UNIVERSITY OF WAIKATO

Hamilton
New Zealand

The Impact of Remittances on Monetary Transmission Mechanisms during the Pre and Post-Conflict Eras in Sri Lanka

Jahan Abdul Raheem, Gazi M. Hassan and Mark J. Holmes

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Corresponding Author

Jahan Abdul Raheem
School of Accounting, Finance and Economics
University of Waikato
Private Bag 3105
Hamilton 3240
New Zealand

Email: ja122@students.waikato.ac.nz

Gazi M. Hassan
School of Accounting, Finance and Economics
University of Waikato
Hamilton 3240
New Zealand
Email: gmhassan@waikato.ac.nz

Mark J. Holmes
School of Accounting, Finance and Economics
University of Waikato
Hamilton 3240
New Zealand

Email: holmesmj@waikato.ac.nz

Abstract

This study analyses the impact of remittances on the monetary transmission mechanism (MTM) of the Sri Lankan economy during its conflict and post-conflict eras, using monthly data from 1996 to 2009. In addition, the study focuses on how the impact of remittances varied over different intermediate transmission channels, especially credit, asset prices, and exchange rate, in transmitting monetary policy shocks to the economy. The SVAR model is used to analyse the impact of remittances in the transmission of monetary policy shock to real economic variables. The empirical findings reveal that remittances affect the MTM of Sri Lanka in the post-conflict period significantly and their impact on bank credit and asset prices is relatively more intense than the exchange rate channel in the post-conflict period. The findings of this study also suggest that conflict-driven migration and the consequent increase in the inflow of remittances could impact monetary policy measures through wealth and liquidity effects more after the end of the conflict.

1. Introduction

Remittance inflow has been a crucial source of foreign exchange earnings for many low and middle-income countries (LMICs). These foreign exchange earnings, sent by migrant workers to their home countries, have been one of the major sources of income that reduces poverty and improves economic well-being. According to the World Bank (2019) the remittance inflow into LMICs reached USD 529 billion in 2018 and increased to USD 554 billion in 2019 (World Bank, 2020). The influx of remittances is believed to have impacts on the monetary transmission mechanism (MTM) of remittance recipient countries, challenging their macroeconomic targets (Barajas, Chami, Ebeke, & Oeking, 2018). Many studies focused on the effects of remittance inflow on the different macroeconomic variables, especially GDP, exchange rate, and institutions in low-income countries (LICs). However, only a very few studies have been undertaken so far to determine the effects of remittance inflow on the MTM. A recent study of over 163 countries undertaken by Barajas et al. (2018) reveals that remittance inflow contributes to weakening the MTM through the accumulation of loanable funds available with commercial banks. Research by Vacaflores (2012) on Latin American countries also reveals that remittance shock affects monetary policy measures. However, an investigation by Ruiz and Vargas-Silva (2010) on the impact of remittances on monetary policy variables indicates that remittance influx does not have a significant effect on monetary transmission channels.

In addition, the prevalence of civil conflict in remittance-dependent economies has been identified as another factor contributing to migration and the increase in remittance inflow. Studies have shown that a sizable proportion of remittances flow into conflict-affected countries, because a considerable proportion of people migrate to other countries as a result of conflict rather than for economic reasons (Carling, Erdal, & Horst, 2012). Furthermore, migrant diasporas also transfer funds to their home countries to support their community members during and in the aftermath of conflict (Erdal & Stokke, 2009; Gioli, Khan, & Scheffran, 2013).

The increasing amount of remittances due to conflict can contribute to an increase in the magnitude of the effects of remittances on economic variables, especially gross domestic product (GDP), price levels, money aggregates, exchange rates, and investment. In addition, the purpose of remittance inflow differs between conflict and post-conflict periods. During periods of conflict, remittances flow into the country of origin primarily for altruistic reasons to support consumption smoothing for family members (El-Sakka & McNabb, 1999; Lucas & Stark, 1985) whereas the transfer of remittances during post-conflict periods is also intended for investment purposes (Alleyne, Kirton, McLeod, & Figueroa, 2008; El-Sakka & McNabb, 1999; Yoshino, Taghizadeh-Hesary, & Otsuka, 2020).

Remittances have been identified as one of the sources of several macroeconomic challenges, particularly exchange rate appreciation, fiscal adjustment delays, weakening of institutions, and indeterminate effects on economic growth. However, the economic growth effects of remittances vary among remittance-receiving countries. These challenges have been widely researched and many studies have established the macroeconomic impacts of

remittances. Although a significant number of studies have been undertaken on other macroeconomic challenges posed by remittance inflows, to the authors' knowledge only a very few studies have investigated the impact of remittances on MTM.

Monetary policy is used to maintain economic stability in a country by maintaining appropriate levels of GDP and price. Central Banks around the world execute monetary policy measures by altering the money supply in the economy. MTM is the channel through which monetary policy measures are transferred into the real economy. The primary channels of monetary policy transmission are money supply and interest rates, while bank credit, asset prices, and exchange rates also play a significant intermediate role in monetary policy transmission.

There is research evidence that remittances affect monetary policy transmission channels. The linkage between remittances and monetary transmission channels can impact the smooth functioning of transmission channels and ultimately hamper the macroeconomic targets of monetary policy outcomes. Monetary policy transmission among countries around the world differs based on their economic and institutional backgrounds. Low-income countries (LICs), which heavily depend on remittances to finance their balance of payments (BOPs), have weaker transmission, due to their rudimentary financial markets and existing institutional set-ups. The dominance of remittance inflow into these less developed economies can further impact monetary transmission channels, leading to prolonged macroeconomic challenges.

Although some of the existing literature reveals relationships between remittances and MTM, researchers have not sufficiently focused on the impact of remittances on different monetary transmission channels, especially in the context of pre- and post-conflict eras. This study investigates whether remittances affect the functioning of intermediate monetary transmission channels and whether conflict alters the effects of remittances on these monetary transmission channels. In this respect, this article contributes to the literature in two main aspects.

(1) Firstly, this research analyses the effect of remittances on different intermediate monetary transmission channels, particularly credit, asset prices, and exchange rate channels, using the SVAR model.
(2) Secondly, this study investigates the impact of conflict on remittances in influencing MTM, which is a novel aspect of this study.

The outcome of this study will help policymakers in remittance-dependent economies and those facing conflict-driven migration to consider the impact of remittances on MTM and execute appropriate policies and strategies to minimise this impact.

Sri Lanka has been taken as a model of a developing economy for this study as it is a remittance-dependent economy in which the contribution of remittances is nearly eight percent of its GDP (CBSL, 2020). In addition it is a small, open economy, which has recovered from a three-decade-long internal armed conflict.

Figure 1: Remittances, FDI, and ODA inflow into Sri Lanka
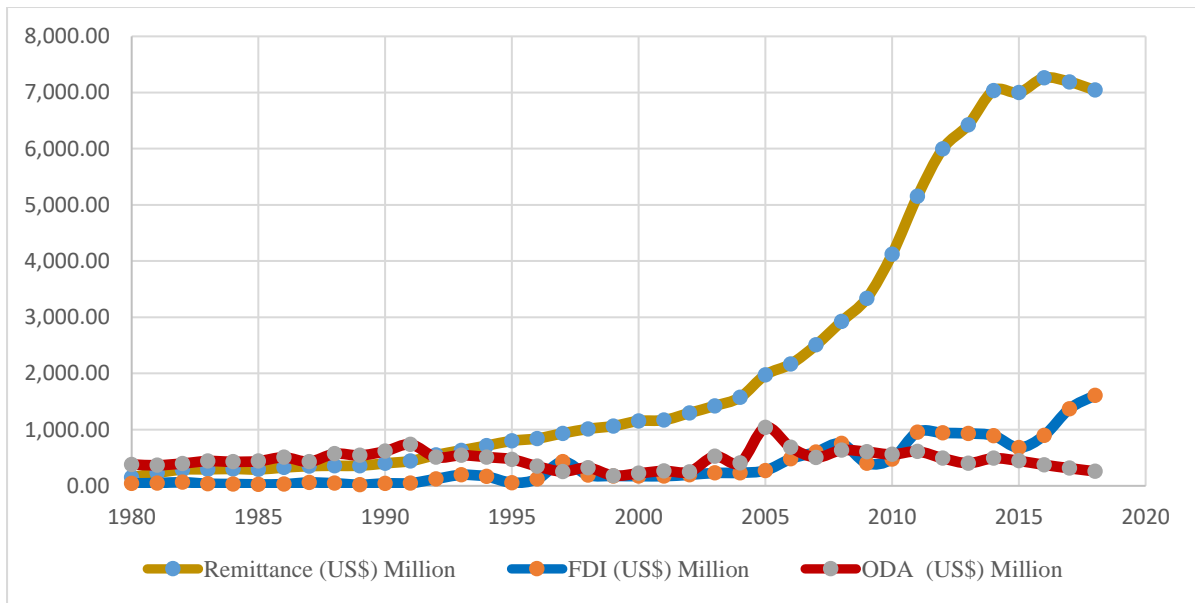
Source: IMF and World Bank statistics

Figure 2: Remittances to GDP ratio in Sri Lanka
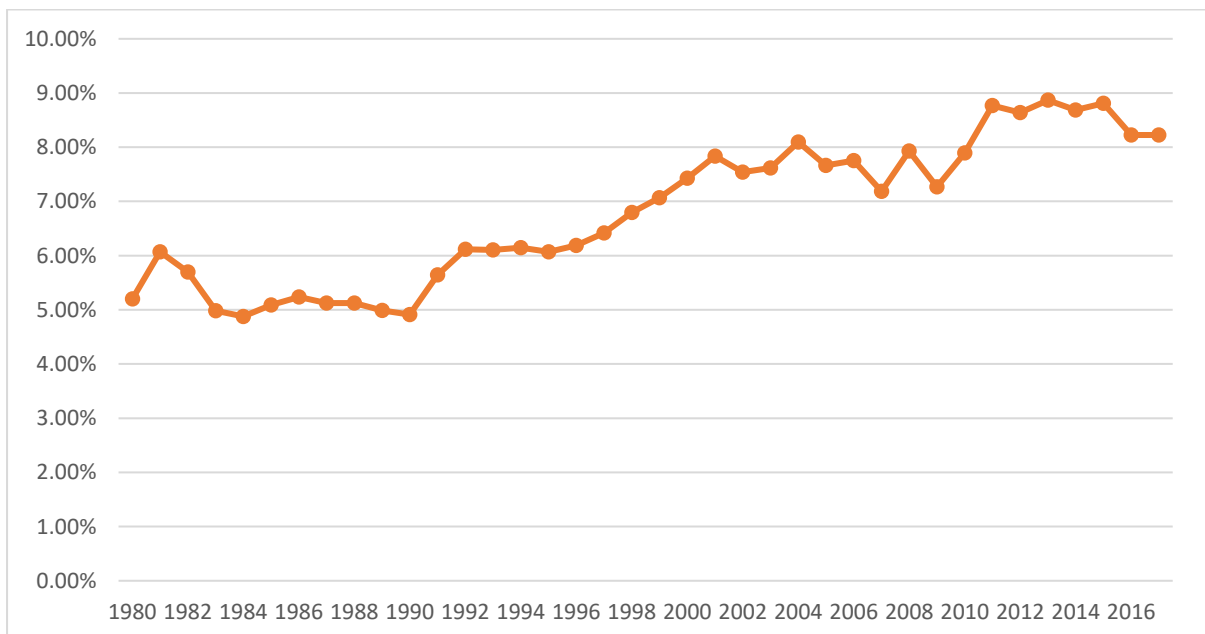
Source: IMF and World Bank statistics

The inflow of foreign remittances commenced following the 1977 economic upheaval and migration and began to increase after the commencement of the nearly three-decade-long civil conflict that lasted from the early part of the 1980s to the middle of 2009. Sri Lanka's remittance inflow has been significant in terms of its ratio to GDP and foreign exchange earnings in recent years. According to the CBSL (2020), remittance inflow into Sri Lanka was USD 6,717 million, equivalent to nearly 8 percent of its GDP and nearly 56 percent of Sri

Lanka's total exports in 2019. Moreover, the CBSL (2019) reveals that worker remittance inflow into Sri Lanka was USD 7,015 million, equivalent to 59 percent of total exports in 2018.

This study uses the SVAR model, which is suitable for capturing the dynamic effects of economic variables (Bernanke, 1986; Sims, 1986), and a significant number of previous studies that dealt with MTM used this model for empirical investigations. The SVAR model can capture the impulse responses of the transmission channels to a shock in the policy variable, using remittances as an endogenous and exogenous variable. The variations in the impulse responses of monetary transmissions channels can reveal the impact of remittances in two different periods. The empirical findings of the SVAR models for the period of conflict and post-conflict show a clear deviation in the IRs of intermediate transmission channels investigated in this study. In addition, the inclusion of remittances in the SVAR models results in explicit deviation in the outcome of empirical analysis between the two periods. Similarly, impulse responses of GDP and price level also show changes in their behaviour in the transmission of the policy shock to real variables in the two sub-periods. The inclusion of remittances significantly impacts the transmission of policy shock to output and price level in the post-conflict period compared to the conflict era in Sri Lanka. In addition, credit and asset price channels are subject to more intense effects of remittances in the post-conflict period.

2. Literature review

Remittances have been widely researched in terms of their linkage with welfare enhancement and growth acceleration (Adams & Cuecuecha, 2010; Ale, Akter, & Islam, 2018; De & Ratha, 2012; Kadozi, 2019; Lim & Simmons, 2015; Meyer & Shera, 2017; Shirazi, Javed, & Ashraf, 2018; Walker & Brown, 1995). However, recent empirical works (Barajas et al., 2018; Vacaflores, 2012) suggest that foreign remittances disturb the smooth functioning of monetary transmission channels in remittance-receiving LICs. Many studies have traditionally focused on monetary transmission in developed economies rather than developing economies. Mishra, Montiel, and Spilimbergo (2012) point out that monetary transmission is believed to be weak and unreliable in LICs and further explain that this condition prevails in LICs, especially, due to poorly developed financial markets and weak institutional characteristics. In contrast, Bulíř and Vlček (2016) point out that monetary transmission can operate in countries with underdeveloped financial markets. However, recent research by Barajas et al. (2018) on the effects of remittances in 131 countries consisting of advanced, emerging, and developing economies reveals that remittance inflow weakens monetary transmission channels, shutting down the link between policy rate and bank lending rate, which is a leading transmission channel in LICs. In addition, many studies have analysed the operation of monetary transmission channels in LICs and these also indicate that the bank lending channel has been the primary transmission channel operative in LICs compared to other transmission channels such as interest rates, exchange rates, and asset prices. However, the empirical findings of these investigations do not rule out the operation of the other channels of monetary transmission in LICs (Agha, Ahmed, Mubarik, & Shah, 2005; Alam & Waheed, 2006; Aleem, 2010). In

contrast, research by Isakova (2008) in three central Asian countries: Kazakhstan, the Kyrgyz Republic and Tajikistan, reveals exchange to be the leading monetary transmission channel in these countries. In the case of Sri Lanka, Perera and Wickramanayake (2013) empirical study shows that interest rate channel is the leading operator among the monetary transmission channels, while other channels are also functional in the economy.

The inflow of remittances also tends to have a significant effect on the exchange rate, which is one of the monetary transmission channels, in remittance recipient countries resulting in their exports become less competitive in the world market. A study by Amuedo-Dorantes and Pozo (2004) on 13 Latin American countries indicates that remittance inflow results in real exchange rate appreciation. This finding agrees with a more recent study by Hassan and Holmes (2013), who find that remittance inflow into 24 high-remittance-receiving countries leads to real exchange rate appreciation, resulting in an uncompetitive tradable goods sector. At the same time, Barajas, Chami, Hakura, Montiel, and Tressel (2011) also point out that remittance inflow causes exchange rate appreciation in remittance recipient countries. Mandelman (2013), in a study on the impact of remittances in the Philippines, finds the same result. And in a study on the nexus of remittances and exchange rates in Mexico, Rahman, Foshee, and Mustafa (2013) also note the appreciation effect of local currency over foreign currencies. Research conducted by Acosta, Baerg, and Mandelman (2009) on 109 developing and transition economies on the impact of remittances on exchange rate shows that remittances tend to exert upward pressure on the exchange rates; however, this effect becomes weaker with financial development.

Mottaleb, Sene, and Mishra (2016) reveal that remittance inflow has a significant impact on housing prices in Bangladesh. Changes in property prices could have an impact on household wealth, thereby altering the intended outcome of monetary policy actions. In addition, Jhandir (2013), finds a positive relationship between stock market development and foreign remittance in three South Asian countries: Bangladesh, India, and Pakistan. Moreover, research on migrants from Ghana shows that a part of the remittances flow into Ghana is invested into housing construction (Obeng-Odoom, 2010). The investment of remittances in the housing market could alter the expected outcome of market interest rate changes.

Although remittances can be viewed as a foreign variable that affects domestic economic variables, there is a strong linkage between remittance inflow and the domestic socio-economic background of the migrants. At the micro-level, remittances flow into home countries primarily due to altruistic purposes, and secondly as a transfer of migrants' savings to invest in assets and durable goods (Barajas et al., 2008; Batu, 2017; Chami, Fullenkamp, & Gapen, 2009; Lucas & Stark, 1985). At the same time, macroeconomic factors, especially domestic incomes, price levels, asset prices, and exchange rates also influence the remittance inflow. The relationship between domestic income and remittance inflow may be either positive or negative. Migrants can remit more to assist their family members, altruistically, in times of depressed income level (Alleyne et al., 2008) while increased income levels may attract more remittances due to investment motives and optimism about domestic economic

performance. Fluctuations in income level in the home country also affect the remittance inflow, since a sudden drop in income may demand more in remittance inflow in the home country (Jackman, 2013). At the same time, fluctuations in remittance inflow also affect the remittance-recipient countries because of their economic significance (Jackman, 2013). However, the volatility in the remittance flow is relatively small compared to other external finances, especially FDI and ODA (Ratha, 2005). Increasing price levels in the country of origin would motivate migrants to remit more to maintain the consumption expenditures of their family members in their home countries and to invest in real assets (El-Sakka & McNabb, 1999). At the same time, higher inflation in the home country and its consequent depreciation of domestic currency could result in sending less foreign currency to migrants' home countries.

The prevalence of domestic conflict also demands more remittances to support family members in the home country. Studies have revealed that ongoing conflict in the home country exerts upward pressure on sending remittances (Carling et al., 2012; Lindley, 2009) whereas remittance inflow into conflict-affected countries increases for investment purposes in the aftermath of conflict (Fagen, 2006; Gioli et al., 2013).

3. Data

Monthly data from various sources, mainly the IMF, World Bank, Central Bank of Sri Lanka (CBSL), and Colombo Stock Exchange (CSE), are used in this study. The primary variables in the study are remittances and intermediate monetary transmission channels, especially bank credit, exchange rate, and asset price. Data on remittances – transfers by migrant workers employed outside Sri Lanka – come from the International Financial Statistics (IFS) of the IMF and CBSL databases. Nominal exchange rate data are also used from the IMF data source. Data on GDP and Consumer Price Index (CPI) are obtained from the World Bank and IMF databases respectively. Standing Deposit Facility Rate (SDFR), which is used to represent interest rate, narrow money (M1), and bank credit are sourced from CBSL. The All Share Price Index (ASPI), which is used as the proxy for asset prices, was obtained from the Colombo Stock Exchange (CSE).

The sample period of the study covers from 1996: M1 to 2019: M12. Given the changes in socio-economics conditions that prevailed in Sri Lanka, the study period is divided into the conflict era (1996: M1 to 2009: M6), which covers the period of severe armed conflict, and the post-conflict era (2009: M6 to 2019: M12), which covers the aftermath of the armed conflict. The two sub-periods are used to assess the impact of remittances over the Sri Lankan MTM during the conflict and post-conflict periods. All the variables except interest rate are used in logarithmic form. Data subject to seasonal variations are seasonally adjusted using the X-12 process.

4. Methodology

This study uses structural vector autoregression (SVAR), which is one of the key empirical tools used in modern macroeconomic analysis. Vector Auto Regression (VAR) has been used in many studies to analyse the effects of monetary policy shocks (Agha et al., 2005; Aleem, 2010; Barajas et al., 2018; Mishra, Montiel, Pedroni, & Spilimbergo, 2014; Perera & Wickramanayake, 2013). The SVAR model is an extension of the VAR approach and it measures the dynamic responses of economic variables to policy shocks. The SVAR model is preferred due to criticism of the VAR model by Cooley and LeRoy (1985) regarding the inconsistency between economic theory and shocks generated by the VAR model, which is believed to have no economic interpretation. The SVAR model has been used to identify the effects of different economic policies and shocks. The primary advantage of the SVAR model is the application of necessary restrictions on the reduced form of the model to identify the structure on which the economic theory is based. The SVAR model isolates exogenous shocks and obtains the responses of endogenous variables. In addition, SVAR can be used to analyse a small number of variables compared to other existing models. Economic or policy shocks are used to generate the impulse responses (IRs) of different economic variables to estimate their dynamic response. These functions can be used to compare the dynamic effects of economic variables as economic theories predict. This research applies the SVAR model to determine the impact of remittances on monetary transmission channels; i.e. credit, exchange rate, and asset prices. The identifications used in the SVAR are based on economic theories and existing literature to exercise restrictions on the contemporaneous relationships between variables in the model rather than purely depending on the ordering of the variables (Bernanke, 1986; Kim & Roubini, 2000).

Monetary policy measures are transmitted into real economic variables, GDP, and price level via different monetary transmission channels including money supply, interest rates, bank credit, asset prices, and exchange rates. Changes in these channels ultimately impact the goods and money market operations, leading to changes in outputs and price levels in the economy. However, the interaction of these channels with other influencing economic variables results in changes in the intended policy outcome. This study has developed an SVAR model to identify the impact of remittances on the monetary transmission channels.

The IRs of monetary transmission channels in response to a shock in interest rate are presented to show how impulse responses align with economic theories and previous empirical findings. In addition, shutdown methodology is applied as proposed by Disyatat and Vongsinsirikul (2003), Nizamani, Karim, ZaidiI, and Khalid (2016), and Raghavan, Silvapulle, and Athanasopoulos (2012) to examine the effect of remittance inflow on each transmission channel during pre and post-conflict periods.

This study is modelled with the primary economic variables of GDP, price index, interest rate, money supply (M1), with the interaction of intermediate monetary transmission channels, credit, exchange rate, and asset price, in the constrained SVAR model and with

remittances in the extended base model to determine how the impact of remittances on these transmission channels varies in pre and post-conflict periods.

SVAR for this study has been modelled to show the relationship among the variables as:

$$M_0 Y_t = M_1 Y_{t-1} + \cdots + M_p Y_{t-p} + \varepsilon_t \qquad (1)$$

where Y_t is a (K × 1) vector of endogenous variables at time t. M_i is a (K × K) matrix of parameters i=0, 1……p. ε_t is a (K × 1) matrix of multivariate white noise error with the properties of E (ε_t) = 0 and E ($\varepsilon_t, \varepsilon'_{t,}$)= $\sum_\varepsilon$.

The SVAR model is estimated in two stages since the coefficients of M_0 …………M_p and values of ε_t cannot be estimated directly.

The reduced form of VAR related with (1)

$$Y_t = K_1 Y_{t-1} + \cdots + K_p Y_{t-p} + e_t \quad (2)$$

where $K_i = M_0^{-1} M_i$, $e_t = M_0^{-1} \varepsilon_t$ and $e_t \sim$ N (0, $\sum$) is estimated using the ordinary least square equation method; therefore, the residuals of e_t are the innovations corresponding to the VAR reduced form. The innovations of SVAR are related to the innovations of the reduced form by

$$\sum_e = M_0^{-1} \sum_\varepsilon (M_0^{-1})' \ (3)$$

By imposing necessary restrictions the contemporaneous matrix of M_0 is identified in the second stage and the covariance matrix of $\sum_\varepsilon$ is estimated by likelihood function maximization conditional upon the estimates of the parameters of the first stage VAR. SVAR with unrestricted dynamics with maximum likelihood estimation is as follows:

$$\ln A = -\frac{B}{2} \ln(2\pi) - \frac{1}{2} \ln [M_0^{-1} \sum_\varepsilon M_0^{-1'}] - \frac{1}{2} \hat{e}_t' (M_0^{-1} \sum_\varepsilon M_0^{-1'})^{-1} \hat{e}_t \ (4)$$

where ê is the estimated residuals of VAR from the first stage. The logarithm of the function of a sample of t= 1,2…………… T observation is given as lnA = $\sum_{t=1}^{T} ln \ A_t$

The IRs are used to assess the dynamic effects of policy and non-policy variables due to a shock in policy variables. In this study, the dynamic effects of macroeconomic variables are assessed with regard to a shock in a policy variable, which is the interest rate, in the presence of remittances in the base model and without remittances in the constrained model described in the next section. Each model consists of at least seven domestic variables, which represent both goods and money markets and the channels of monetary transmission investigated in this research.

The orthogonal monetary policy shock obtained from the SVAR model explains the effects of policy shocks on various macroeconomic variables in the economy. A number of researchers have used existing economic theories and stylised facts to identify the SVAR system that suits their study. In this context, this study uses economic theoretical background and empirical findings to identify the SVAR system for a small economy like Sri Lanka,

incorporating the general idea of Kim and Roubini (2000) for the imposition of restrictions in the model. The matrices presented in the next section summarize the identification of parameters for the SVAR approach for MTM with the inclusion and exclusion of remittances in SVAR models.

5. Estimation results

In constructing the SVAR model, stationarity tests were carried out to ensure that all variables of interest are stationary. This study uses Phillips-Perron (PP) and Augmented Dickey-Fuller tests to analyse the stationarity of the data. The results of the stationarity tests in terms of level and first difference for SDFR and log level and first differences for all other variables are presented in Table 1. All variables are stationary at their first difference; therefore, it is concluded that all variables are integrated at I (1). Secondly, the proposed SVAR models were tested for stability of the models and serial correlation.

Schwarz information criteria (SC) and the Hannan-Quinn (HQ) information criterion propose a lag length of 2 as optimal. This study chooses a lag length of 4 for all estimations since choosing a shorter lag length could fail to identify the underlying mechanics in the model and lead to the autocorrelation of residuals (Disyatat & Vongsinsirikul, 2003). At the same time, choosing a longer lag length may lead to losing degrees of freedom.

Table 1: Unit root test statistics

Variables	Phillips-Perron test statistic		Augmented Dickey fuller (AIC)		Augmented Dickey fuller (SCI)		Augmented Dickey fuller (HQ)	
	Log	1st Difference	Log	1st Difference	Log	1st Difference	Log	1st Difference
	test-stat	test-stat	test-stat	test-stat	test-stat	test-stat	test-stat	test-stat
GDP	5.0714	-2.1231**	1.6787	-2.1088**	1.6787	-2.1088**	1.6787	-2.1088**
CPI	6.9119	-12.7004***	4.5486	-4.2460***	6.7990	-4.7552***	4.5486	-4.2460***
M1	7.6837	-19.5512***	4.1954	-3.7054***	4.1954	-3.7054***	4.1954	-3.7054***
CREDIT	9.4107	-10.7867***	4.1312	-2.2895**	5.0609	-2.5720***	4.1312	-2.5720***
ER	4.5269	-12.5511***	4.4016	-6.7357***	4.4016	-11.6411***	4.4016	-6.7357***
ASPI	1.5767	-14.9811***	1.6096	-6.5446***	2.0906	-14.4760***	1.7897	-14.4760***
REMIT	0.8193	-18.9263***	0.8190	-11.5619***	0.6214	-18.6632***	0.6214	-18.6632***
	Level	1st Difference	Level	1st Difference	Level	1st Difference	Level	1st Difference
	test-stat	test-stat	test-stat	test-stat	test-stat	test-stat	test-stat	test-stat
SDFR	-1.3695	-17.1393***	-0.7369	-9.3283***	-0.7369	-9.3283***	-0.7369	-9.3283***

CPI- Consumer price index, SDFR-Standing deposit facility rate, Exrate-Exchange rate, ASPI-All share price index, REMIT: Remittances.

*** Indicates statistically significant at 1 percent level of testing, ** indicates statistically significant at 5 percent level of testing.

Identification of SVAR base model

$$
\begin{array}{c}
\text{vGDP} \\
\text{vCPI} \\
\text{vM1} \\
\text{vSDFR} \\
\text{vCredit} \\
\text{vASPI} \\
\text{vExrate} \\
\text{vRemit}
\end{array}
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
a21 & 1 & 0 & 0 & 0 & 0 & 0 & a28 \\
a31 & a32 & 1 & 0 & 0 & 0 & 0 & a38 \\
0 & 0 & a43 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & a54 & 1 & 0 & 0 & a58 \\
0 & 0 & a63 & a64 & 1 & 1 & 0 & a68 \\
a71 & a72 & a73 & a74 & a75 & a76 & 1 & a78 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1
\end{bmatrix}
\begin{array}{c}
\text{uGDP} \\
\text{uCPI} \\
\text{uM1} \\
\text{uSDFR} \\
\text{uCredit} \\
\text{uASPI} \\
\text{uExrate} \\
\text{uRemit}
\end{array}
$$

where vGDP, vCPI, vM, vSDFR, vCredit, vASPI, vExrate, and vRemit are, respectively, the shocks by output, price level, money supply, interest rate, bank credit, asset prices, exchange rate, and remittances. uGDP, uCPI, uM1, uSDFR, uCredit, uASPI, uExrate, and uRemit are the residuals that reveal the unanticipated movements of regressors respectively.

The first block in the model is the non-policy block, which represents the goods market equilibrium of the economy. The first equation represents output, which is not contemporaneously affected by all other variables; however, it is affected by the lag of other variables as indicated in a significant number of studies (Anh, Quan, Phuc, Chi, & Duc, 2018; Can, Bocuoglu, & Can, 2020; Raghavan et al., 2012). Secondly, the price level is subject to the contemporaneous effect of GDP (Can et al., 2020; Raghavan et al., 2012; Vinayagathasan, 2014) and remittances. All other variables in the model affect price level with a lag.

The second block, which consists of the policy instruments of the Central Bank, represents the money market equilibrium in the economy. Money supply and interest rate contemporaneously respond to the price level (Cushman & Zha, 1997; Kim & Roubini, 2000; Rafiq & Mallick, 2008) revealing Tylor rule identification, which shows monetary policy reaction in response to the state of the economy. M1, the narrow money balance, contemporaneously responds to output, price level, and the inflow of remittances into the country. The policymakers in Central Banks take monetary policy decisions primarily based on information regarding the current price level; therefore, interest rate contemporaneously depends on both price level and money supply.

The next block, which consists of bank credit, asset prices, and exchange rate, represents the remaining monetary policy transmission channels in the economy. Bank credit is contemporaneously affected by interest rate and remittances and by the lag of other variables in the economy. The reason behind this assumption is that customer borrowing changes, primarily, based on the prevailing market interest rate (Berkelmans, 2005; Rabab'ah, 2015). Stronger credit growth is also associated with expansionary monetary policy measures (Berkelmans, 2005). Furthermore, the traditional monetary view emphasizes that consumers and investors react to monetary policy measures with a lag; therefore, it is assumed that variables other than interest rate will affect the credit channel with a lag. Moreover, the lagged relationship between output and lending behavior has been identified in previous studies

regarding bank credit (Romer, Romer, Goldfeld, & Friedman, 1990). Bank credit is assumed to responds to remittance in the same period as the immediate relationship between remittances and bank credit, as has been emphasised in previous studies (Awdeh, 2016; Brown & Carmignani, 2015). The asset price, contemporaneously responds to money, interest rates (Raghavan et al., 2012) and remittance inflow, as remittances increase the availability of funds for investment in the stock market (Issahaku, Abor, & Harvey, 2017), and thus stock market prices in the current period. In addition, it is assumed that all the variables contemporaneously affect the exchange rate since it is a forward-looking asset price that reacts immediately to all market variables (Can et al., 2020; Cushman & Zha, 1997; Kim & Roubini, 2000; Raghavan et al., 2012). However, the exchange rate is assumed to have no instantaneous effect on other variables in the SVAR model.

Finally, the remittances do not contemporaneously depend on other variables; however, all the variables affect remittances with a lag. Although remittances can be viewed as a foreign variable, the transfer of remittances into the domestic economy and its volume is affected by domestic output, price levels, interest rates, credit, and exchange rates (Alleyne et al., 2008; El-Sakka & McNabb, 1999).

The base model is modified by applying the shutdown methodology as proposed by Disyatat and Vongsinsirikul (2003), Nizamani et al. (2016), Raghavan et al. (2012), and Ramey (1993) to assess the impact of remittances on monetary transmission channels. In this constrained SVAR model, remittances are muted to eliminate their effect on MTM. The constrained model eliminates all the effects of remittances passed through monetary transmission channels in the base SVAR model.

Identification of SVAR constrained model

vGDP	1	0	0	0	0	0	0	uGDP
vCPI	a21	1	0	0	0	0	0	uCPI
vM1	a31	a32	1	0	0	0	0	uM1
vSDFR	0	0	a43	1	0	0	0	uSDFR
vCredit	0	0	0	a54	1	0	0	uCredit
vASPI	0	0	a63	a64	1	1	0	uASPI
vExrate	a71	a72	a73	a74	a75	a76	1	uExrate

Table 2 summarizes the IRs of economic variables to a contractionary monetary policy shock in conflict and post-conflict periods, tested in both base and constrained SVAR models. The first column in Table 2 shows the expected outcome of IRs according to the theoretical background. The estimations show that some of the IR movements are not statistically significant; however, most IR performances in the models are economically significant. All the IRs, except price level, reveal the expected, economically significant movement aligning with economic theories and previous empirical findings relating to MTM. The price puzzle exists not only in both models but also in two sub-periods. The existence of the price puzzle has been

a common issue in many previous empirical studies on MTM. This issue offers the possibility for further investigation to study the presence of the price puzzle in the Sri Lankan case.

The movement of IRs shows the theoretically consistent relationship between GDP and interest rate. A positive shock in interest rate initially leads to a fall in GDP, which gradually increases to reach its initial level in both post-conflict and conflict periods. Similarly, money aggregates fall in response to a positive shock in interest rate in both periods. In addition, bank credit also falls with a positive innovation in interest rate, following an initial increase in both conflict and post-conflict periods. The initial increase in bank credit due to a positive shock in interest rate shows that immediately after the shock in interest rate, borrowing increases to minimise the impact of the foreseen economic downturn. Similar findings have been noted in previous studies (Bernanke & Blinder, 1992; Romer et al., 1990), which explain that the initial increase in credit is aimed to cover upcoming expenses during a recession.

Table 2: Impulse responses of variables to a contractionary monetary policy shock in SDFR

Variables	Expected outcome	Base SVAR Model	Constrained SVAR Model
Conflict period			
GDP	-	-	-
CPI	-	+ *	+ *
Money	-	-	-
Interest rate	+	+	+
Asset Prices	-	-	-
Exchange rate	+	+	+
Remittances	-	-	
Post-conflict period			
GDP	-	-	-
CPI	-	+ *	+ *
Money	-	-	-
Interest rate	+	+	+
Asset Prices	-	-	-
Exchange rate	+	+	+
Remittances	-	-	

*Price puzzle: Increase in price level instead of decrease due to contractionary monetary policy innovation.

ASPI falls due to a positive shock in interest rate in both conflict and post-conflict periods. The fall in asset prices is associated with the increasing cost of investment in assets caused by the interest rate hikes. A positive shock in interest also leads to the appreciation of the domestic currency in both periods. Furthermore, a positive innovation in interest rates leads to a fall in remittances, which then increase toward their initial level later. The impulse response of remittances to a positive shock in interest rate shows a decline in the inflow of remittances in both periods. The decline in remittance inflow is due to an appreciation in the domestic

currency as remitters are not motivated to transfer funds (Lin, 2011; Rahman et al., 2013). The price level increases in response to a positive shock in interest rate instead of declining.

The existence of a price puzzle in both conflict and post-conflict periods may be related to price rigidity, exchange rate appreciation, and increased cost of borrowing due to interest rate hikes. The price puzzle has been a common issue in many studies dealing with monetary policy transmission mechanisms in the past. All the impulse responses of the variables, except price level, show economically significant relationships to a contractionary monetary policy shock in both conflict and post-conflict periods. The IRs are presented in the appendix.

This section explains how the monetary transmission channels subject to investigation in this study react to orthogonal shock in the policy variable (interest rate) in conflict and post-conflict periods. The shocks are measured in 1 standard deviation of the orthogonal errors for the two different periods analysed in this study. Table 3 summarises the IRs of intermediate transmission channels as well as GDP and CPI in both the base and constrained SVAR models for the two sub-periods.

Figure 3 displays that a contractionary monetary policy shock leads to a similar reaction in credit channel in both SVAR models, with an increase in borrowing during the initial period, during which short-term borrowing increases and then begins to fall during both the conflict and post-conflict periods. It is plausible that firms' short-term borrowing increases after an unanticipated contractionary monetary policy shock in order to finance expenses due to recession and to build up inventories. A positive shock in SDFR leads to a fall in credit due to an increase in market interest rates, and thus a declining demand for credit. After nearly a year, the inclusion of remittances in the SVAR model leads to worsening contraction of credit in response to a contractionary monetary policy shock in the post-conflict period compared to the period of conflict. The reason behind this could be that remittances build up loanable funds available at commercial banks (Barajas et al., 2018); therefore, credit becomes less responsive to interest rate shock in the post-conflict period. In addition, the main purpose of remittance inflow into the economy during the conflict period is to support the living expenses of family members (Carling et al., 2012). However, after the end of the conflict, inflowing remittances could contribute to savings and investment purposes (Issahaku et al., 2017); therefore, remittance inflow deposited with commercial banks could build up their loanable funds.

A positive shock in SDFR leads to a fall in ASPI. This is the outcome of falling demand for assets due to the increased cost of investment. The IR performance of ASPI to a contractionary monetary policy shock has the same outcome in both the conflict and post-conflict periods. However, in the post-conflict period, the contraction of ASPI worsens with the inclusion of remittances in the SVAR model nearly 6 months after the interest rate shock. This shows that remittances weaken the functioning of the asset price channel, especially in the post-conflict period. A major reason for this outcome is probably the use of remittances for savings and investment purposes, so that remittances build a resistance (Barajas et al., 2018) to interest rate shocks that are transmitted via asset prices.

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Table 3: Summary of impulse response movements

Economic Variables	Conflict Period		Post-conflict period	
	Base model	Constrained model	Base model	Constrained model
Credit	Persistent decline with initial increase	Persistent decline with initial increase	* Persistent decline with initial increase * Worsening contraction of credit	Persistent decline with initial increase
Asset Prices	Transitory decline	Transitory decline	* Transitory decline * Worsening contraction of asset prices	Transitory decline
Exchange rate	Persistent increase	* Persistent increase * More appreciation effect	* Transitory increase * More appreciation effect	Transitory increase
GDP	Persistent decline	Persistent decline	* Transitory decline * Worsening contraction	* Transitory decline
CPI	Transitory decline with initial price puzzle	Transitory decline with initial price puzzle	* Persistent increase * Worsening price puzzle	* Persistent increase

A positive shock in SDFR leads to an appreciation of the domestic currency due to an increase in the market interest rate. The inclusion of remittances in the model does seem to affect the exchange rate channel in both periods. However, the pattern and existence of the exchange rate effect vary in the two sub-periods. In the post-conflict period, the inclusion of remittances leads to short-lived appreciation, followed by depreciation until the seventh month, while in the conflict period, remittances seem to undermine appreciation from the sixth to the fourteenth month. As Sri Lanka used a managed floating exchange rate regime, it is difficult to measure the impact of interest rate shock on the exchange rate and the influence of remittances on its transmission of monetary policy shocks.

Figure 4 shows that a shock in the interest rate leads to a worsening contraction in GDP as well as the prolonged existence of the price puzzle with the inclusion of remittances (base model) in the post-conflict period. The constrained model in the post-conflict period improves the contraction in GDP and reduces the price puzzle in comparison. In contrast, the base model shows improved transmission of interest rate shocks to GDP and CPI in the conflict period. The inclusion of remittances leads to improvement in the contraction in GDP and minimizes the existence of the price puzzle in a contractionary monetary policy shock. However, the difference in the performance of IRs of both GDP and CPI are relatively minimal between the base and constrained model during the period of conflict. The IRs for GDP and CPI show that remittances do not seem to have a significant impact on MTM in Sri Lanka during the period of conflict. However, they seem to have significantly weakened the transmission in the post-conflict period.
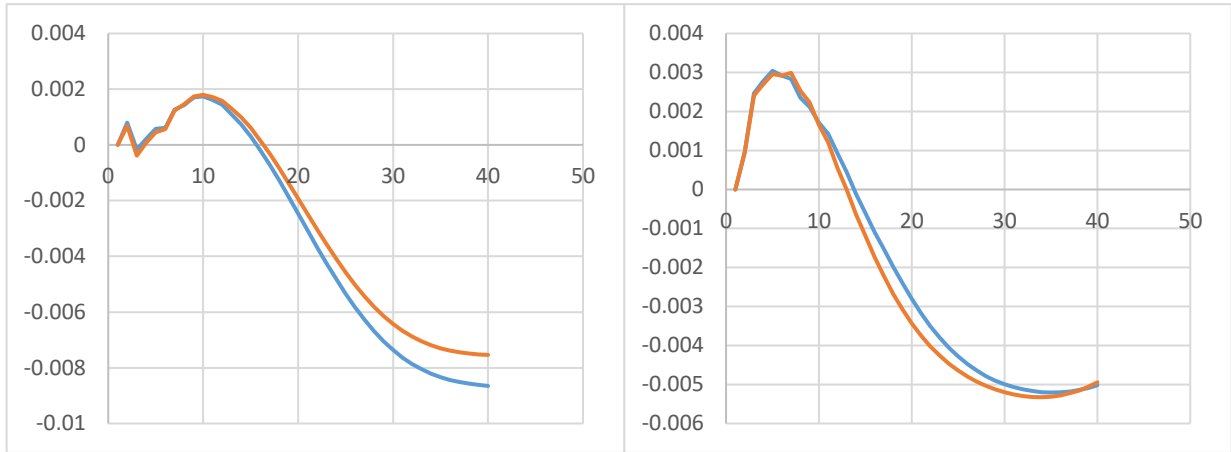
Figure 3: IRs of transmission channels to 1 SD shock in SDFR
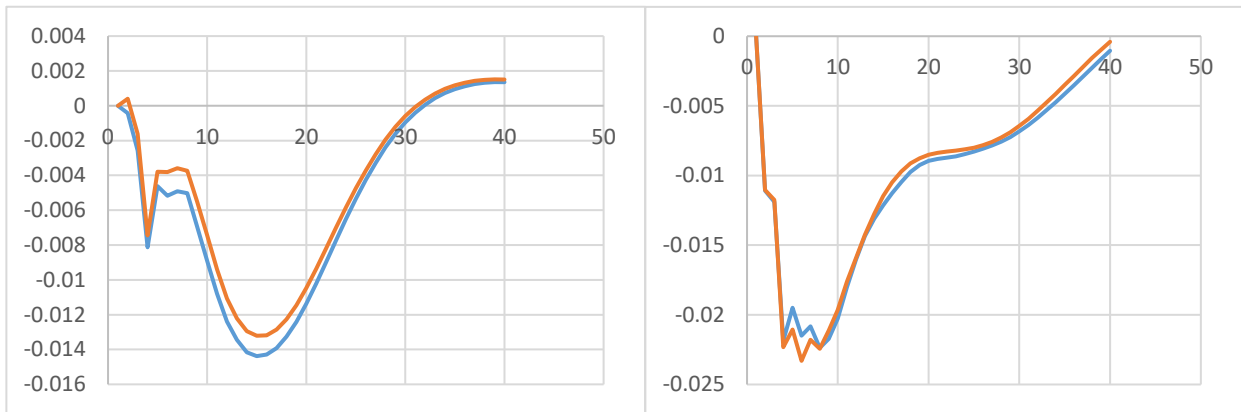
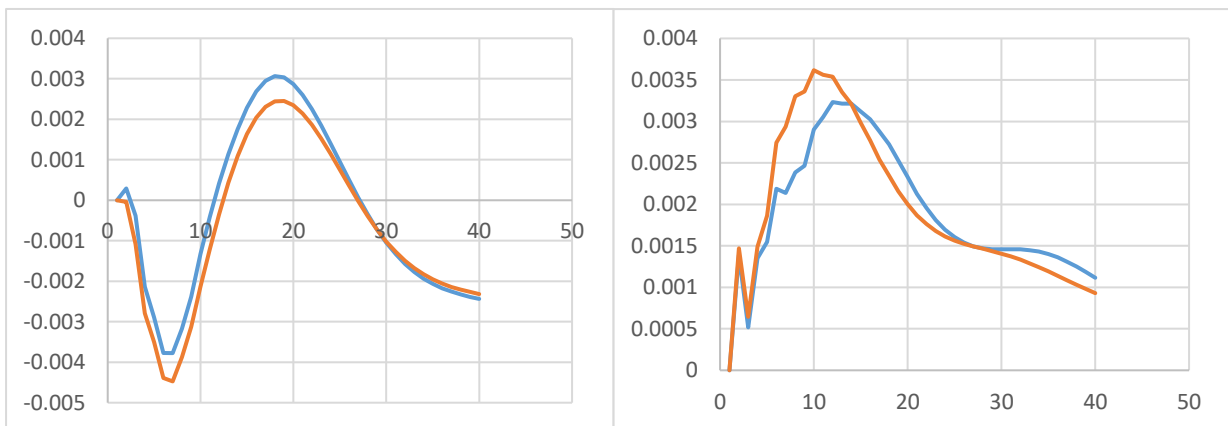**Post-conflict period**   **Conflict period**

Response of Credit to a shock in SDFR

Response of ASPI to a shock in SDFR

Response of Exrate to a shock in SDFR

——— Base model   ——— Constraint model

Figure 4: Response of GDP and CPI to 1 SD shock in SDFR

Post-conflict Period   Conflict Period

Response of GDP to a shock in SDFR

Response of CPI to a shock in SDFR
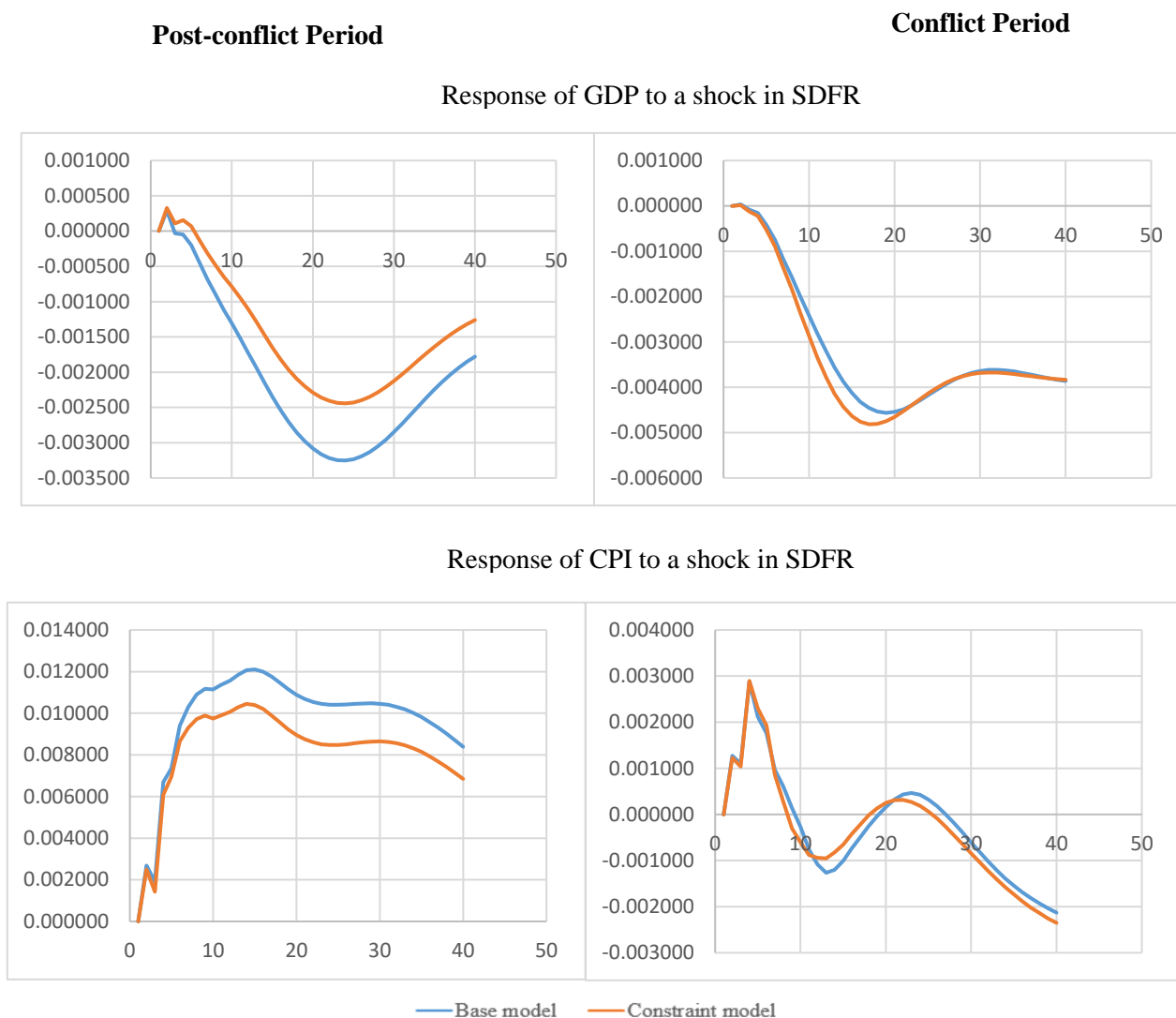

— Base model   — Constraint model

Figure 5 shows that muting credit channels along with remittances leads to worsening contraction in GDP to a positive innovation in SDFR in the post-conflict period. However, muting credit with or without remittances results in an improved contraction in GDP in the period of conflict. In addition, exogenising credit without remittances does not show a significant change in the IRF of GDP in the period of conflict. The worsening contraction of GDP in response to a positive shock in SDFR could be associated with the increase of credit prompted by the increase in loanable funds from remittances in the post-conflict period. Exogenising credit with or without remittances does not produce significant changes in the prolonged effect of the price puzzle in the conflict period. However, exogenising credit with remittances leads to a relatively more prolonged price puzzle in the post-conflict period. This indicates that remittances impact the operation of the credit channel in transmitting the interest rate shock to CPI in the post-conflict period compared to the conflict period. The common observation is that the effect of remittances on the functioning of the credit channel has been more intense in the post-conflict period compared to the period of conflict in Sri Lanka.

Figure 5: Response of GDP to a shock in SDFR-Credit Channel

Post-conflict Period   **Conflict Period**

Response of GDP to a shock in SDFR

Response of CPI to a shock in SDFR

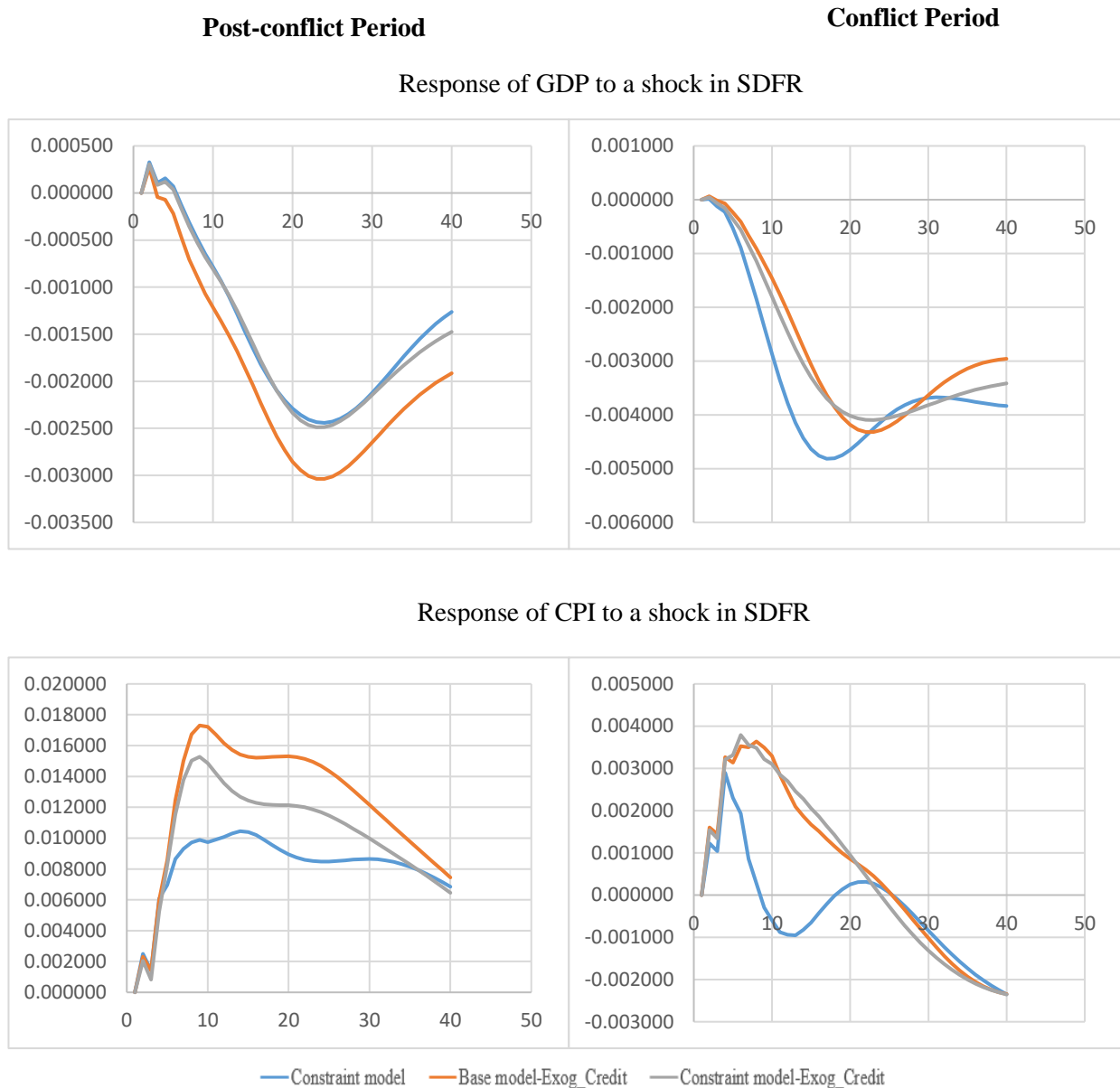—— Constraint model   —— Base model-Exog_Credit   —— Constraint model-Exog_Credit

Figure 6 shows that muting ASPI with or without remittances leads to worsening contraction in GDP during both the conflict and post-conflict periods. Muting ASPI with or without remittances does not show a significant change in the IRs of GDP in the conflict period. However, the impact of remittances leads to an apparent impact on the asset price channel in transmitting the contractionary monetary policy shock to GDP in the post-conflict period. Similarly, muting ASPI with remittances leads to more prolonged existence of the price puzzle in the post-conflict period. At the same time, exogenising ASPI with or without remittances does not show a significant change in the IRs of CPI in the conflict period. The outcome of IR estimates shows that remittances significantly influence asset prices in the post-conflict period.

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Figure 6: Response of GDP to a shock in SDFR-Asset price channel

Post-conflict Period   **Conflict Period**

Response of GDP to a shock in SDFR

Response of CPI to a shock in SDFR

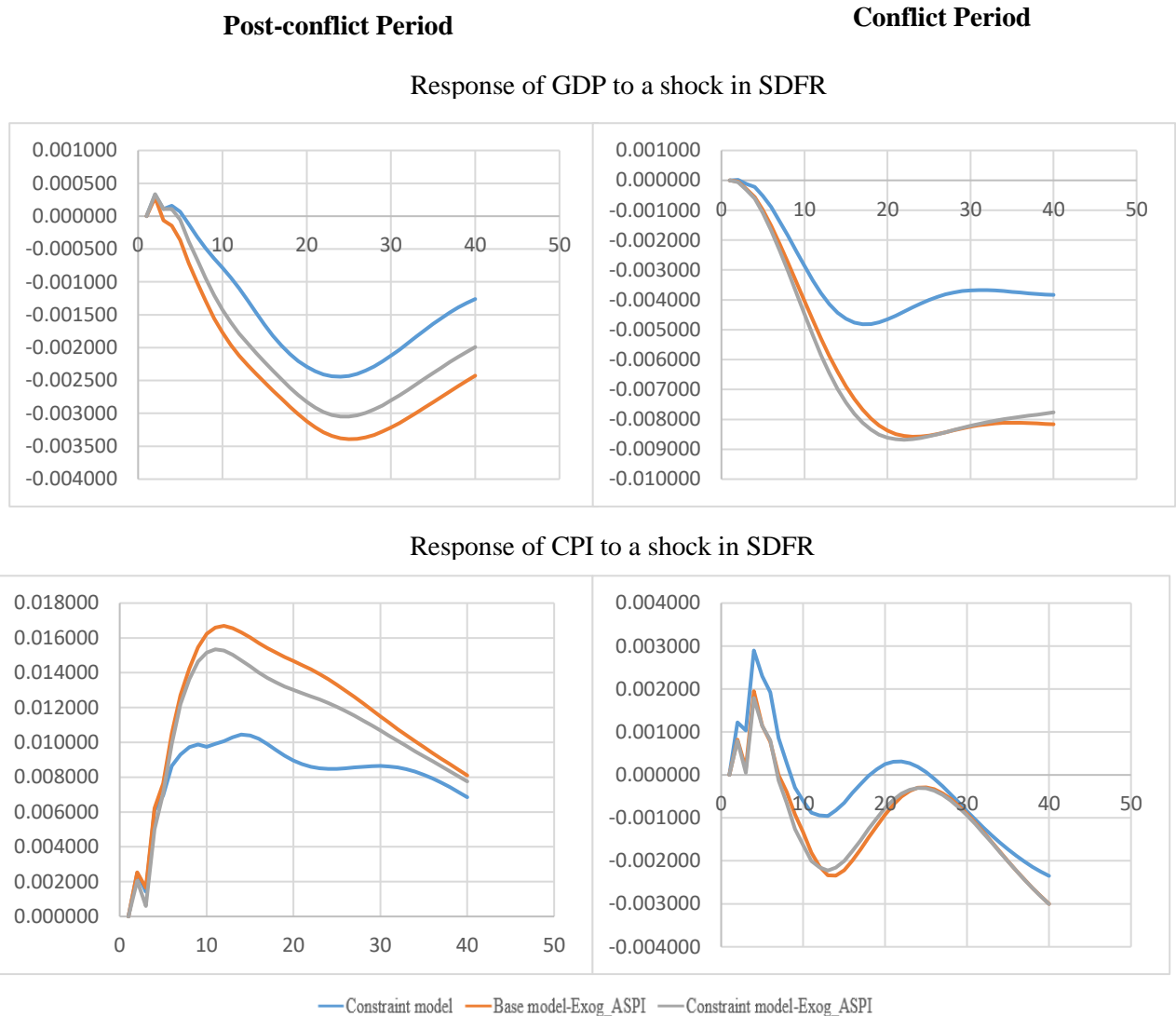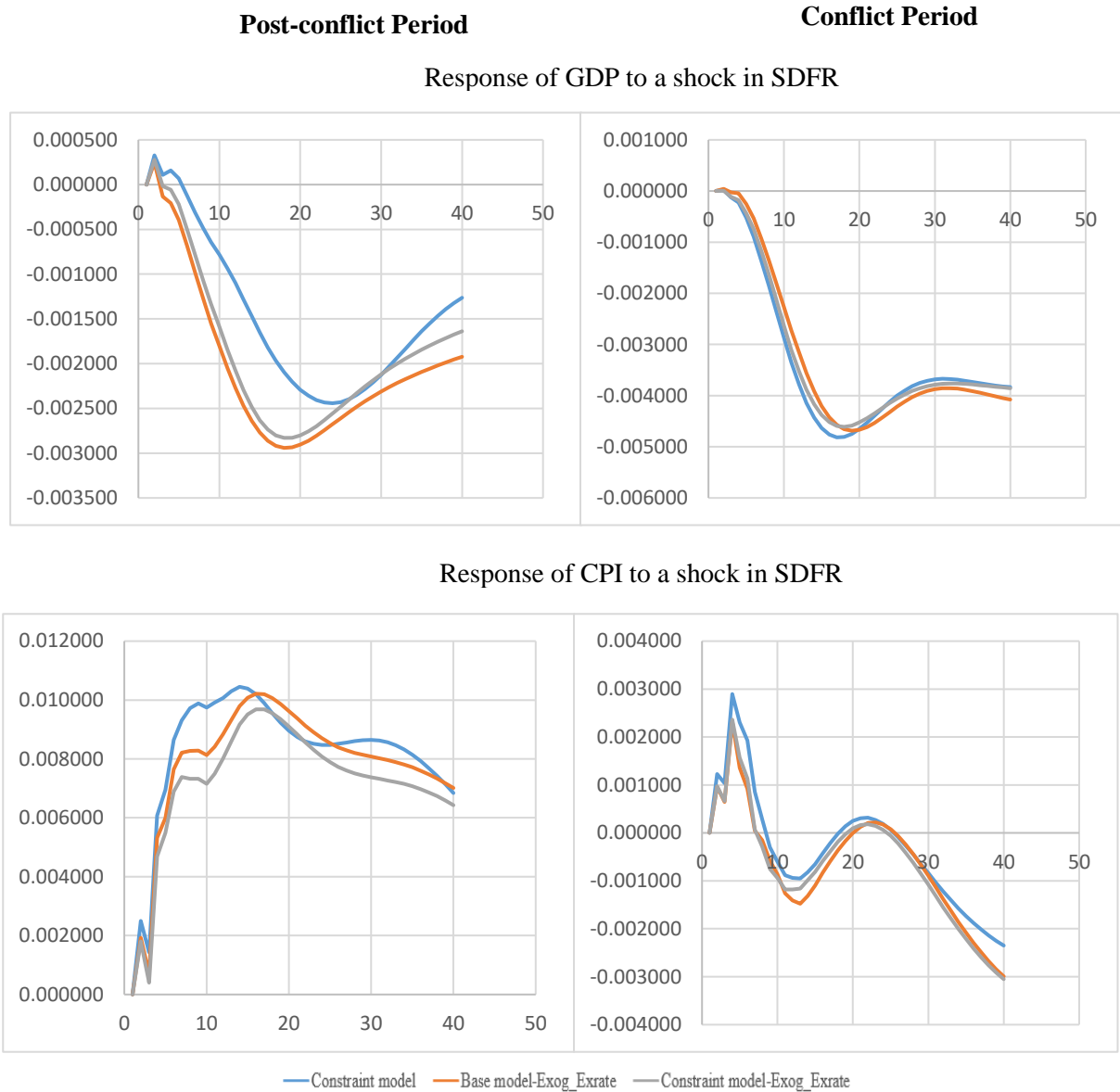—Constraint model   —Base model-Exog_ASPI   —Constraint model-Exog_ASPI

Figure 7 shows that muting the exchange rate channel with or without remittances does show a significant change in the IRs of GDP to a contractionary interest rate shock in the period of conflict. However, muting the exchange rate in the post-conflict period results in worsening contraction in GDP in response to a positive interest rate shock. Similarly, muting the exchange rate does show a significant change in the IRF of CPI to a contractionary monetary policy shock in most of the months during the conflict period. However, exogenising the exchange rate leads to varied changes in the IRs of CPI from the fourth month onward after the shock occurred.

6. Summary of empirical analysis

The impact of monetary transmission channels can be analyzed, primarily, based on the IRs of the real variables, output and price level, and the movement of intermediate transmission channels. The IRs reveal the cumulative impact of transmission channels on output and price level to a shock in the policy variable: the interest rate. The impact of remittances is also transmitted to real economic variables through the intermediate monetary transmission channels: bank credit, asset prices, and exchange rate. In addition, changes in the movement of

these intermediate channels also reveal the impact of remittances on these channels to a shock in policy variable. This study applies two SVAR models to identify the impact of remittances through the intermediate monetary transmission channels. The base model treats remittances as an endogenous variable whereas the constrained model treats remittances as an exogenous variable, thereby muting all the impact of remittances on these intermediate channels.

Figure 7: Response of GDP to a shock in SDFR-Exchange rate channel

Post-conflict Period   **Conflict Period**

Response of GDP to a shock in SDFR

Response of CPI to a shock in SDFR

—— Constraint model   —— Base model-Exog_Exrate   —— Constraint model-Exog_Exrate

The IRs estimated for the base SVAR model and the constrained model with the mutation of remittances in both the period of conflict and post-conflict are mostly consistent with the predictions of economic theories and existing empirical works carried out on MTM. The IRs to a 1 SD shock in SDFR in the base model lead to significant changes in the responses of intermediate transmission channels compared to the constrained model, thereby significantly affecting GDP and price level in the post-conflict period. This reveals that remittances play a

crucial role in influencing the monetary policy transmission mechanism, especially, in the post-conflict period in Sri Lanka.

Most of the monetary transmission channels react to interest rate shock within a short period after the shock occurs. The credit channel is the prominent channel for transmitting the interest rate shock to GDP, followed by the exchange rate and asset price in the conflict and post-conflict periods. The inclusion of remittances in the model generates changes in the outcome of IRs in the two sub-periods. However, the inclusion of remittances influences the transmission of policy shocks to GDP more in the post-conflict period compared to the period of conflict that prevailed in Sri Lanka. Similarly, the impact of remittances on the MTM is also present in the transmission of policy shocks to CPI in the post-conflict period. In addition, changes in the movement of intermediate transmission channels, particularly in credit and asset prices, also align with these effects. A plausible reason for this is the use of remittances as a source of savings and investment rather than solely a financing source for consumption smoothing during the post-conflict period: therefore, it could lead to wealth and liquidity effects. The peaceful environment prevailing in Sri Lanka has been conducive to new investment opportunities and the restoration of means of livelihood may have diverted the remittance inflow more towards savings and investment opportunities. Overall, remittances have a noticeable impact on monetary transmission channels in Sri Lanka, especially during the post-conflict period, thus ultimately affecting output and price levels through intermediate monetary transmission channels.

7. Concluding remarks

This study has demonstrated how remittance inflow affects monetary policy transmission channels and the intended outcome of monetary policy in the conflict and post-conflict periods in Sri Lanka. After the review of literature related to MTM and remittance inflow, SVAR models were developed to differentiate the effects of remittances in the transmission of monetary policy shock to real economic activities during the two sub-periods identified for this investigation. In the SVAR models developed for this study, the constrained SVAR model muted the effects of remittances in the empirical analysis while the base model included their impact. Both models included the economic variables for goods and money market equilibrium and the transmission channels chosen for investigation in this study. Although some of the IR movements are not statistically significant, most of the IRs performances in the models are economically significant. The inclusion of more observations in the model could rectify the statistical issue, which creates room for further investigation in the future.

The outcome of the empirical work performed indicates that monetary policy works through all the intermediate channels investigated in this study while credit channel play a dominant role in transmitting policy shocks to GDP during both conflict and post-conflict periods. Asset price and exchange rate channels dominate the transmission of policy shock to price level respectively in the periods of conflict and post-conflict followed by bank credit. This study establishes that remittances play a significant role in altering the functioning of intermediate monetary transmission channels, thus affecting the outcome of policy shocks to

real economic variables in Sri Lanka, especially in the post-conflict period. The outcome of this study also reveals that conflict plays a role in altering the effect of remittances over the MTM in Sri Lanka.

Considering the differences in the effects of remittances in the functioning of MTM in Sri Lanka in the conflict and post-conflict periods, policymakers should understand how increasing inflows of remittances can dominate the MTM, especially in the post-conflict period. In addition, this study also provides information for policymakers in remittance-dependent economies and those experiencing a high volume of remittances due to conflict-driven migration, to enable them to apply appropriate policies and strategies to manage remittances. Monetary policy can still function as an effective tool for sustainable long-term economic growth and price stability.

Remittances are primarily seen as a source of foreign exchange in many LICs, and they help to relieve poverty in these countries. The prevalence of conflict in several LICs drives migration, which results in the increasing transfer of remittances to home countries to support family members during the conflict periods. Conflict-driven migration and the consequent increase in the inflow of remittances could impact monetary policy measures through wealth and liquidity effects more significantly after the end of the conflict. Hence, LICs, especially those facing flooding of remittances due to conflict, should be prepared to face the long-term challenges caused by remittances to the execution of monetary policy measures.

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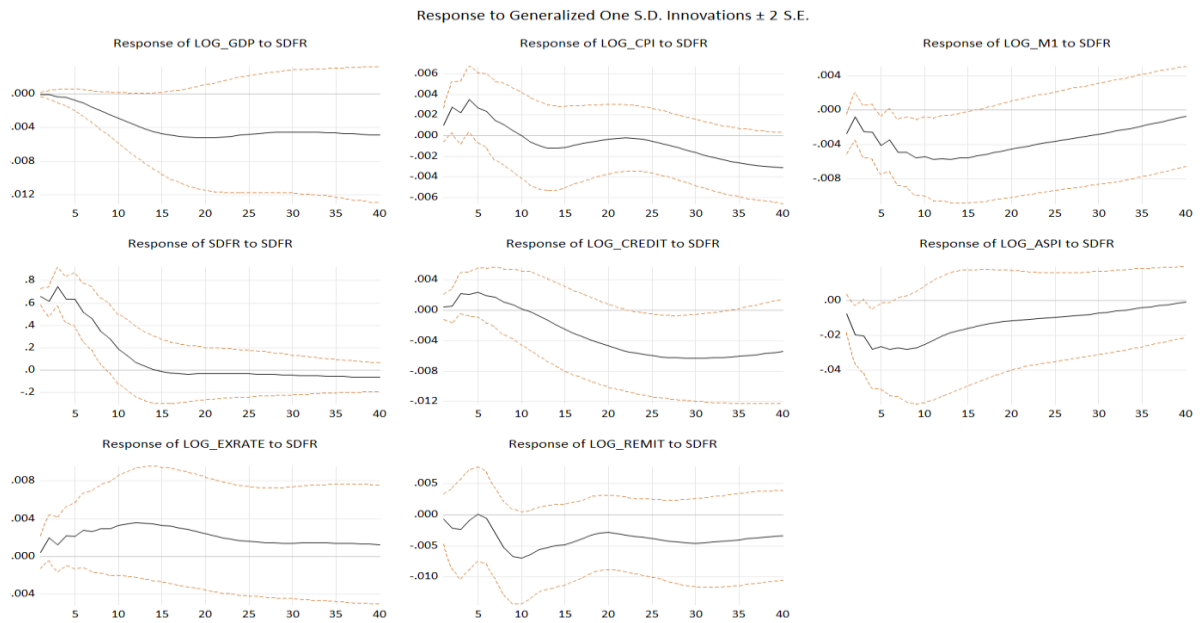
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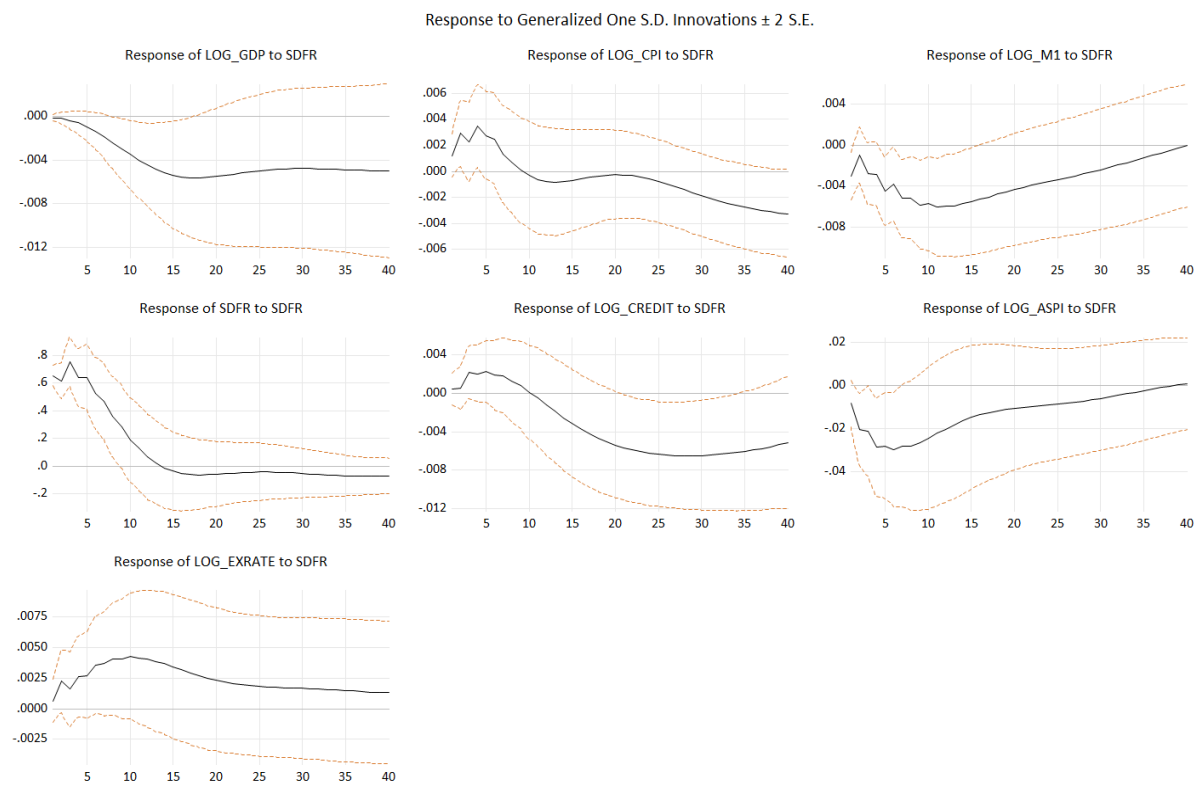
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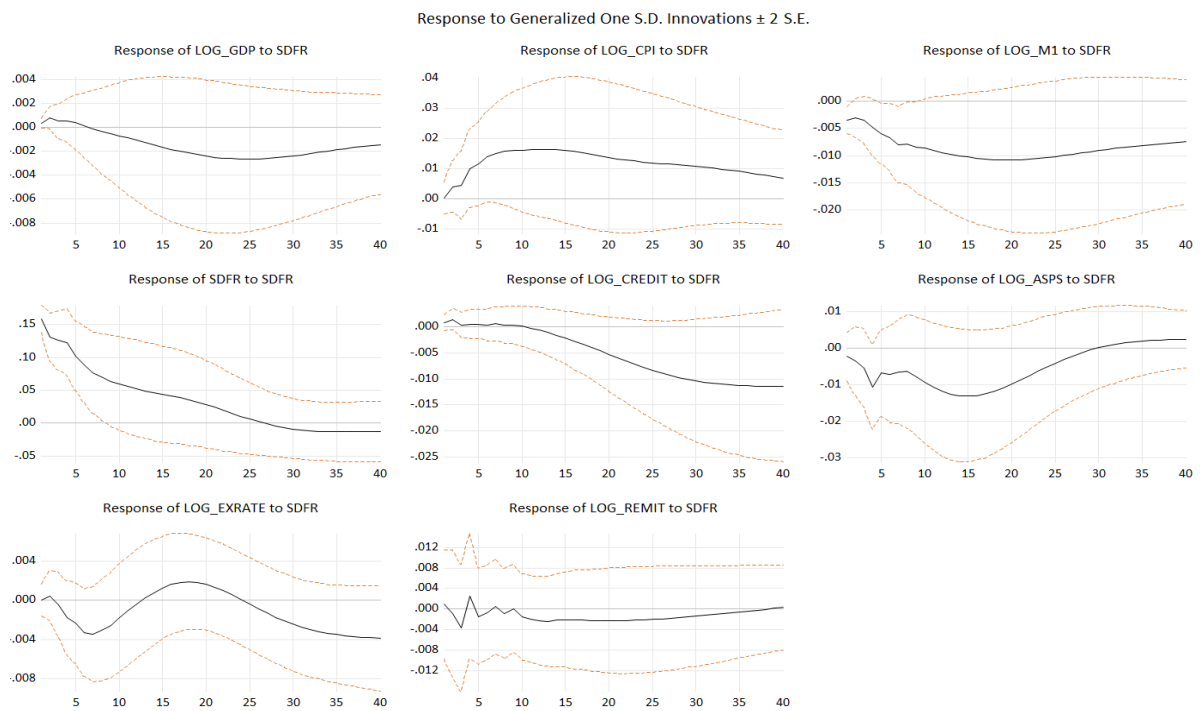
Appendix

Impulse response to a shock in SDFR in SVAR base model: conflict period

Response to Generalized One S.D. Innovations ± 2 S.E.

Impulse response to a shock in SDFR in SVAR constrained model: conflict period

Response to Generalized One S.D. Innovations ± 2 S.E.

Impulse response to a shock in SDFR in SVAR base model: post-conflict period

Response to Generalized One S.D. Innovations ± 2 S.E.

Impulse response to a shock in SDFR in SVAR constrained model: post-conflict period

Response to Generalized One S.D. Innovations ± 2 S.E.