{\text{Interest rate}} \\ u_t^{\text{Exchange rate}} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{21} & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{31} & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{41} & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{51} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{61} \end{bmatrix} \begin{bmatrix} e_t^{\text{Output}} \\ e_t^{\text{Inflation}} \\ e_t^{\text{Credit}} \\ e_t^{\text{Lending}} \\ e_t^{\text{Interest rate}} \\ e_t^{\text{Exchange rate}} \end{bmatrix} \quad (4)$$

⁷ The incorporation of inflation and exchange rate also help to address well-known price and exchange rate puzzles, whereby inflation increases, and exchange rate depreciates, due to contractionary monetary policy (Sims, 1992; Cushman and Zha, 1997). Similar approach is adopted by Juhro and Iyke (2018) to address the monetary transmission on financial condition in Indonesia.

Here, we assume the commercial banks' lending does not respond contemporaneously to interest rate as commercial banks do not change lending rate quickly to the monetary policy changes and hence lending changes with lag. Whereas, the exchange rate is contemporaneously endogenous to all other variables in the system as it responds quickly to changes in real variables as well as monetary variables in the system.

Finally, in Model 3, we incorporate global oil price to account for global supply shocks. An increase in the prices of oil may increase the cost of production and subsequently leads to higher price level (Narayan et. al, 2014; Besnet and Upadhyaya, 2015). Hence, the central bank is assumed to react to the global oil price movements by changing policy rate. In this case, we assume oil price is contemporaneously exogenous to all other factors in the system. The identification for the model 3 as follows

$$X_t = (\text{Oil}, \text{Output}, \text{Inflation}, \text{Credit}, \text{Interest rate}, \text{Exchange Rate})^8$$

$$\begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 0 & 0 \\ 0 & a_{52} & a_{53} & a_{54} & a_{55} & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} \end{bmatrix} \begin{bmatrix} u_t^{Oil} \\ u_t^{Output} \\ u_t^{Inflation} \\ u_t^{Credit} \\ u_t^{Interest\ rate} \\ u_t^{Exchange\ rate} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{21} & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{31} & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{41} & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{51} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{61} \end{bmatrix} \begin{bmatrix} e_t^{Oil} \\ e_t^{Output} \\ e_t^{Inflation} \\ e_t^{Credit} \\ e_t^{Interest\ rate} \\ e_t^{Exchange\ rate} \end{bmatrix} \quad (5)$$

We use structural variance decomposition and structural impulse response functions to find the dynamics of the variables in the SVAR system. Impulse response functions are helpful to analyse the response of one variable to a shock in other variables in the system. Variance decomposition assess the percentage of forecast error explained by the innovation of each variable in the system.

IV. DATA

The study utilizes the monthly data from January 2006 to December 2018. We collected data from various Bank Indonesia reports. The beginning period is attributed to the availability of data

⁸To maintain the degrees of freedom, we do not include commercial banks' lending in model 3.

related to credit card transactions in Indonesia. The policy interest rate is proxied by BI rate, which is the indicator of the stance of monetary policy. The industrial production index (IIP) is taken as a measure of output due to unavailability of monthly output data. The credit card usage is measured in real terms (defined as the total value of credit card transactions divided by the consumer price index) and inflation is measured as the percentage change of consumer price index corresponding to its period year same month. Moreover, IIP, credit card transactions, and bank lending are in percentage changes that have been seasonally adjusted using the Census Bureau's X-12 method⁹. The exchange rate is measured as the number of Indonesian Rupiah in terms of US Dollar. Oil price is proxied by percentage changes in West Texas Intermediate (WTI) crude oil price, Cushing, Oklahoma taken from U.S. Energy Information Administration¹⁰. The table I reports the descriptive statistics such as mean, standard deviation, skewness, kurtosis and Jarque-Berra, of the variables considered for the analysis. It is interesting to note that the credit card usage has high standard deviation (14) indicating high fluctuations during the study period. And Jarqu-Berra indicates that the distribution is not normal in the case of credit card usage.

INSERT TABLE I

V. EMPIRICAL RESULTS

As a first step, we examined the stationarity properties of the variables. As the standard unit root tests such as Augmented Dickey-Fuller (ADF) test and Phillip-Peron (PP) test do not take into account the possible structural breaks(s) in the data series, the study employs the unit root test which accounts for two endogenous structural breaks proposed by Narayan and Popp (2010) (NP test hereafter). The main highlight of this test as compared to other structural break tests such as Lumsdaine and Papell (1997) and Lee and Strazicich (2003) is it uses a Dickey-Fuller-type test approach and it chooses the break date by maximizing the significance of the break date coefficient. The NP test has good size and stable power and identifies the structural breaks

⁹ We follow similar approach adopted by Yilmazkuday (2011).

¹⁰ <https://www.eia.gov>

accurately in finite samples. NP test suggests two models M1 and M2 which permit two breaks in levels and two breaks in level and trend. The test statistics reported in Table II shows that the null of the unit root can be rejected in all cases except exchange rate as per model M1 (intercept). Moreover, the break dates are found to be in various months during 2009- 2011 in most variables. For instance, the credit card growth experienced a break in 2010M1 and 2011M6. Our empirical findings of structural break test are in line with the study by Sharma et al (2018), in which they found that most of the macroeconomic data of Indonesia suffer from structural breaks.

INSERT TABLE II

In order to perform the SVAR test, exchange rate is converted into the first difference to ensure that all variables are stationary at levels. Then, the optimal lag length for VAR is chosen through SBC and LR Test criteria, and these tests select three as optimal lags for model 1 and two for model 2 and 3. The models fulfill diagnostics tests such as autocorrelation, normality and heteroskedasticity. Apart from that, intercept dummy variables are included, as exogenous in the SVAR system, corresponding to the break dates suggested by NP test.

A. Estimation of Model 1

The impulse response function from the SVAR system is depicted in Fig. 4. The dashed lines correspond to plus or minus two standard errors around the impulse responses. From Fig. 4 it is evident that the interest rate is significantly and positively responding to a positive shock on inflation and the response is statistically significant up to four months. This finding is not surprising, as the BI adheres to inflation targeting and hence it changes the policy rates when inflation deviates from its target, and this monetary policy strategy is popularly known as Taylor-rule. It is also important to note that interest rate is not responding to output and credit card transactions, which further underlines the BI's preference to inflation over output. However, the response of inflation to interest rate is found to be negative but effect is not statistically significant, signaling a weak monetary policy transmission through lending channel.

It is also interesting to note that inflation responds positively to credit card transactions. The rise in inflation may be attributed to the higher velocity of money with the use of credit card. Likewise, the response of credit card to output is positive and significant. The significant effect of output on credit card usage indicates that the consumers use the credit card for transactions or purchases when their income increase. This underscores the role credit cards in consumption-smoothing among high-income consumers. It is also evident that the policy rate does not have any significant effect on credit card usage. This finding could be attributed to the sticky interest rate charged on credit card. This inelastic nature of credit card usage to the policy rate may weaken the monetary transmission through credit card channel.

Table III reports the variance decomposition. It reveals that variations in output are largely driven by the variation in output itself (94% in the 10th month). Similarly, variations in inflation are largely explained by its own variations, i.e. around 84% in the 10th month. Whereas the contributions of output and interest rate to inflation are found to be 0.8% and 9.6%, respectively. Importantly, output explains around 38% variation in credit card transactions in the 10th month, which further shed some light on the role of high economic growth in Indonesia, over the last decade, on credit card usage. Similarly, around 15% of variation in the interest rate is explained by inflation.

The key findings of the analysis can be summarized as follows:

1. Inflation significantly explains the variations in interest rate indicating the central bank's monetary policy response to price stability.
2. Credit card transactions marginally explain variations in inflation.
3. Output significantly explains the variations in credit card transactions, indicating its role of consumption-smoothing.
4. The impact of policy rate on inflation is not statistically significant, signals the weak transmission of monetary policy through lending channel.

INSERT FIG. 4 AND TABLE III

B. Estimation of Model 2

Fig. 5 shows additional insights about the dynamics of monetary policy and credit card usage in the presence of exchange rate and commercial banks' lending. It is interesting to note that the response of interest rate to inflation is positive and statistically significant. This again shows the central bank's reactions to inflation, which is consistent with the inflation targeting policies of Bank Indonesia. However, the response of lending to interest rate is not found to be significant, provides the evidence of weak monetary transmission through lending channel. This may be attributed to a delay from commercial banks to adjust their lending rate in response to the central bank's policy actions. More importantly, bank lending is positively responding to credit card usage, which may reflect the pro-lending behavior of commercial banks to credit card holders. In other words, credit card usage boosts the commercial banks' lending activities in the country. The figure also shows that commercial banks' lending responds to exchange rate. An exchange rate depreciation leads to a significant decline in lending in the 3rd month, indicating the liquidity crunch faced by the commercial banks during the domestic currency depreciation.

The impulse response functions of credit card show that credit card usage is positively and significantly affected by output, and lending. These findings again reiterate the role of income and commercial banks' lending in determining the usage of credit card. It can be observed that inflation is positively and significantly responded to variations in the exchange rate, indicating depreciation of domestic currency leads to higher inflation. This underscores the role of external shocks in determining inflation in Indonesia. Unlike the previous section, the response of inflation to the credit card is not found to be significant here. Whereas, the response of inflation to interest rate is insignificant, which is consistent with the findings in the previous section. Output again not found to be responsive to any of the variable in the system except its own variations.

The variance decomposition reported in table IV further shows that exchange rate explains around 15% variations in inflation and 17% in bank lending. Similarly, output and lending explain 36% and 10% variations in credit card usage. Likewise, inflation explains 12.9% in change

in interest rate, but the interest rate explains only 4.5% in variations in inflation. Similarly, variations in output largely explained by its own variations, suggesting a stable output during the study period.

The key results can be summarized as follows:

1. Exchange rate significantly explains variations in inflation, indicating the international shocks pass-through to the domestic inflation.
2. In the presence of the exchange rate, the effect of credit card usage on inflation found to be insignificant.
3. Exchange rate significantly explains commercial banks' lending, indicating the liquidity stress faced by banks during the exchange rate depreciation.
4. Output significantly explains variations in credit card usage, indicating the consumption smoothing role credit cards at a higher income level.
5. Monetary policy transmission is found to be more prevalent through exchange rate rather than lending channel.

INSERT FIG. 5 AND TABLE IV

C. Estimation of Model 3

As we have seen from the previous section that an increased role of international shock pass-through to the domestic inflation through exchange rate, in this section we include world oil price in the analysis. Fig. 6 exhibits the impulse response function of SVAR of Model 3. The responses of inflation to oil price is positive and statistically significant from 2nd month to 7th month, which is a clear indication of global oil price pass-through to domestic inflation. This may be due to the high oil import by Indonesia in the recent years. Though Indonesia was one of the members of OPEC, after 2004 the country become a net importer of oil due to the increased consumption along

with decline in oil production (EIA, 2015)¹¹. Similarly, it is also interesting to see that the response of exchange rate to oil price is also positive and statistically significant, implies an increase in oil price in the world market depreciates the domestic currency. As Indonesia is a net importer of the oil, an increase in oil price in the international market would lead to high current account deficit, which subsequently leads high demand for foreign currency and domestic currency depreciate.

The response of inflation to exchange rate is also found to be positive and significant, indicates depreciation of domestic currency leads to inflation, which again emphasizes the relevance of exchange rate channel in the monetary policy transmission. It can also be seen that the domestic interest rate responds positively to oil price, indicating the central bank accounts for oil price dynamics while framing the monetary policy. Moreover, the oil price is found to be not affected by any of the domestic variables in the system which underscores its exogenous nature. The rest of the findings, especially related to credit cards are consistent with the previous section.

The variance decomposition shown in Table V reveals that around 14% variations in inflation is explained by oil price emphasizes the role of global oil price pass-through to prices. Whereas the exchange rate contributes around 8% of variation in inflation, which is lower than that of from the Model 2 (15%), reported in Table IV. This finding also shows that the presence of oil price in the model decreases the role of exchange rate in explaining inflation. In other words, once the source of external shock is accommodated in the model through oil prices, the role of mediator variable i.e. exchange rate become moderate. We can also see that the oil price explains around 7% variations in exchange rate.

The key findings from this section can be summarized as follows:

1. Oil price significantly explains variations in inflation, indicating the international shocks pass-through to the domestic inflation.

¹¹ Due to the decline in production of oil, the country suspended its membership from OPEC in in 2008 and reactivated in 2016 but suspended again in 2018 (OPEC, 2019).

2. In the presence of the oil price, the effect of exchange rate on inflation become moderate.
3. Oil price significantly explains the policy rate, indicating that the central bank accommodates oil price related information while framing the monetary policy.

INSERT FIG. 6 AND TABLE V

VI. CONCLUSION

This paper investigated the monetary policy transmission in the presence of credit card usage in the context of Indonesia. As Indonesia adopted inflation targeting, the excessive credit card usage is expected to have an important implication for the conduct of monetary policy. Using monthly data from 2006 to 2018 and a SVAR modelling framework, our empirical findings shows that the credit card usage marginally affects domestic inflation. However, in the presence of the exchange rate, the effect credit card on domestic inflation is not significant. Interestingly, our results show that the credit card usage in Indonesia is mainly driven by the country's high economic growth over the last decade, which indeed signifies the role of credit cards on consumption smoothing. However, the credit card usage is not found to be sensitive to the policy rates indicating the sticky interest rate prevails in the credit card market. Our empirical findings also provide some evidence of pro-active lending of commercial banks those to the users of credit cards. Finally, the monetary policy transmission through lending channel is found to be weak as neither commercial bank lending nor credit card transactions respond to changes in policy rate. Whereas role of external factors such as global oil price movements and exchange rate being more prevalent in transmission process, stressing the need for accounting for global risk factors while framing the monetary policies.

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Table I: Descriptive Statistics

This table presents descriptive statistics for the period 2007-2018. The mean, Standard Deviation (SD), skewness, Jarque–Bera (JB) test coefficient and its respective p-values are presented in its parenthesis. The JB test examines the null hypothesis of a normal distribution. Where Output, Credit, lending and Oil denote growth rate of Index of Industrial Production, credit card transactions, commercial banks' lending and oil price respectively.

	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
<i>Output</i>	4.15	3.95	-0.44	4.98	28.40(0.00)
<i>Inflation</i>	5.48	2.25	0.99	3.60	25.76 (0.00)
<i>Credit</i>	15.90	14.60	1.11	3.86	34.17 (0.00)
<i>Lending</i>	11.50	6.29	0.13	1.62	11.71(0.00)
<i>Interest Rate</i>	6.70	1.32	-0.008	2.40	2.10 (0.34)
<i>Exchange rate</i>	11136.5	2023.2	0.28	1.50	15.32 (0.00)
<i>Oil</i>	6.57	36.50	0.32	2.91	2.56 (0.276)

Table II: Structural Break Unit Root Test

This table shows Narayan and Popp (2010) unit root results for monthly data. Columns 3 and 4 show the sample period and the corresponding number of observations (T). We refer to Table 3 of Narayan and Popp (2010) for critical values for unknown break dates. Models 1 and 2 are two models for testing unit root. Model 1 (see Column 5) allows for two breaks in intercept and the Model 2 allows for two breaks in intercept as well as trend (see Column 6). The true break dates are denoted by TB1 and TB2; k represents the optimal lag length; and ***, **, and * indicate that the unit root null hypothesis is rejected at the 1%, 5%, and 10% levels of significance, respectively and M denotes month. Similarly, Output, Credit, lending and Oil denote growth rate of Index of Industrial Production, credit card transactions, commercial banks' lending and oil price respectively.

M1: Two Breaks in Intercept					M2: Two Breaks in Intercept and Trend			
Variables	Lag	t-stat	TB1	TB2	Lag	t-stat	TB1	TB2
<i>Output</i>	0	-0.579 (-6.704)*	2011M8	2012M1	0	-0.537 (-6.156)*	2011M8	2012M2
<i>Inflation</i>	4	-0.122 (-4.202)**	2013M6	2014M12	4	-0.120 (-4.290)	2013M6	2014M12
<i>Credit</i>	2	-0.400 (-4.210)**	2010M1	2011M6	3	-0.487 (-4.523)***	2010M1	2010M6
<i>Lending</i>	4	-0.083 (-3.859)***	2009M8	2011M11	2	-0.030 (-1.153)	2011M11	2010M6
<i>Interest rate</i>	4	-0.783 (-6.741)*	2009M9	2009M11	4	-0.810 (-6.821)*	2009M9	2009M11
<i>Exchange rate</i>	4	-0.072 (-1.622)	2013M1	2015M9	4	-0.132 (-2.805)	2013M10	2015M9
<i>Oil</i>	4	-0.780 (-6.741)*	2009M9	2010M9	4	-0.810 (-6.821)*	2009M9	2010M9
Critical Values for Unit root test			1%		5%		10%	
Model M1 (Break in Intercept only)			-4.731		-4.136		- 3.825	
Model M2 (Break in Intercept and Trend)			-5.318		-4.741		-4.430	

Table III

Variance Decomposition of Forecasted Variables (Model 1)

This table shows the variance decomposition of Model 1 estimated using SVAR methodology. These decompositions show the proportion of the variance in the forecast error of a variable that can be attributable to its own innovations and innovations in other variable in the VAR system. Where Output and Credit denote growth rate of Index of Industrial Production and credit card transactions, respectively.

Variance Decomposition of Output				
Period	Output	Inflation	Credit	Interest rate
1	99.99	0.00	0.00	0.01
5	94.38	4.31	0.79	0.52
10	93.89	4.68	0.90	0.53
Variance Decomposition of Inflation				
Period	Output	Inflation	Credit	Interest rate
1	0.01	92.25	0.23	7.51
5	0.77	83.82	5.84	9.57
10	0.83	83.68	5.86	9.63
Variance Decomposition of Credit				
Period	Output	Inflation	Credit	Interest rate
1	0.72	0.00	99.26	0.02
5	36.50	1.56	60.27	1.67
10	38.04	1.98	58.34	1.64
Variance Decomposition of Interest Rate				
Period	Output	Inflation	Credit	Interest rate
1	0.00	0.00	0.00	100.00
5	0.50	14.76	0.90	83.84
10	0.67	15.06	0.92	83.34

Table IV

Variance Decomposition of Forecasted Variables (Model 2)

This table shows the variance decomposition of Model 2 estimated using SVAR methodology. These decompositions show the proportion of the variance in the forecast error of a variable that can be attributable to its own innovations and innovations in other variable in the VAR system. Where Output, Credit and lending denote growth rate of Index of Industrial Production, credit card transactions and commercial banks' lending, respectively.

Variance Decomposition of Output						
Period	Output	Inflation	Credit	Lending	Interest rate	Exchange rate
1	98.07	0.00	0.00	0.69	1.22	0.00
5	90.07	2.81	1.06	2.40	1.89	1.73
10	85.96	3.23	2.34	2.56	2.92	2.95
Variance Decomposition of Inflation						
Period	Output	Inflation	Credit	Lending	Interest rate	Exchange rate
1	0.05	93.10	1.15	2.25	3.42	0.00
5	2.64	81.31	2.02	1.86	3.93	8.21
10	2.76	75.42	2.10	1.98	4.59	15.12
Variance Decomposition of Credit						
Period	Output	Inflation	Credit	Lending	Interest rate	Exchange rate
1	0.18	0.00	94.87	4.94	0.00	0.00
5	36.96	2.04	43.54	9.21	4.530	3.68
10	36.52	1.99	40.95	10.44	5.78	4.28
Variance Decomposition of Lending						
Period	Output	Inflation	Credit	Lending	Interest rate	Exchange rate
1	0.00	0.00	0.00	99.97	0.02	0.00
5	2.77	5.33	13.50	61.02	3.36	13.99
10	4.32	5.12	13.43	53.79	5.93	17.38

Variance Decomposition of Interest rate						
Period	Output	Inflation	Credit	Lending	Interest rate	Exchange rate
1	0.00	0.00	0.00	0.00	100.00	0.00
5	3.13	11.47	0.73	1.49	80.52	2.63
10	4.93	12.99	0.79	1.48	75.36	4.43
Variance Decomposition of Exchange rate						
Period	Output	Inflation	Credit	Lending	Interest rate	Exchange rate
1	0.01	0.65	6.16	2.75	0.02	90.38
5	5.53	3.92	5.36	3.91	5.48	75.77
10	6.80	5.52	5.18	3.69	7.04	71.75

Table V

Variance Decomposition of Forecasted Variables (Model 3)

This table shows the variance decomposition of Model 3 estimated using SVAR methodology. These decompositions show the proportion of the variance in the forecast error of a variable that can be attributable to its own innovations and innovations in other variable in the VAR system. Where Output, Credit and Oil denote growth rate of Index of Industrial Production, credit card transactions and oil price respectively.

Variance Decomposition of Oil						
Period	Oil	Output	Inflation	Credit	Interest rate	Exchange rate
1	100	0	0	0	0	0
5	96.44	1.24	0.04	0.87	1.34	0.07
10	94	1.3	0.21	0.79	3.64	0.06
Variance Decomposition of Output						
Period	Oil	Output	Inflation	Credit	Interest rate	Exchange rate
1	0.04	99.96	0	0	0	0
5	6.3	89.35	1.45	0.44	1.88	0.59
10	6.55	88.67	1.44	0.54	2.11	0.69
Variance Decomposition of Inflation						
Period	Oil	Output	Inflation	Credit	Interest rate	Exchange rate
1	0.75	0.03	99.22	0	0	0
5	10.05	0.9	81.03	0.26	0.14	7.61
10	14.23	1	75.5	0.28	0.51	8.48
Variance Decomposition of Credit						
Period	Oil	Output	Inflation	Credit	Interest rate	Exchange rate
1	0.04	0.59	0.01	99.36	0	0
5	2.23	30.06	0.68	62.08	4.38	0.57

10	2.72	34.01	0.79	57.43	4.4	0.65
Variance Decomposition of Interest rate						
Period	Oil	Output	Inflation	Credit	Interest rate	Exchange rate
1	0.03	0.31	3.37	1.02	95.26	0
5	9.93	2.33	8.23	2	77.05	0.46
10	14.03	2.62	12.36	1.9	68.68	0.42
Variance Decomposition of Exchange rate						
Period	Oil	Output	Inflation	Credit	Interest rate	Exchange rate
1	0.93	0.66	2.3	3.09	1.74	91.28
5	7.15	2.52	2.93	3.69	4.22	79.5
10	7.2	2.69	2.89	3.7	5.59	77.93

Fig.1 Usage of Credit Card

The figure presents the trends in credit card transactions in Indonesia. Value of transactions are reported in IDR Trillion, whereas volume of transactions re reported in millions. The data come from CEIC and Bank Indonesia website.

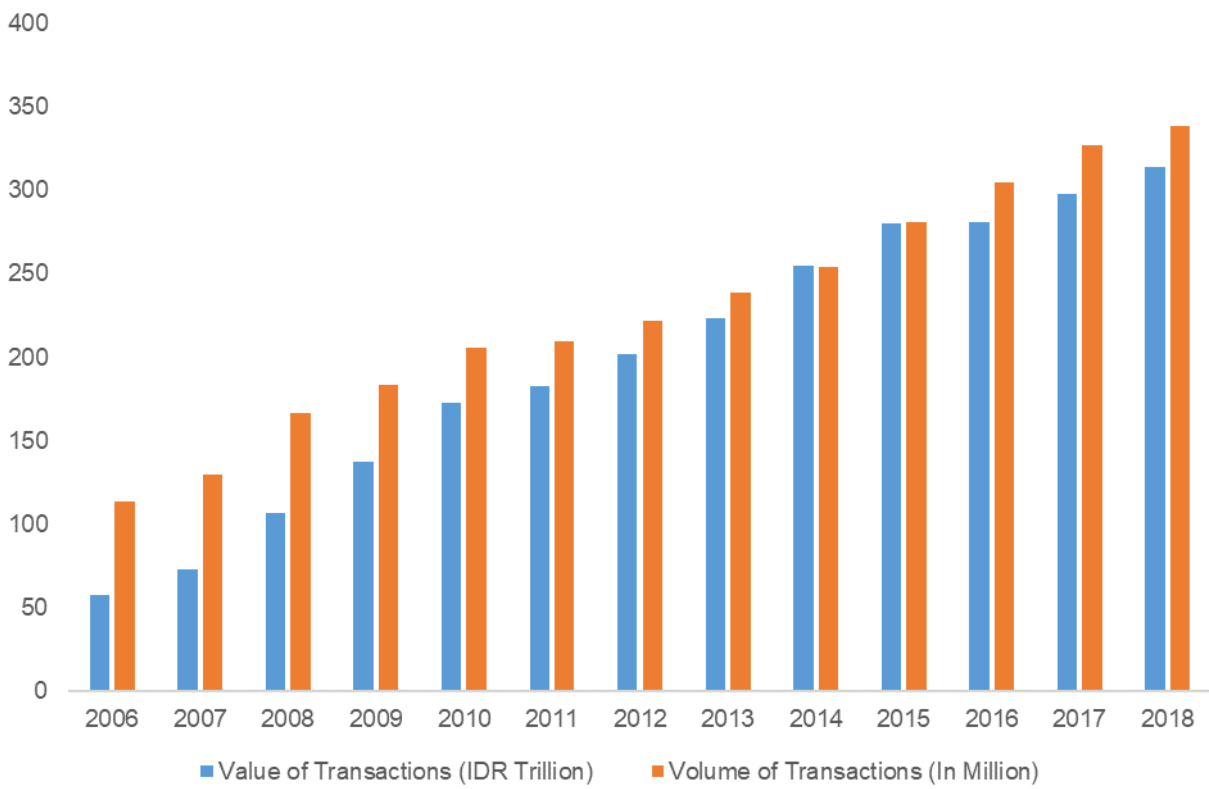


Fig. 2 Growth of Credit Card transactions (CAGR, in percentages)

The figure represents the compound annual growth of volume and value of credit card transactions in Indonesia for two sub-periods 2006-2010 and 2011-2018. The values are represented in percentages, and data comes from CEIC and Bank Indonesia website.

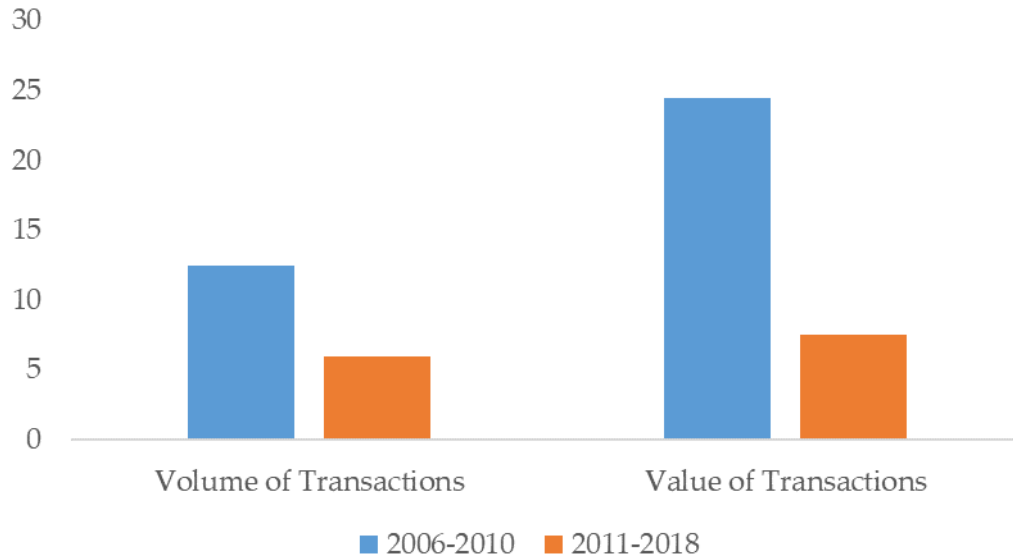


Fig. 3 Usage of Credit Card for Purchase and Cash Withdrawal

The figures represent the proportion of credit card usage (value of transactions) in terms of purchase and cash withdrawal. The values are represented in percentages for two years, i.e., 2006 and 2018, and data comes from CEIC and Bank Indonesia website.

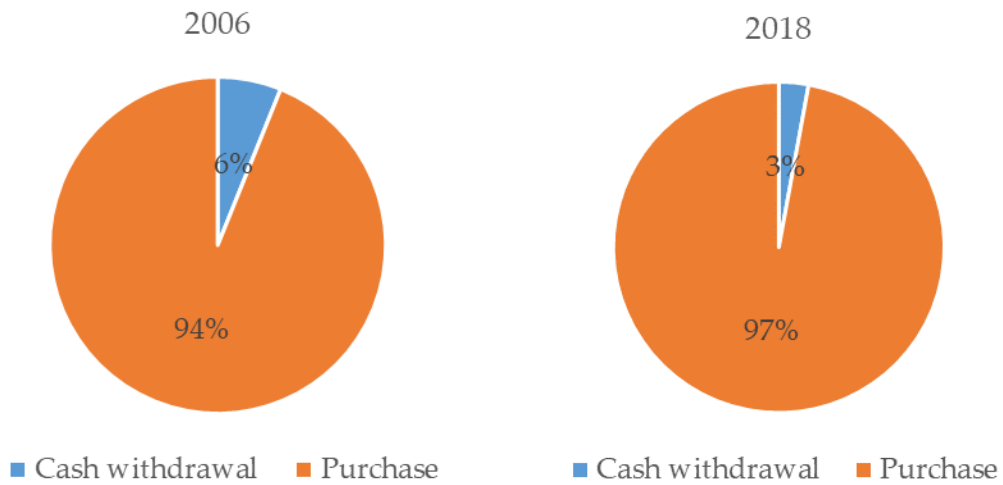


Fig. 4 Impulse Response Function (Model 1)

The figure represents the impulse response functions derived from SVAR form the Model1. The impulse response function traces the effect of a one standard deviation shock to one of the variables on current and future values of all the endogenous variables in the VAR system. Dashed lines represent the intervals of two standard deviations, while the solid lines represent the impulse function.

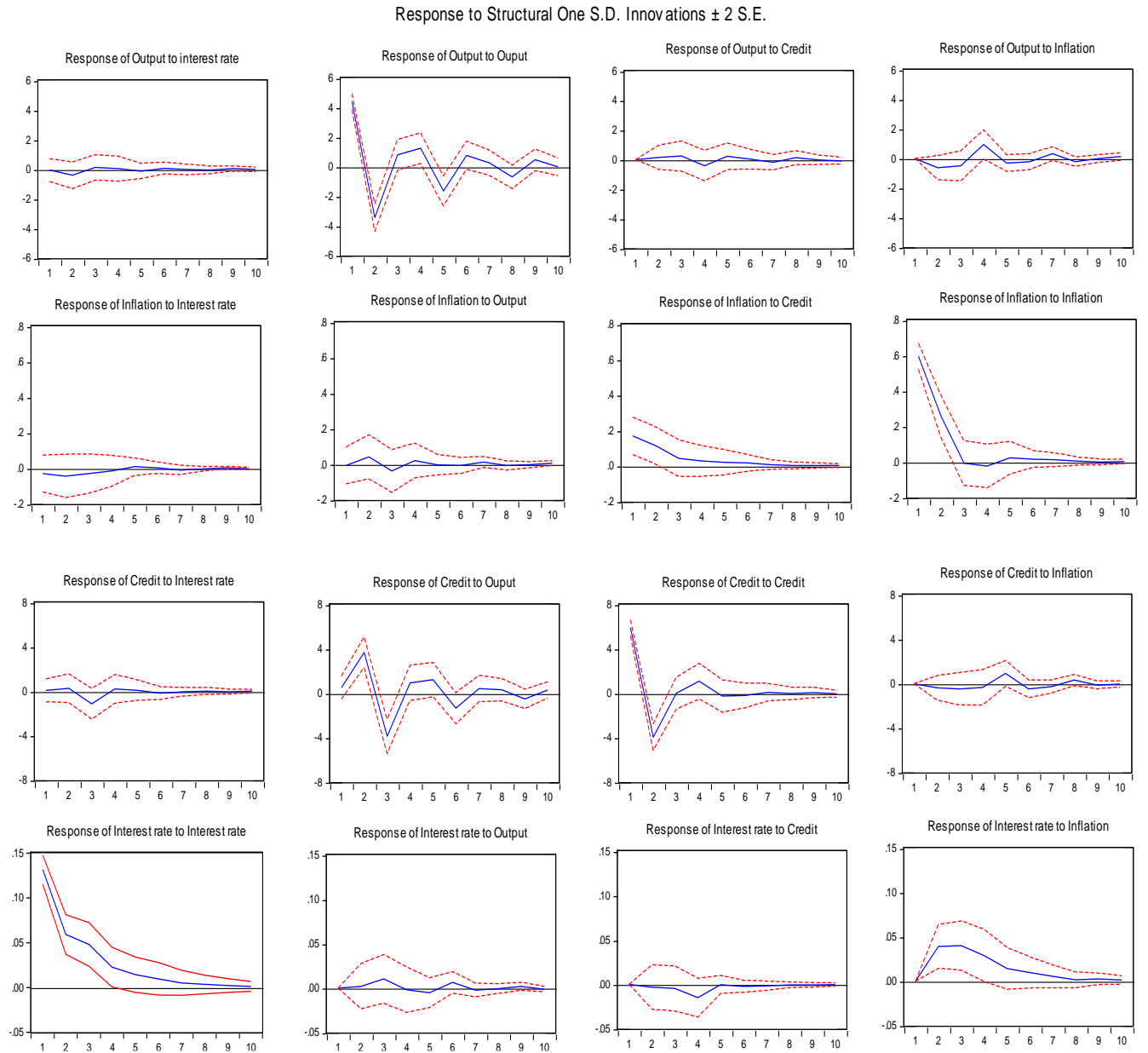


Fig. 5 Impulse Response Function (Model 2)

The figure represents the impulse response functions derived from SVAR form the Model 2. The impulse response function traces the effect of a one standard deviation shock to one of the variables on current and future values of all the endogenous variables in the VAR system. Dashed lines represent the intervals of two standard deviations, while the solid lines represent the impulse function.

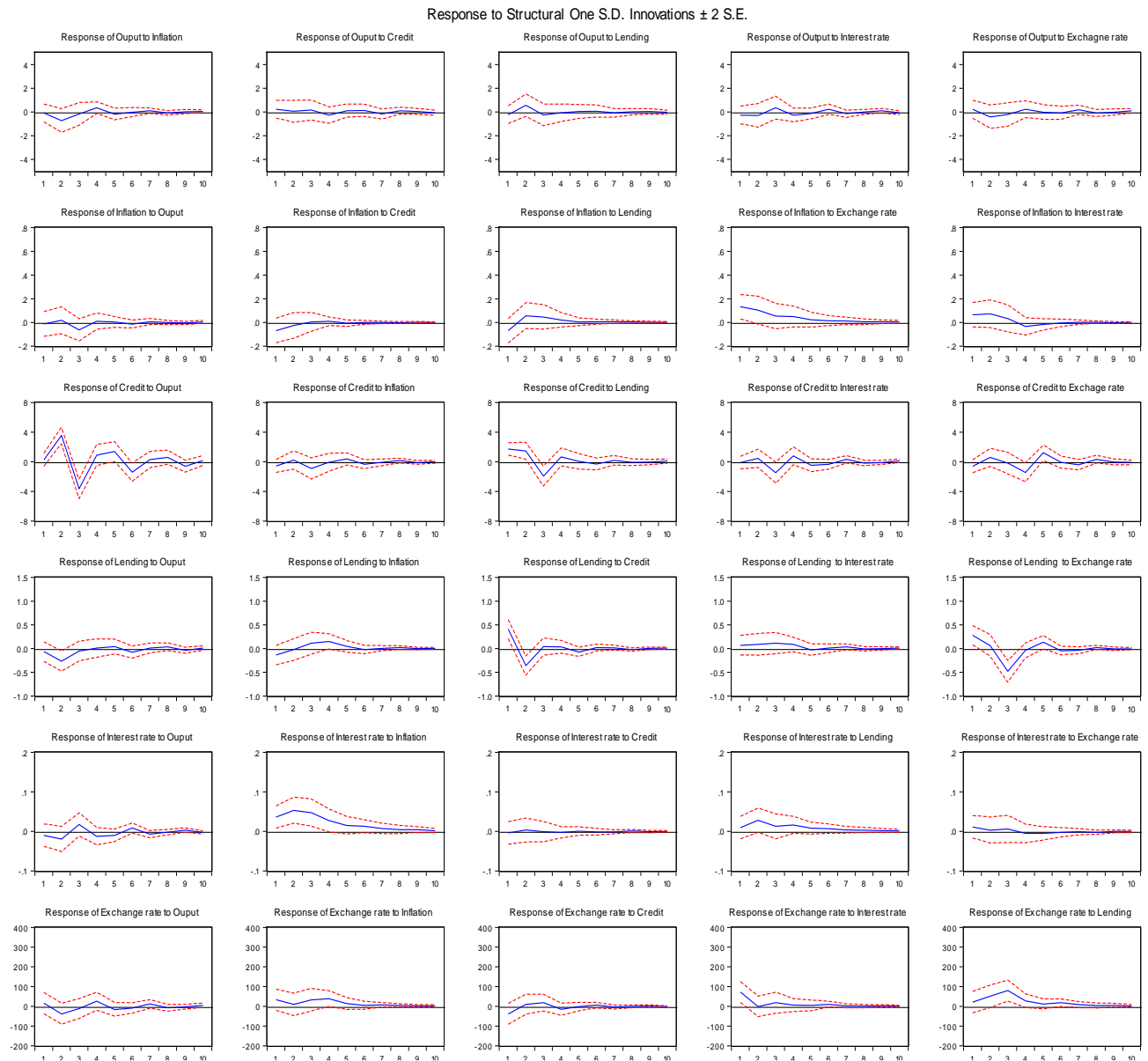


Fig. 6 Impulse Response Function (Model 3)

The figure represents the impulse response functions derived from SVAR form the Model 3. The impulse response function traces the effect of a one standard deviation shock to one of the variables on current and future values of all the endogenous variables in the VAR system. Dashed lines represent the intervals of two standard deviations, while the solid lines represent the impulse function.

