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The Impact of Remittances on Monetary Transmission Mechanism in Remittance-recipient Countries: with Focus on Credit and Exchange Rate Channels

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Working Paper in Economics 06/23

April 2023

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Abstract

Remittances contribute to welfare enhancement and poverty alleviation in many remittance-recipient economies. However, recent literature also focuses on the macroeconomic impact of remittances due to their increasing inflow into these economies. We use an unbalanced heterogeneous panel Structural Vector Autoregression (SVAR) methodology to study the impact of remittances on intermediate monetary transmission channels in remittance-recipient countries. In particular, we analyse the effect of remittances on credit and exchange rate channels in these economies. We, initially, estimate credit and exchange rate impulse responses (IRs) to a shock in remittances. The IRs estimates suggest a significant variation among countries in credit and exchange rates in response to a shock in remittances. In the next stage, we run a cross-section regression of these responses to identify the factors influencing the IRs of these variables. We find that the magnitude of remittances received by an economy significantly impacts the exchange rate channel thus affecting the smooth functioning of the monetary transmission mechanism. However, the effect of remittances on the credit channel is dependent on the level of remittance inflows and savings in remittance-recipient economies. Our finding also reveals that remittances weaken the functioning of the credit channel at a higher level of remittance inflows, especially, when the remittances are higher than approximately five percent of GDP in remittance-recipient economies. Overall, our findings have broad policy implications revealing that policymakers have to pay attention to the possible effects of remittances on intermediate monetary transmission channels in achieving the monetary policy targets.

Keywords

remittances

monetary policy

monetary transmission mechanism

JEL Classification

E5

E52

F24

Acknowledgements

We would like to thank the Central Banks of the countries selected for this research, the IMF, and the World Bank for providing access to the data required for this study. In addition, we acknowledge DevNet, New Zealand for providing funds for this study.

1. Introduction

Remittances help poverty reduction and economic growth objectives in many remittance-recipient economies. They form a major part of the balance of payment (BOP) among many developing economies, thus helping these countries relax their BOP constraints. Every day, thousands of migrant workers living in different parts of the world send a small amount of money home, primarily for altruistic reasons. However, the accumulated amount of remittances the migrant workers send home has become a very significant amount which surpassed the official development assistance (ODA) and Foreign Direct Investment (FDI) in Low and Middle-Income countries (LMICs) in recent years. According to World Bank (2019), the inflow of remittances into LMICs reached US$ 529 billion in 2018 with an increase of 9.6 per cent compared to the previous year, and it reached nearly US$ 554 billion in 2019 (World Bank, 2020). However, the value of remittance inflows into remittance-recipient countries is expected to be more than the reported figures (Barajas et al., 2008; Ratha, 2005).

Remittances lead to macroeconomic challenges (Jansen et al., 2012) despite their benefits in reducing poverty levels and improvement in economic and social welfare (Acosta et al., 2008; Olowa et al., 2011); therefore, remittance-recipient countries have to be cautious about the remittance-driven challenges, especially, real exchange rate appreciation (Hassan & Holmes, 2013), inflation, deteriorating terms of trade (Amuedo-Dorantes & Pozo, 2004), income inequality (Howell, 2017) and disturbance to monetary transmission mechanism (Barajas et al., 2018). Although most of these macroeconomic impacts of remittances are widely researched, the impact of remittances on individual monetary policy transmission channels is not given sufficient focus. A very few studies have been undertaken to analyse the effects of remittances on monetary transmission mechanisms leaving room for further investigation into the implication of remittances on individual transmission channels. Vacaflores (2012) uses a limited participation model to examine the relationship between the share of remittances and monetary policy in a small open economy model. Ruiz and Vargas-Silva (2010) analyse the effect of remittance on Mexico's monetary policy variables. And Barajas et al. (2018) examine the relationship between the remittances and pass-through of the policy rate into bank lending rate in a panel study. However, the question of the effect of remittances on other transmission channels in the remittance-recipient wider cluster of economies still needs answers.

Bank credit and exchange rate channels are operative monetary transmission channels in most developing countries, where remittances play a significant role in the economy. These countries are heavily dependent on remittance inflows. The inflow of remittances may significantly alter the functioning of these intermediate monetary transmission channels; therefore, policymakers have to consider the effect of remittances on these channels in remittance-recipient countries. The credit market is important for credit growth and consequent production and consumption during the expansionary monetary policy. Likewise, policymakers expect a decline in credit through contractionary monetary policy measures to achieve the inflation target. The influence of remittances may alter the expected policy outcome

when remittances delink the banks and interbank credit market by accumulating loanable funds available with banks. Likewise, the inflow of remittances directly contributes to monetary aggregates and consequent inflationary pressure in the economy. This may trigger the alarm to introduce contractionary monetary policy measures to control inflation in the economy; therefore, remittance-driven monetary aggregates may result in the appreciation of the domestic currency. The policymakers in remittance-recipient economies will have to assess their inflation-targeting monetary policy decisions considering the fluctuations in remittance inflows into their economies.

Our study examines the implications of remittances investigating 1. whether remittances affect credit and exchange rate channels in remittance-recipient economies. 2. how does the effect of remittances on credit and exchange rate channels vary across the remittance-recipient economies? 3. what factors contribute to the varying effect on these transmission channels? To answer these questions, we use a two-stage approach. In the first stage, we estimate the IRs of bank credit and exchange rate to a shock in remittances using the methodology introduced by Pedroni (2013). In the second stage, we regress the IRs on a set of other variables, explained in the previous empirical literature, to describe how remittances affect these monetary transmission channels.

This study distinguishes itself from other previous studies by employing a panel SVAR model with long-run and short-run restrictions. In addition, remittances have been used as one of the variables in the SVAR model itself reflecting its interrelationship with other variables. Furthermore, the use of SVAR approach addresses the endogeneity issue in the statistical analysis. In addition, the panel SVAR approach proposed by Pedroni (2013) can capture the dynamic effects of variables in an unbalanced panel of heterogeneous economies. This research also considers the demand and supply-side effects of remittances on the credit channel as remittances are not only channeled into the formal financial system, thereby increasing the loanable funds available with banks (Barajas et al., 2018), but they may also reduce the demand (Calderon et al., 2008) for bank credit with the substitution of remittances for borrowings from banks (Awdeh, 2016; Brown & Carmignani, 2015). At the same time, remittances may not contribute to credit growth if the households spend all the remittances on consumption due to distrust of the financial system or opt to choose different forms of saving funds (Aggarwal et al., 2011). We also use the most recent quarterly data from 2000 to 2019 for 51 remittance-recipient economies in different regions with different socio-economic conditions to capture the responses of transmission channels to structural shocks and minimise the possible bias in the statistical outcome.

This research expands the literature on the implications of remittances in the effectiveness of monetary transmission channels in remittance-recipient economies. In addition, the outcome of this study would assist policymakers in remittance-recipient economies in considering the inflow of remittances in making their decision regarding employment and inflation targets.

2. Literature review

Monetary policy measures are used to maintain economic stability in a country by maintaining appropriate employment and price levels. Central Banks around the world execute this policy measure by altering the money supply in the economy. The monetary policy transmission mechanism is the medium through which monetary policy decisions are transferred into the real economy. The primary medium of monetary policy transmission is the interest rates; however, bank lending, stock market price, real estate price, and exchange rates play a significant role in monetary policy transmission (Bernanke & Blinder, 1992; Mishkin, 2001; Mishra et al., 2014; Romer et al., 1990; Taylor, 1995).

Monetary policy transmission in developing economies differs from developed countries, especially due to their financial structure, banking system, and institutional arrangements. Mishra et al. (2012) emphasize that monetary transmission is weak in developing economies since the institutional weaknesses that exist in these countries limit the role of security markets. Bhattacharyya and Sensarma (2008) also support this view on this issue. In addition to these factors, heavy intervention by Central Banks in developing economies on their exchange rates affects the functioning of the exchange rate channel in these countries. Furthermore, the uncompetitive banking sector is also a hindrance to the lending channel in developing economies.

Many studies on monetary transmission mechanisms in developing countries find the bank-lending channel as the primary monetary transmission channel. Mishra et al. (2012) reveal that bank lending is the dominant transmission channel in developing countries, at least in relative terms. Agha et al. (2005), in their research on monetary transmission mechanisms in Pakistan, find that the bank-lending channel is the primary transmission channel. The same outcome is revealed by a study undertaken by Aleem (2010) in India as well. Although these studies identify bank lending as the leading transmission channel, they do not rule out the functioning of other transmission channels. Moreover, most of the studies, which emphasize the function of bank lending channels in developing economies, do not firmly confirm the inexistence of other transmission channels in these economies.

Although several studies reveal that developing countries have different natures of their monetary transmission mechanisms compared to high-income economies due to rudimentary financial market development, some studies in developing countries show the function of interest rates and exchange rates as leading transmission channels. A study of the Georgian economy on the operation of the monetary transmission mechanism reveals that exchange is the primary transmission channel (Aslanidi, 2007). At the same time, Isakova (2008), in research over three Central Asian countries, Kazakhstan, the Kyrgyz Republic, and Tajikistan, shows that the exchange rate has the strongest pass-through among the monetary transmission channels in these economies. In addition, research on transmission mechanisms in the Mexican economy indicates that interest rates and exchange rates dominate the monetary transmission mechanisms (Martínez et al., 2001). Furthermore, the dominance of the interest rates channel

is also emphasized by Carrasquilla and Settlements (1998) in a study of the Columbian economy.

Remittance inflows interact with monetary transmission channels in the remittance-recipient economies. The inflow of remittances into these economies is believed to impact the monetary transmission channels, thereby affecting the smooth functioning of the monetary transmission mechanisms and causing obstacles to achieving the intended macroeconomic targets. A higher level of inflow of remittances may deteriorate the effectiveness of monetary policy transmission mechanisms in the economy (Vacaflores, 2012). At the same time, remittance inflows may transmit the monetary policy effect of other countries into the domestic economy as well. A study on the Jordanian economy by Al-Hindawi (2016) reveals that monetary policy effects of the United States economy are transmitted to the Jordanian economy through remittance inflows.

A study by Barajas et al. (2018) show that increasing remittance inflows could impact bank lending by forming a resistance between the policy rate and interbank market lending. They show that increasing inflow of remittances builds loanable funds available with commercial banks; therefore, the banks become less reliant on the interbank market. This can disconnect the pass-through of the policy rate to retail lending rates. However, substituting remittances for borrowings from the financial markets can lead to a decline in demand for domestic credit (Aggarwal et al., 2011; Calderon et al., 2008; Demirgüç-Kunt et al., 2011). A study by Brown and Carmignani (2015) indicates that remittances lead to a fall in bank credit; however, they show that a higher remittances to GDP ratio would increase domestic credit. However, banks in developing countries are reluctant to extend their lending to all of their customers due to weak institutional setup, poor investment opportunities, and collateral issues (Coulibaly, 2015; Mishra et al., 2014) though lending capacity increases due to remittances. Onyeisi et al. (2018) also show that remittances have an insignificant positive relationship with domestic credit to the private sector in Nigeria. However, a study on the relationship between bank credit and remittances in the Bangladesh economy reveals that remittances positively impact bank credit in the long run (Muktadir-Al-Mukit & Islam, 2016). Moreover, Ajide (2019) indicates that remittances along with bank concentration can have a positive effect on domestic credit in the long run.

Several studies reveal that the exchange rate is the other prominent transmission channel affected by remittance inflows. The inflow of remittances could affect exchange rates; as a result, resistance to the pass-through of interest rate could develop in the economy. The inflow of remittances increases the money supply (Narayan et al., 2011) in the remittance-recipient countries; therefore, monetary authorities introduce contractionary monetary policy measures to contain inflation in the economy. Increase in interest rate driven by the remittances to control inflation results in the appreciation of nominal exchange rates (Kim, 2019; Mandelman, 2013). This is one of the reasons for remittance-recipient economies to choose fixed exchange rate regime (Singer, 2010) to minimise the stress on their exchange rates. The policy to follow fixed exchange rate regime restricts the exchange rates channel's functioning

in remittance-recipient economies. In addition, the inflow of remittances results in appreciation of the domestic currency, thereby making domestic export uncompetitive and leading to "Dutch Disease" (Acosta et al., 2009; Amuedo-Dorantes & Pozo, 2004). However, Barajas et al. (2011), while accepting this as a standard developed based on the assumption in a theoretical model, propose modifying the phenomenon with reasonable changes in the modelling. They prove their work with empirical evidence that remittances lead to real exchange rate appreciation while concluding that such an effect is very small. In addition, Acosta et al. (2009) show that a higher level of financial development in the remittance-recipient economies can lower the effect of remittances on the real exchange rates. At the same time, Hassan and Holmes (2013), in their investigation of 24 countries, find that remittance inflows lead to real exchange rate appreciation, consequently resulting in the uncompetitive tradable sector. Lartey et al. (2012) also detect similar empirical outcomes in their study on 109 remittance recipient economies. The same result is also found in other investigations regarding the relationship between remittances and real exchange rates (Adejumo & Ikhide, 2019; Bourdet & Falck, 2006).

3. Methodology

This study uses the panel SVAR methodology proposed by Pedroni (2013), which decomposes common and idiosyncratic shocks from structural shocks. This methodology is more suitable for a large group of heterogeneous economies to detect the dynamic relationship among macroeconomic variables. This approach considers the fact that each member in the panel responds to their idiosyncratic shocks and common shocks among the members in the panel. This methodology also enables inference for any member in an unbalanced panel for which the time series data is inadequate to perform statistical analysis. The application of this methodology also helps estimate the responses of domestic variables to changes in the domestic macroeconomic conditions while controlling for changes that take place outside the domestic boundaries. In addition, this methodology addresses the issues of cross-sectional dependencies and dynamic heterogeneity in an unbalanced panel (Montiel & Pedroni, 2019). Controlling for dynamic heterogeneity and cross-sectional dependency is necessary because they may result in inconsistent dynamic responses of variables, and inferences of these responses may also become inconsistent. This approach resolves these issues by decomposing the structural shocks into common and idiosyncratic elements and generating efficient estimates of common elements of the country-specific loadings. We can generate robust and consistent estimates of the common and idiosyncratic impulse responses and variance decomposition quantiles by using this methodology.

3.1 Model Specification

The authors estimate the panel SVAR model to analyse the dynamic effect of remittance inflows on monetary transmission channels. The equation below describes the reduced form of panel VAR

$Y_{i,t}=B_i(\mathrm{L})\, Y_{i,t}+\mathrm{x}_{i,t}$

where Y is a vector of variables, B_i(L) is the lagged officiants' polynomials, and ε is the error term in the reduced-form of panel VAR. The lag length is selected for general-to-specific (GTOS) criteria proposed by Pedroni (2013). A panel SVAR is obtained using a long-run non-recursive identification approach to the reduced-form of panel VAR. This enables the formation of structural VAR as follows:

$A_{0,i}y_{i,t}=A_i(\mathrm{L})\, y_{i,t}+\varepsilon_{it}$, (1)

where $A_{0,i}$ is the matrix of contemporaneous coefficients, A_i is the matrix of lagged coefficients, $Y_{i,t}$ is the vector of endogenous variables, including the log of remittances, money supply (M1), domestic credit and nominal exchange rates of individual countries, and ε_{it} is the vector of composite structural shocks which may be independently distributed over time and cross-sectionally dependent. Each composite structural shock in the vector of ε_{it} is decomposed into (M x 1) vector of $\vec{\epsilon}_{it}$ individual country-specific idiosyncratic and $\bar{\epsilon}_t$ orthogonal common shocks as follows:

$$\varepsilon_{it}= \Lambda_i\bar{\epsilon}_t +\vec{\epsilon}_{it} \text{ where } \mathrm{E}\,(\xi_{it}\xi'_{it}) = \begin{bmatrix} \Omega_{i,\bar{\epsilon}_t} & 0 \\ 0 & \Omega_{i,\vec{\epsilon}_t} \end{bmatrix} \quad \forall\, i,\, t, \qquad \mathrm{E}\,(\xi_{it}) = \quad \forall\, i,\, t,$$

$$\mathrm{E}\,(\xi_{it}\xi'_{it}) = 0 \qquad \forall\, i,\, s \neq l, \qquad \mathrm{E}\,(\bar{\epsilon}_t\bar{\epsilon}'_{it}) = \qquad \forall\, i,\, t \neq j \qquad (2)$$

where $\xi_{it}= (\vec{\epsilon}'_t,\ \vec{\epsilon}'_{it})$' and Λ_i is M × M diagonal matrix where the diagonal elements are the coefficients $\lambda_{i,m}$ $m = 1,\ldots$.M. The restriction imposed suggests that covariance of the composite white noise takes the form E $(\epsilon_{it}\epsilon'_{it}) = \Omega_{i,t}$. This is also a diagonal covariance matrix with randomly normalized variances with adding up constraints described by equation (2).

The reduced form of M+1 VARs are estimated in order to obtain the estimates for composite shocks ε_{it}shown in the equation: one for each country and another one using the crossectional mean value

$$y_{1,t} = K_i(\mathrm{L})\, y_{1,t} + \mathrm{e}_{1,t}$$

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$$y_{M,t} = K_M(\mathrm{L})\, y_{M,t} + \mathrm{e}_{M,t}$$

$$\bar{y}_{,t}= \bar{K}\ (\mathrm{L})\ \bar{y}_{,t} + \bar{\mathrm{e}}_{,t} \qquad (3)$$

where $K_i(\mathrm{L}) = A^{-1}{}_{0,i}\ A_i(\mathrm{L})$, $\mathrm{e}_{i,t} = A^{-1}{}_{0,i}\ \varepsilon_{i,t}$, $\bar{K}\ (\mathrm{L}) = \bar{A}^{-1}\bar{A}\ (\mathrm{L})$, $\bar{\mathrm{e}}_t = \bar{A}_0^{-1}\bar{\varepsilon}_t$

generates the composite and common shocks from the residuals of the reduced form. Hence, estimating the idiosyncratic shock $\vec{\epsilon}_{it}$ is the next step in the estimation process. This can be performed using the properties of equation (2), in which structural shocks are white noise and

covariance between $\bar{\epsilon}_t$ and $\acute{\epsilon}_{it}$ is zero. The loading matrix of common factors is constructed by estimating equation (2) for each country i with OLS regressions. This results in the estimates of M × M diagonal matrix of $\dot{\Lambda}_i$ with sample estimates of E ($\varepsilon_{it,m}\, \bar{\varepsilon}_{t,m}$)/ E ($\epsilon_{t,m}^{-2}$) for m = 1,….., M along the diagonals.

The next step is decomposing the composite responses for each country i into common and idiosyncratic responses using the equation below for each country.

$A_i(L) = A_i(L)\, \Lambda_i + A_i(L)\, (I - \Lambda_i\, \Lambda'_i)^{-½}$ (4)

where

$A_i(L) \equiv \bar{A}_i(L)$ and $A_i(L)\, (I - \Lambda_i\, \Lambda'_i)^{-½} \equiv \check{A}_i(L)$

represents, respectively, common and idiosyncratic responses

As we estimate the effect of remittance inflows over the intermediate monetary transmission channels, namely, bank credit and exchange rate, we use four variables consisting of remittances, money supply (M1), banks credit, and nominal exchange rate in our panel SVAR model, and they are arranged in the corresponding order.

Many previous studies dealing with monetary policy transmission use the short-run approach to identify the dynamic relationship among macroeconomic variables by imposing restrictions on contemporaneous responses to structural shocks (Bernanke, 1986; Blanchard, 1989; Christiano et al., 1994; Raghavan et al., 2012). At the same time, some other studies use only the long-run restrictions ignoring the short-run relationship among the variables (Mishra et al., 2014). These studies highlight that imposing restrictions on contemporaneous relationships requires information regarding timing and responses by authorities. However, we use both the short-run and long-run restrictions considering the common characteristics among countries in implementing monetary policy measures and traditionally used restrictions in the macroeconomic literature.

The matrices below show a non-recursively identified model with short-run restrictions.

$$A_{0i} y_{it} = \begin{bmatrix} - & 0 & 0 & - \\ - & - & 0 & 0 \\ - & - & - & 0 \\ - & - & - & - \end{bmatrix} \begin{bmatrix} r_{i,t} \\ m_{i,t} \\ c_{i,t} \\ e_{i,t} \end{bmatrix}$$

where the "-" and "0" represent unrestricted and restricted parameters, respectively. The identification strategy is used based on the idea that remittances affect the domestic money supply, bank credit, and nominal exchange rate in the short run, whereas only the nominal exchange rate affects remittance inflows in the current period. Money supply affects bank credit and exchange rate in the short run, but only remittances affect it. The exchange rate,

which is a forward-looking asset price, is affected by all the variables in the short run. However, it is assumed that the exchange rate does not influence all other variables, except remittances, in the short run. These short-run restrictions are based on the instantaneous relationship between money supply, nominal exchange rate, and remittances (Adenutsi & Ahortor, 2008; Kim, 2019), bank credit, and remittances (Awdeh, 2016; Brown & Carmignani, 2015).

The matrices below show non-recursively identified models with long-run restrictions.

$$A_{0i}y_{it} = \begin{bmatrix} - & 0 & 0 & 0 \\ - & - & - & - \\ - & - & - & - \\ - & - & - & - \end{bmatrix} \begin{bmatrix} r_{i,t} \\ m_{i,t} \\ c_{i,t} \\ e_{i,t} \end{bmatrix}$$

where the "-" represents the unrestricted parameters, whereas "0" represents zero restriction. It assumed that remittances affect all the variables in the long run; however, all other variables do not affect remittances in the long run. This assumption is based on the idea that remittances are an external flow of funds transferred to the domestic economy. They are not sensitive to domestic interest rates (Chami et al., 2009); therefore, other factors would not influence significantly in the long run.

3.2 Data

This study uses quarterly data covering 20 years from 2000:1to 2019:4 for fifty-one remittance-recipient countries. The domestic credit and money supply (M1) data are obtained from the respective Central Banks' databases. The remittances and nominal exchange rates data are collected from the IMF's International Financial Statistics (IFS) database. The data for this sample is unbalanced with 2010 country-year observations from 51 countries and compiled based on data availability for the members in the panel.

This study imposes a restriction to remove the data for the period during which the members in the panel fixed their exchange rates continuously for four quarters. In addition, each member in the panel has data, at least for five years continuously, to choose the suitable lag truncation while maintaining enough degree of freedom to ensure the estimation of average variable values and structural shocks reasonably well. At the same time, this panel has sufficient cross-sectional dimensions for each time period chosen in this study. These measures ensure the cross-sectional and temporal variation in the data for the sample of countries. The appendix details the list of countries and the time period of data used for each member in the panel.

The data are tested to check for the stationarity condition at the initial stage of estimating the panel SVAR model. The results of the stationary tests in terms of level and first difference of remittances, money supply, bank credit, and nominal exchange rates are presented in Table 1. The results show that the variables of all panel members are stationary in their first

difference. In the next step, the variables used in the estimation are tested for panel co-integration, and the outcome of the tests indicates that the variables are not co-integrated. The test results will be made available if required.

Table 1: Unit root analysis

Variables	Fisher-PP		Fisher-ADF		Im, Pesaran, Shin	
	Level	1st Difference	Level	1st Difference	Level	1st Difference
Remittances	63.44	7979.07***	59.68	3126.83***	-0.77	-39.34***
Money Supply	2.12	2880.40***	2.74	638.86***	19.54	-17.23***
Credit	5.12	978.26***	11.63	475.91***	19.97	-20.40***
Exchange rate	340.92***	2778.45***	335.70***	2519.38***	-0.72	-38.35***

Note: *** indicates $p < 0.01$ significance level

3.3 Estimation results

The idiosyncratic and common IRs are estimated using Pedroni (2013) approach. The descriptive statistics for idiosyncratic and common IRs are reported in the median, 25th and 75th percent quantile ranges. We report the IRs of variables to idiosyncratic and common shocks in figure 1 and variance decomposition in figure 2. The middle line represents the median IRs and variance decomposition of the sample of countries, while the upper and lower lines depict the 75th and 25th percent quantile responses, respectively. The deviation between these two lines shows the heterogeneity among the countries in responding to structural shocks.

We find the expected positive response of nominal exchange rate for a large group of countries, and the IRs of nominal exchange rates show a persistent appreciation effect in their median and 75th percentile responses; however, the 25th percentile response does not show significant change throughout its time horizon in the sample of countries. The median response of nominal exchange rate to one unit country-specific shock in remittances results in 0.005 per cent of appreciation of the domestic currency in the following quarter and 0.009 per cent in the 12th quarter. The 75th percentile response leads to 0.015 per cent of appreciation in the next quarter and 0.025 per cent in the 12th quarter. However, the 25th percentile response reveals a subset of countries in the sample that do not show a significant change in their nominal exchange rates.

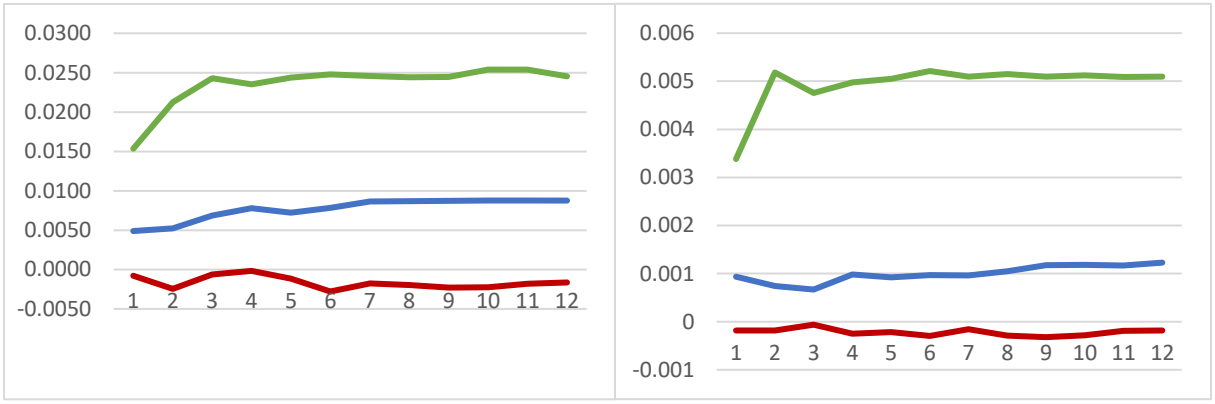
The IRs of bank credit also reveals heterogeneous response among the countries chosen for this study. We find the expected positive response of bank credit to country-specific shock in remittances in a large set of countries; however, there are large variations in the IRs of bank credit. The median and 75th percentile responses to country-specific one unit shock in remittances result in 0.0003 and 0.004 per cent increase in bank credit in the following quarter, 0.0003, and 0.007 per cent in the 12th quarter, respectively. The 25th percentile response results in 0.005 per cent decline in bank credit in the following quarter 0.011 per cent in the 12th

quarter. The IRs of bank credit show a wide deviation among the sample of countries in responding to a shock in remittances.

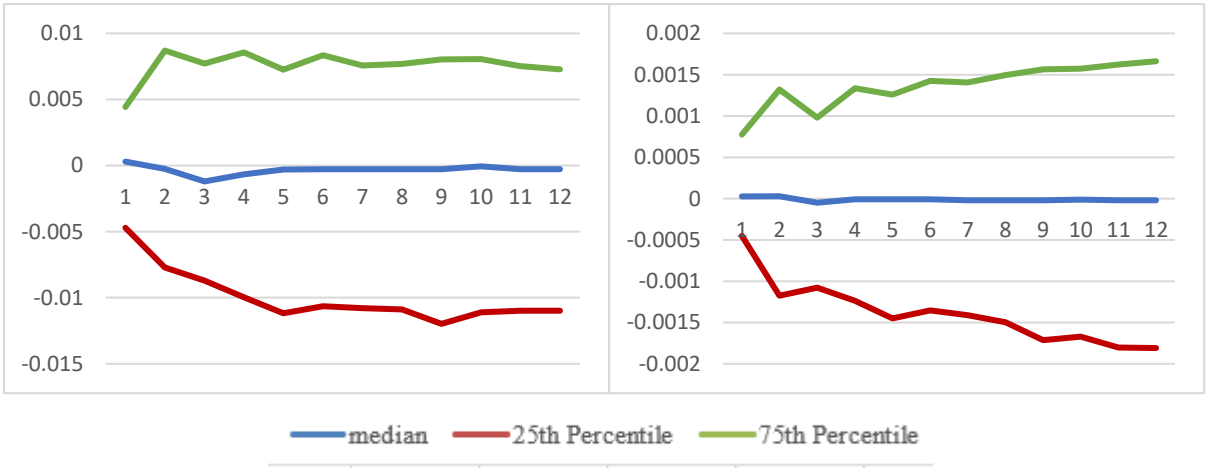
Figure 1: Impulse response from panel SVAR model

Idiosyncratic shock **Common shocks**

Response of lnexrate to lnremit



Response of lncredit to lnremit

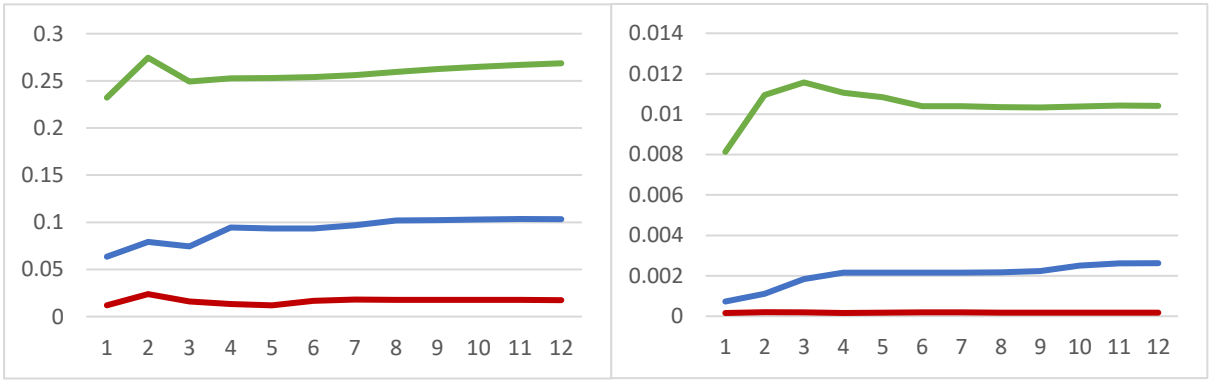


The variance decompositions of these two variables also show a similar pattern of variations in responding to a shock in remittances in the sample of countries. In the short-term (first quarter), variation in the nominal exchange rates is nearly 0.01 per cent to 0.23 per cent, and in the long run (12th quarter), it ranges from 0.02 per cent to 0.27 per cent. The variation in the bank credit in the short-run (first quarter) ranges from close to 0.01 to 0.1 per cent, while in the long run (12th quarter), it varies from close to 0.02 to 0.18 per cent. We investigate whether these IRs are random effects or are there any factors that determine the pattern of IRs among the sample of countries. Hence, we further examine the heterogeneous individual country responses by regressing the individual IRs to idiosyncratic shock on individual remittances to GDP ratio to find out if the level of remittance inflows into these countries has an impact on the response of nominal exchange rates and bank credit.

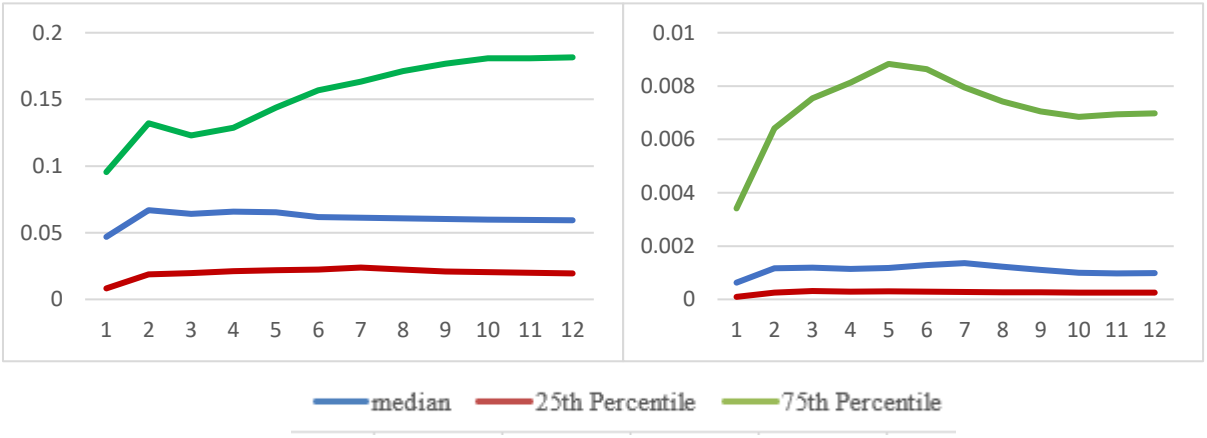
Figure 2: Variance decomposition from panel SVAR model

Idiosyncratic shock **Common shocks**

Response of lnexrate to lnremit



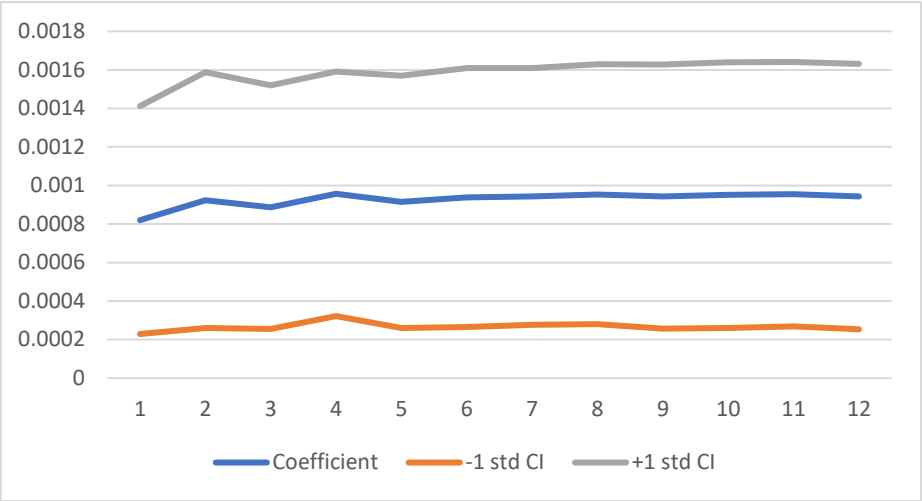
Response of lncredit to lnremit



The regression results of the IRs of nominal exchange rates and bank credit to an idiosyncratic shock on remittances and remittances to GDP ratio is shown in figure 3 and 4, respectively. The horizontal axis corresponds with the time period of IRs, while the middle line represents the estimated coefficients from cross-country regression of the estimated IRs and the remittances to GDP ratio. In other words, this reveals the cross-country association between the response of these intermediate monetary transmission channels and the remittances to GDP ratio in the sample of remittance-recipient countries.

As shown in figure 3, the association between the IRs of exchange rates and remittances to GDP ratio is positive at all-time horizons of IRs. The graph also shows the one standard deviation band estimated from the regression of these two variables. The relationship between remittances to GDP ratio and IRs of nominal exchange rate suggests a persistent positive association among remittance-recipient countries. This reveals that the remittances to GDP ratio is positively associated across the sample of remittance-recipient countries with the appreciation effect of nominal exchange rates.

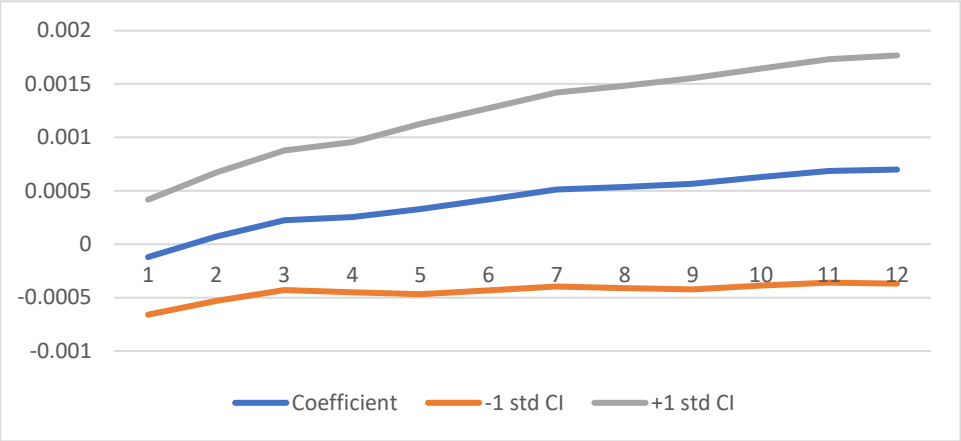
Figure 3: IRs of exchange rate and remittances to GDP ratio



Our empirical findings, while complementing the previous studies on the impact of remittances, also expand the scope including the effect of remittances on the exchange rate channel in the monetary transmission mechanism. The previous empirical findings show that the impact of remittances varies based on the exchange rate regimes and other macroeconomic conditions in remittance-receiving economies. Ball et al. (2013) find that the impact of remittances on money supply and inflation varies depending on the exchange rate regimes whereas Narayan et al. (2011) conclude that remittances have a pronounced effect on inflation in remittances-receiving economies. At the same time, Lartey et al. (2012) in their study on developing and transition economies find that an exogenous shock in remittances results in the appreciation of the nominal exchange rate in the flexible exchange rate regimes. However, we find that remittances generally lead to the appreciation of nominal exchange rate in remittance-receiving economies thus affecting the smooth functioning of the monetary transmission mechanism. In addition, our empirical findings also reveal that the effect of remittances on the exchange rate channel is dependent on the magnitude of remittance inflows into an economy. The plausible reason behind this is that the increasing remittance inflows lead to inflationary pressure (Narayan et al., 2011); therefore, monetary authorities increase the interest rates to contain inflation. This contractionary monetary policy measure results in exchange rate appreciation in the remittance-recipient economies.

As displayed in figure 4, the association between the IRs of bank credit and remittances to GDP ratio is positive from the second period onward at all-time horizons of IRs. However, this positive relationship between these two variables is insignificantly different from zero; therefore, we run another cross-section regression on the IRs of bank credit to idiosyncratic shock in remittances in the next stage.

Figure 4: IRs of credit and remittances to GDP ratio



We run this cross-section regression to identify the other influencing factors in the response of bank credit to remittance inflows in the sample of remittance-recipient economies. We use a similar methodology used by Aslan et al. (2021) Hao et al. (2017), and Mishra et al. (2014) that use individual IRs from SVAR in the second stage of cross-section regression. We present our cross-section regression results in Table 2 in which we use IRs from the panel SVAR as the dependent variable and the rest as explanatory variables. In the first four columns, we use the IRs of bank credit in the first four quarters as dependent variables, respectively. The dependent variable in the fifth column is the average of IRs of bank credit in the first four quarters.

Considering the previous empirical literature that examines the relationship between remittances and bank credit, we use four explanatory variables in our regression model. We include the ten-year (2000-2019) average national savings ratio and bank branches per one hundred thousand adults as dependent variables in the regression. In addition, we add two dummy variables in the regression. The first dummy variable is used for the higher remittance-recipient category. We follow (Barajas et al., 2018; Brown & Carmignani, 2015) in classifying the countries into high and low remittance recipient countries. We assign one if a country on average has more than five per cent of remittances to GDP in the ten-year (2000-2019) period otherwise, zero. The second dummy variable is used to represent the upper-income category. We use World Bank criteria to classify countries based on the GNI per capita in the current US dollar. We assign one if a country falls under the upper-middle-income category or above in the ten-year (2000-2019) period otherwise, zero.

The idea behind choosing the explanatory variables in the cross-section regression is the possible links to influence the effect of remittances in the responses of bank credit in the remittance-recipient countries. The savings to GDP ratio is one of the prominent indicators which reveals gross savings of all sectors in the economy. This would also represent the savings made by households from migrants' remittances as migrants also transfer remittances for savings and investment purposes (Batu, 2017; Fullenkamp et al., 2008). The second variable we use in the regression model is the higher remittance category. We divide the sample of countries into two main categories based on their remittances to GDP ratio in the later ten-year

period of our study. We categorize one set of countries as a higher remittance-recipients if they account for more than five per cent of remittances to GDP in the ten-year (2010-2019) period on average. Our categorization of countries is based on previous empirical findings (Barajas et al., 2018); (Brown & Carmignani, 2015) reveal that varying remittances to GDP ratio has a differential impact on remittance-recipient economies. We choose the other two explanatory variables to control for income level and access to banking facilities to address the possible criticism that the statistical outcome may be linked to income level and access to credit facilities.

Table 2: The second stage regression results

Variables	IR1	IR2	IR3	IR4	IR avg
Savings to GDP	0.0005**	0.0005**	0.0005*	0.0005*	0.0005**
	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0002)
Higher remittance recipient	0.0101**	0.0129**	0.0155***	0.0165***	0.0138***
	(0.0046)	(0.0053)	(0.0057)	(0.0062)	(0.0053)
Bank branches per 100,000 adults	0.0003*	0.0002	0.0002	0.0002	0.0002
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Upper income level	0.0005	0.0013	0.0019	0.0033	0.0018
	(0.0040)	(0.0045)	(0.0049)	(0.0054)	(0.0045)
Observations	51	51	51	51	51
R-squared	0.191	0.161	0.168	0.159	0.174
F-statistic	2.604	2.118	2.228	2.084	2.321

Note: Standard errors are in parenthesis, *** p < 0.01 ** P < 0.05 * p < 0.10 significance levels

The regression result indicates that the savings to GDP ratio coefficient is positive and statistically significant. This explains that the bank credit in countries with higher levels of savings to GDP responds stronger than those countries with low savings to GDP ratio on average to the same remittances shock. This result is in line with the empirical literature, which emphasises that remittances-driven fund flow into commercial banks would influence the commercial banks' lending capacity (Aggarwal et al., 2011; Barajas et al., 2018). This finding reiterates that when migrants' remittances contribute to savings in their home countries, the banking sector will increase its capacity to provide more credit facilities to their borrowers. At the same time, the fluctuation in the inflow of remittances would significantly affect the lending capacity of the banks as long as remittances dominate the composition of their lending capital.

In addition, the coefficient estimate of the dummy variable for the higher remittance-recipients category is also positive and statistically significant. This reveals that bank credit in countries with higher remittances to GDP ratio responds stronger to remittances shock than the countries with low remittances to GDP ratio on average. This finding is also in line with the previous empirical work. Brown and Carmignani (2015) provide evidence that at the higher level of remittances, the effect of bank credit becomes positive than at the low level. This reveals that migrants' remittances initially flow into their home countries for altruistic

purposes, and then migrants transfer more remittances for savings and investment purposes. At the higher level of remittance inflows, a part of remittances is deposited at banks; therefore, they become one of the lending sources of banks. This ultimately influences the banks' lending capacity.

The coefficients of the other two explanatory variables are positive at all periods as expected; however, only bank branches per 100,000 adults is significant in the first quarter at the ten per cent level of testing, and the upper-income level is not significant at all periods. In particular, we use these explanatory variables to control for the accessibility to banks and income level in their possible influence on bank lending.

4. Conclusion

Existing literature reveals that the underdeveloped financial market and poor institutional qualities prevail in many developing countries affect the monetary transmission mechanism. In this literature, a vast majority of these countries are identified as remittance-recipient economies, and remittances occupy a significant proportion of their balance of payments. In particular, remittances exceed capital flows and export revenues in many of these economies. This study finds remittances as a significant factor affecting the monetary transmission mechanism in these remittance-recipient economies.

This study investigates the impact of remittances on intermediate monetary transmission channels, namely, bank credit and nominal exchange rates in remittance-recipient economies. Our initial empirical evidence suggests that the responses of bank credit and nominal exchange rates are heterogeneous among remittance-recipient economies. Our empirical results, in particular, reveal that the remittances to GDP ratio has a significant effect on nominal exchange rates.

Our second step cross-section regression results indicate that savings to GDP ratio and the higher level of remittance inflows have significant explanatory power on the response of bank credit to a shock in remittance inflows. This result may be interpreted as in countries where savings to GDP ratio and remittance inflows are high; remittances may significantly affect the bank credit channel. Increasing remittance inflows through banks would expand the lending capacity of banks; therefore, the banks in countries receiving higher levels of remittances are likely to lend more even under tightening monetary policy measures. In particular, when remittances contribute to savings at banks, the banks may not be dependent on the interbank market; therefore, the linkage between the policy rate and bank lending may deteriorate. This has implications for the operation of the credit channel by decreasing the dependency of banks on the interbank market.

The remittance-recipient economies may not be able to pursue independent monetary policy as remittances may weaken the monetary transmission channels. In particular, central banks in these countries may find it difficult to achieve their credible target to control inflation through their changes in the policy rate to the real economy; therefore, they may fail to implement their policy framework. such as inflation targeting. At the same time, the countries

with an increasing amount of remittances would possibly opt for a fixed exchange rates regime (Singer, 2010) rather than flexible exchange rates. The measures to follow a fixed exchange rate regime would restrict the pass-through of interest rate shock to exchange rates, thereby affecting the functioning of the exchange rate channel.

Our empirical findings suggest that countries need to effectively implement policies to handle the excess funds built by remittances to allow central banks to achieve their targets through monetary policy measures. Firstly, we propose to insulate the monetary base by providing government bonds with a premium for remittance-based deposits. Issuing bonds for remittance-based deposits would help maintain the inflow of remittances and shield the monetary base against remittances. This measure would prevent immediate inflationary pressure on the economy, thereby minimizing the necessity for contractionary monetary policy measures. This may also reduce the excess stress on nominal exchange rates. Secondly, we propose to increase the reserve requirement of banks; therefore, excess reserve funds built by remittances can be eliminated from the banking system. This would make banks more reliant on borrowings from the interbank market; therefore, the changes in policy rates would effectively change bank landings and borrowing patterns. However, it is necessary to assess the effect of the initial credit crunch due to the decline in bank lending because of this policy measure.

Overall, there is a necessity to have a balanced policy approach in mitigating the impact of remittances in dealing with the macroeconomic challenges as remittances play a crucial role in welfare enhancement and poverty elevation in many developing countries. The policies purely targeting the mitigation of macroeconomic challenges caused by remittances may undermine the beneficial effects of remittances particularly, in remittance-recipient developing countries.

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Appendix

List of countries

#	Countries	Data availability		#	Countries	Data availability	
		From	To			From	To
1	Albania	2002q4	2019q4	27	Kyrgyz Republic	2009q1	2019q4
2	Armenia	2003q1	2019q4	28	Lao PDR	2012q3	2019q4
3	Bolivia	2001q1	2019q4	29	Lesotho	2009q1	2019q2
4	Bosnia	2001q1	2019q4	30	Mauritius	2014q1	2018q3
5	Brazil	2001q4	2019q4	31	Mexico	2003q4	2019q4
6	Bulgaria	2009q1	2019q4	32	Morocco	2003q1	2019q4
7	Cabo Verde	2010q4	2019q4	33	Mozambique	2005q1	2019q4
8	Cambodia	2008q3	2019q4	34	Nigeria	2014q1	2019q4
9	Colombia	2000q1	2019q4	35	North Macedonia	2003q1	2019q4
10	Costa Rica	2001q1	2019q4	36	Peru	2001q1	2019q4
11	Croatia	2000q1	2019q4	37	Philippines	2000q1	2005q4
12	Czech Republic	2014q1	2019q4	38	Poland	2009q1	2017q4
13	Dominican Republic	2011q1	2019q4	39	Romania	2013q1	2019q4
14	Fiji	2002q1	2019q4	40	Sao Tome	2011q1	2019q4
15	Gambia, The	2007q1	2019q1	41	Serbia	2007q1	2019q4
16	Georgia	2003q1	2019q4	42	Seychelles	2006q3	2019q4
17	Ghana	2011q1	2019q4	43	Solomon Islands	2011q1	2019q4
18	Guatemala	2000q1	2019q4	44	Sri Lanka	2000q1	2019q4
19	Guinea	2011q4	2019q4	45	Tajikistan	2008q1	2019q4
20	Honduras	2011q2	2019q4	46	Thailand	2011q2	2019q4
21	Hungary	2000q1	2019q4	47	Trinidad	2015q1	2019q4
22	Iceland	2000q1	2008q3	48	Turkey	2008q4	2019q4
23	India	2000q1	2019q4	49	Uganda	2000q3	2019q4
24	Indonesia	2002q1	2017q2	50	Ukraine	2014q1	2019q4
25	Jamaica	2000q1	2019q4	51	Uruguay	2009q4	2019q4
26	Kazakhstan	2000q1	2019q4				