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Economix

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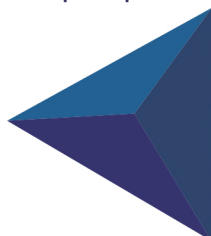


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Global Spillovers of US Monetary Policy: New Insights from the Remittance Channel

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Abstract

This paper examines the global spillovers of US monetary policy through the remittance channel. We use [Jordà \(2005\)](#) local projections to assess the effects of a US monetary policy tightening on 8 major remittance-sending countries and 41 recipient countries over the period from January 1997 to December 2017. Our findings reveal that such monetary tightening significantly impacts not only the US economy but also key remittance-sending nations, resulting in a global contractionary effect. The impact on recipient countries varies based on their reliance on remittances, underscoring the dual role of these personal transfers as both an amplifier and a mitigator of the global business cycle. Specifically, countries with high dependency on remittances experience heightened pro-cyclicality, leading to declines in both output and inflation, while those with moderate or low reliance exhibit counter-cyclical behavior.

Keywords: Global spillovers, Remittances, US monetary policy

JEL: F24, E52, F41, F44

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1. Introduction

In their efforts to mitigate the impact of international spillovers on their domestic economies, policymakers have sought to identify the channels through which monetary policy shocks originating from the United States (US) propagate and influence economies worldwide. Several key transmission mechanisms have been established, including the aggregate demand channel, the expenditure-switching channel, and the financial channel (Ca' Zorzi et al., 2020).

Recently, remittances have emerged as a potential channel for the transmission of US monetary policy across borders due to the remarkable growth of these capital flows, coupled with the US' position as the largest source of remittances (Ratha et al., 2023).¹ Despite this, the implications of US monetary policy shocks on remittance flows and their subsequent effects on recipient countries have remained underexplored.

In this paper, we aim to fill this gap by showing that remittances serve as a significant vehicle for transmitting US monetary policy effects to various remittance-sending and receiving countries. We hypothesize that an unexpected monetary tightening in the US could trigger a ripple effect on other remittance-sending countries due to their close trade and financial integration, and their increased synchronization resulting from the Global Financial Cycle, as described by Rey (2015). This ripple effect may lead to economic downturns in these remittance-sending nations, which could, in turn, result in a reduction in global remittance outflows. Consequently, the repercussions of US monetary tightening could spread across a wide range of recipient countries, thereby amplifying the global synchronization of business cycles. To validate our hypothesis, we use a comprehensive dataset that encompasses a wide range of countries – 8 remittance-sending countries and 41 recipient countries –

¹Remittances now surpass foreign direct investment and development aid in low- and middle-income countries. According the last figures provided by the World Bank, personal remittances received have experienced remarkable growth, evolving from negligible amounts in 1980 to reach 766,85 billion current US\$ in 2022 –equivalent to 0.8 percent of global GDP. <https://data.worldbank.org/indicator/BX.TRF.PWKR.CD.DT>.

spanning the period from January 1997 to December 2017. We rely on a local projections empirical framework (Jordà, 2005). This methodology allows us to examine the responses of macro-financial variables in both remittance-sending and receiving countries to US monetary policy shocks. We instrument unexpected changes in the federal funds rate using the US monetary policy shock, incorporating the information channel as suggested by Miranda-Agrippino and Ricco (2021) and Jarociński and Karadi (2020). By estimating the impulse responses of macro-financial variables, we specifically investigate how these responses are influenced by the degree of reliance on remittances in recipient countries.

Consistent with the existing literature of the global financial cycle, we find that tightening US monetary policy is associated with widespread declines in output, prices, and credit in advanced economies. Importantly, the economic slowdown in these economies, which are also major sources of remittances, leads to a substantial and significant reduction in remittance outflows, illustrating the pro-cyclical nature of these flows in their countries of origin.

We also present a novel finding. Unlike remittance-sending countries, the impact of US monetary policy tightening on recipient countries varies based on their level of dependence on remittances. Specifically, countries with a lower reliance on remittances—less than 4 percent of GDP—exhibit counter-cyclical behavior in remittance flows, in contrast to those more heavily reliant. In other words, following an unexpected tightening of US monetary policy, most countries experience an economic slowdown, except for those with moderate reliance on remittances—1 to 4 percent of GDP—. These findings illustrate the dual role of remittances as both an amplifier and a mitigator of the global business cycle, while also emphasizing how the extent of remittance flows can either constrain or bolster the monetary policy autonomy of recipient countries.

This paper makes several contributions to the existing literature on global economic dynamics and the transmission of US monetary policy. While previous studies have primarily focused on direct financial channels (Rey, 2015; Bruno and Shin, 2015)—such as capital flows, exchange rates, and interest rates—this research highlights

the significant role of remittances in shaping global economic outcomes.

Second, it extends the understanding of the remittance channel as a critical conduit through which US monetary policy shocks influence emerging markets and developing countries. [Machasio and Tillmann \(2023\)](#) demonstrate that monetary policy tightening by the Federal Reserve leads to a reduction in remittance inflows to economies in Latin America and the Caribbean, consequently amplifying the volatility of their business cycles. However, while their findings are suggestive, their applicability may be limited to this specific region due to the significant influence of geographical proximity. Indeed, a considerably high percentage of migrants originating from these countries reside in the US. By incorporating a broader range of countries in different regions, this paper provides a more comprehensive analysis of how US monetary policy influences economies worldwide through this channel.

Finally, this study contributes to the policy debate by shedding light on the potential vulnerabilities of economies that are heavily dependent on remittances, particularly in the context of global financial cycles driven by US monetary policy. By identifying threshold effects—where countries with high remittance dependence experience pro-cyclical impacts, while those with moderate dependence exhibit counter-cyclical responses—this paper underscores the need for targeted policy interventions to mitigate the adverse effects of external financial shocks on these economies.

The remainder of the paper is organized as follows: Section 2 provides some background on the impact of remittances in recipient countries and explores the potential mechanisms through which US monetary policy may be transmitted internationally via these personal transfers. Section 3 describes our sample of countries, outlines the methodology for identifying US monetary policy shocks, and details the empirical framework employed in our analysis. In Section 4, we present our primary findings on the effects of US monetary policy on both remittance-sending and -receiving countries. Section 5 conducts several robustness checks to validate our results. Finally, Section 6 concludes.

2. Remittances and US monetary policy

Remittances have been extensively studied for their role in supporting development in emerging and developing economies ([Ahmed et al., 2021](#); [Gapen et al., 2009](#); [Giuliano and Ruiz-Arranz, 2009](#)). These financial flows provide a unique form of external funding, offering foreign currency to countries and additional income to households, which is then used for both consumption and investment purposes. However, as remittances grow in importance, they also present macroeconomic challenges. For instance, the literature has explored how remittances can trigger a “Dutch disease” effect, leading to an appreciation of the real exchange rate, which in turn suppresses exports and reduces competitiveness, potentially hindering emerging economies from overcoming the middle-income trap ([Acosta et al., 2009](#); [Lartey et al., 2012](#)). Additionally, high levels of remittances can create a wealth effect, leading households to increase their leisure time, which may depress output over time ([Vacaflares, 2012](#)).

Remittances also present challenges for the implementation of monetary policy. When households rely heavily on remittances as a primary income source, the effectiveness of a country’s monetary policy may be undermined. The reason lies in the dual impact of these foreign flows, which can either dampen or stimulate demand and consumer spending, depending on their cyclical nature. For instance, if remittance inflows increase during an economic expansion and the central bank raises interest rates to tighten monetary conditions, these inflows could counteract the intended tightening effect, potentially leading to higher inflation by elevating demand. Conversely, a reduction in remittance inflows might coincide with the central bank’s tightening measures, thereby reinforcing their impact on real economic indicators ([Acosta et al., 2009](#); [Giuliano and Ruiz-Arranz, 2009](#); [Sayan, 2006](#)). Further research highlights the importance of remittances in the financial system, particularly emphasizing the key role banks play in transmitting monetary policy ([Barajas et al., 2018](#)). The interest rate channel effect is notably significant in countries with high levels of remittance inflows. When external financing conditions are favorable, allowing for borrowing at lower interest rates from abroad, domestic loan rates may become less responsive to changes in the policy rate for two main reasons. First, sub-

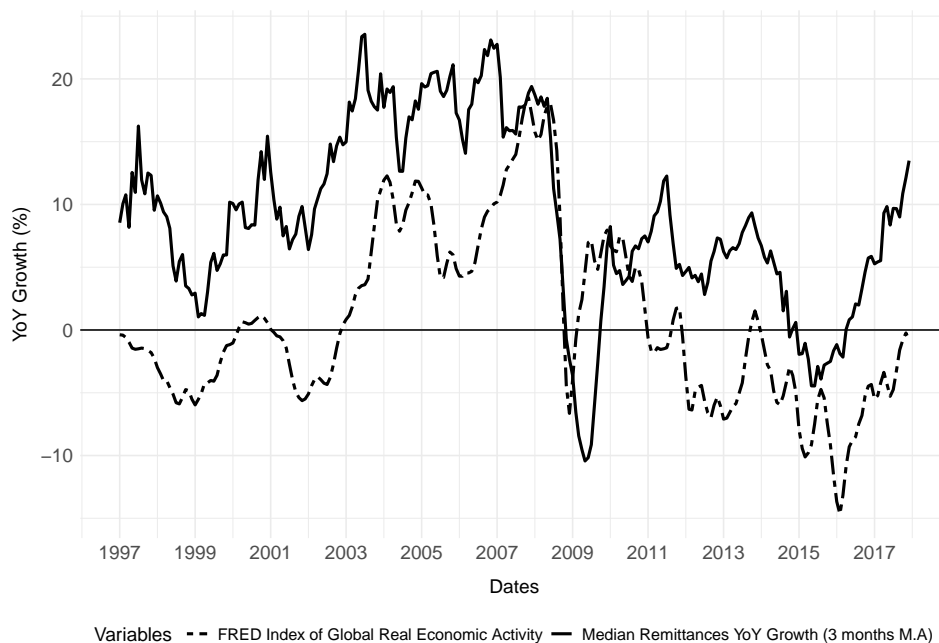
stantial inflows can reduce the risk premium for households, diminishing the impact of monetary tightening on lending rates. Second, when foreign funds – arising from remittance inflows – is abundant, banks may choose not to increase lending rates in response to domestic monetary policy tightening. This decision is influenced by the higher levels of liquidity provided by remittances, which can lead banks to reduce their interest rate pass-through. As a result, banks may insulate themselves from the actions of the domestic central bank, thereby weakening a key channel of monetary policy transmission ([Barajas et al., 2018](#)).

While the effect of US monetary policy on capital flows has been extensively studied, with key contributions highlighting how expansionary monetary policy changes drive capital inflows to emerging markets, the specific impact on remittances remains underexplored ([Calvo et al., 1993](#); [Dahlhaus and Vasishtha, 2020](#)). To our knowledge, the only study examining the impact of US monetary policy on remittances finds that a surprise tightening is associated with a reduction in remittance inflows to Latin American and Caribbean countries. However, this analysis overlooks potential heterogeneities across countries within the sample and does not account for the broader business cycle implications for real domestic variables ([Machasio and Tillmann, 2023](#)). US monetary policy spillovers are global in nature, with repercussions that extend far beyond regional boundaries, affecting economies worldwide. The importance of remittance flows, particularly for recipient countries, underscores their vulnerability to such global economic fluctuations. As illustrated in [Figure 1](#), remittance outflows exhibit a pro-cyclical relationship with global economic activity, further highlighting the widespread exposure of remittance recipients to external shocks.

The US plays a pivotal role as a major sender of remittances, significantly contributing to international remittance outflows. From 2000 to 2022, the US consistently maintained a prominent position, as illustrated in [Figure 2](#), accounting for more than 20 percent of total global remittance outflows. The dominant role of the US as the main sender of remittances, coupled with its significant influence on global economic conditions, underscores the crucial role of US monetary policy on foreign economies

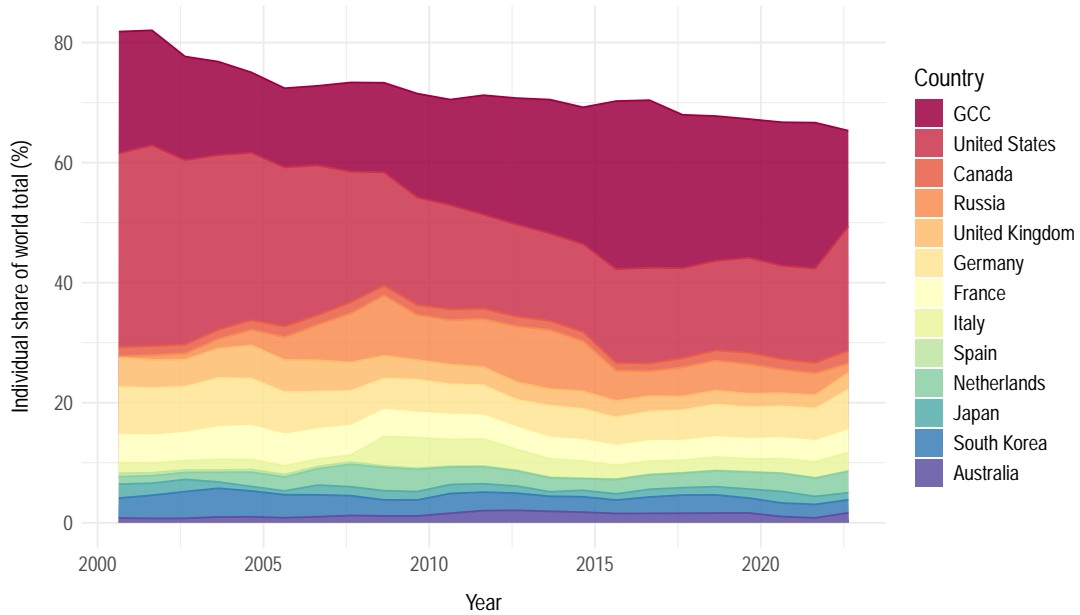
via remittances. US monetary policy, particularly when it becomes more restrictive, can slow economic activity within the US, potentially leading to reduced employment opportunities or lower income for migrants residing there. Since remittances are often a portion of migrants' earnings sent back to their home countries, a decrease in migrants' income directly results in reduced remittance flows. Furthermore, such policy tightening may reduce US aggregate demand, leading to decreased imports of foreign goods. This, in turn, could negatively impact foreign GDP and remittance outflows from others remittance-sending countries. The effects on recipient countries' economies can be significant, though the overall impact may vary depending on various factors, including the structural characteristics of both remittance-receiving and -sending countries, as well as the monetary policy responses of foreign central banks.

Figure 1: *Procyclicality of remittance outflows*



Note: The dotted line represents the year-over-year (YoY) growth of the Index of Global Real Economic Activity while the solid line represents the median YoY growth of remittance outflows. Source: Outward remittances from World Bank data - Personal remittances, paid (current US\$) and Index of Global Real Economic Activity (IGREA) extracted from <https://fred.stlouisfed.org/series/IGREA>.

Figure 2: *Outward remittances, share of world total*



Note: GCC refers to the Gulf Cooperation Council (GCC) countries consisting of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

Source: Outward remittances extracted from <https://www.knomad.org/data/remittances>.

3. Data and empirical methodology

Our approach includes three key elements: a comprehensive sample that covers a broad spectrum of remittance-receiving and -sending countries, a precise indicator for identifying US monetary policy shocks, and the estimation of impulse response functions using local projections, as developed by Jordà (Jordà, 2005).

3.1. The sample

Remittances include all regular transfers, whether in cash or in kind, made by non-resident households to resident households (De Arcangelis et al., 2023). These transfers are primarily made by individuals who have migrated to foreign countries (Orrenius and Zavodny, 2015). The International Monetary Fund (IMF) is the leading source of statistics on international remittances, compiling data from central banks.

National authorities have updated their data collection methodologies and sources to align with the recommendations of the IMF’s Balance of Payments and International Investment Position Manual, sixth edition (BPM6) (IMF, 2014).

To quantify formal remittance flows, central banks predominantly rely on reports from resident banks and payment institutions under their supervision, whether these reports are submitted in physical or electronic form. Additionally, central banks may analyze their own Foreign Exchange balance, which records transactions involving the purchase and sale of foreign currencies within the domestic financial system. However, measuring informal remittances poses more significant challenges, often requiring estimations. To address this issue, authorities utilize various approaches, including targeted surveys of non-resident individuals.²

Despite the growth in remittance flows and improved methods for tracking cross-border transfers, accurately measuring these flows remains a major challenge. As depicted in Figure A.1 in Appendix A, there is a notable disparity between the amounts sent by individuals abroad and the funds received by recipients in their home countries, as recorded by the IMF and the World Bank based on Balance of Payments data. This difficulty in precise quantification is closely associated with the challenges of monitoring transfers that occur outside the traditional banking system, including those conducted through money transfer operators and cash payments (Brown et al., 2014; De Arcangelis et al., 2023; Seth and Kalyanaraman, 2017). Over the past decade, these alternative methods have become increasingly significant, highlighting the issue of under-reporting, with a growing gap between remittance inflows and outflows, which reached 326 billion US\$ in 2022, equivalent to 0.4 percent of global GDP. The KNOMAD-World Bank database, which provides bilateral remittance estimates based on migrant stocks, host country incomes, and origin country incomes, reported total remittance flows of 781 billion US\$ for 2021.

²A common method employed by central banks for assessing informal remittances involves conducting surveys at airports during holiday seasons. These surveys specifically target non-resident individuals, seeking to gather comprehensive data about the remittances they send, including the amounts transferred, the methods of transfer, and the geographical origins of these transactions.

This figure was approximately 6 percent higher than the official reported figures (Ratha, 2017).

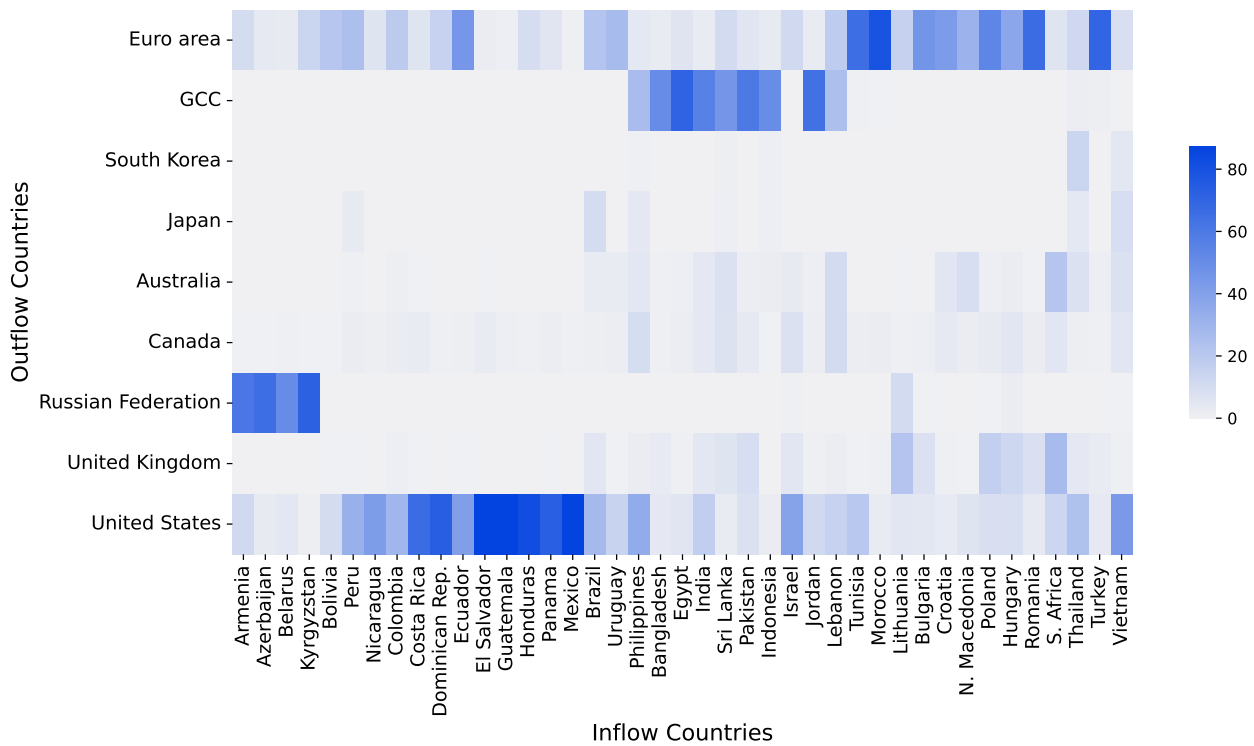
To identify countries that play a significant role in international remittance flows, we use bilateral data from the KNOMAD-World Bank matrix for 2021 (Ratha, 2017). This level of granularity helps to identify the most significant remittance corridors and better understand the dynamics of remittance flows globally. Additionally, the dataset covers a wide range of countries, making it an invaluable resource for assessing the role of remittances in different economic contexts and understanding their impact on both sending and receiving economies. The bilateral remittance flows derived from this dataset are depicted in Figure 3.

The matrix underscores the dominant role of the US in remittance flows across all regions, while also highlighting the crucial roles of other countries as key regional players. For instance, Germany is a major source of remittances for Eastern European nations such as Croatia, Poland, and Hungary, among others. Similarly, Russia is vital for former Soviet Union nations, including Kyrgyzstan, Armenia, Azerbaijan, and Georgia. Spain emerges as a significant remittance sender to Latin American countries, while France plays a key role in remittance flows to the Middle East, North Africa, and Sub-Saharan Africa. The United Kingdom, with its historical ties, emerges as an influential global remittance sender, notably affecting countries in Southeast Asia, East Africa, and the Middle East.

Drawing on these bilateral remittance flows, we identify countries that account for at least 1 percent of total global remittance outflows. However, due to data limitations, we limit our selection to 12 countries and exclude from the empirical analysis the regional economic area formed by the 6 Gulf Cooperation Council countries, which collectively contributed nearly 15 percent of global remittance outflows in 2021.³

³These countries have only begun releasing quarterly and monthly data very recently.

Figure 3: Bilateral remittances matrix



Note: The x-axis represents countries receiving remittances (inflow countries), while the y-axis represents countries sending remittances (outflow countries). The color gradient displays the share of remittances that each country receives from a particular outflow country, ranging from 0 (white) to 100 percent (dark blue). GCC corresponds to the Gulf Cooperation Council countries: Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, Bahrain and Oman.

Source: KNOMAD/World Bank Bilateral Remittance Matrix 2021, December 2022. Extracted from <https://www.knomad.org/data/remittances>.

In selecting recipient countries, we apply specific criteria given the vast number of economies receiving transfers. We focus on countries that, according to KNOMAD data, received at least 0.1 percent of total global remittance inflows annually, on average, from 2000 to 2017.⁴ Additionally, we exclude countries where remittance outflows surpass inflows, and those lacking a monthly output index or available data on personal transfers. Countries that do not meet these criteria account for a relatively minor share of total inflows (14 percent). When including China, which alone contributes 9.3 percent to global inflow figures, the unaccounted portion of flows increases to 23 percent.⁵ Our final selection includes 41 remittance-receiving countries, which collectively represent an average of 65 percent of total remittance inflows, as shown in Figure A.2 in Appendix A.

The descriptive statistics presented in Tables A.1 and A.2 in Appendix A shed light on the average values of several key macroeconomic indicators for the sample of countries sending and receiving remittances. No distinct pattern is evident across these countries. However, countries with a higher reliance on remittances tend to favor fixed exchange rate regimes, whereas those with lower dependency generally adopt floating exchange rate regimes and often have higher per capita income levels. Despite these trends, there seems to be no clear correlation between income levels, dependency on remittances, average growth and inflation rates.

3.2. Identification of US monetary policy shocks

Monetary policy plays a significant role not only in directly influencing economic conditions but also in signaling the central bank's stance on the economy's current state and its expectations for future developments. This signaling aspect complicates the identification of the international spillover effects of the Federal Reserve's

⁴This threshold corresponds to an average annual inflow of 500 million US\$.

⁵Countries excluded from the eligible sample due to data limitations include Albania, Algeria, Argentina, Bermuda, Bosnia, Brasil, Cambodia, China, Chile, Czech Republic, Georgia, Ghana, Haiti, Jamaica, Kenya, Kosovo, Latvia, Moldova, Nepal, Nigeria, Senegal, Serbia, Slovakia, Sudan, Tajikistan, Ukraine, Uzbekistan, Yemen, and Zimbabwe. In the case of China, despite being the third-largest recipient in 2022 with 51 billion US\$, remittances only account for 0.2 percent of their GDP.

policy actions, as highlighted by [Bernanke \(2017\)](#). When analyzing the impact of US monetary policy on global economies, it's crucial to distinguish between the actual shocks resulting from policy changes and the signals sent by the central bank regarding broader economic and financial conditions. Failing to separate these factors can lead to a misunderstanding of the true effects of US monetary policy on other countries and the broader impact of global economic shocks.

[Romer and Romer \(2004\)](#) introduced the narrative approach as a robust and reliable method for identifying US monetary policy shocks by isolating exogenous changes in the Fed's policy through an examination of Federal Open Market Committee (FOMC) minutes. However, the seminal contributions of [Kuttner \(2001\)](#) and [Cochrane and Piazzesi \(2002\)](#), which identify "high-frequency monetary policy shocks" based on changes in futures rates around central bank policy announcements, have become the empirical standard in monetary economics ([Gertler and Karadi, 2015](#)). These high-frequency shocks are constructed using various indicators, such as the fourth federal funds futures contract (FF4) ([Gertler and Karadi, 2015](#); [Jarociński and Karadi, 2020](#); [Miranda-Agrippino and Ricco, 2021](#); [Romer and Romer, 2004](#)), the first principal component of changes in short-term interest rates up to two years ([Barakchian and Crowe, 2013](#); [Nakamura and Steinsson, 2018a](#)), or the entire US yield curve ([Bu et al., 2021](#)).

Recent advancements in analyzing monetary policy shocks have focused on the implications of information asymmetries ([Melosi, 2017](#)). Notably, research has highlighted that market-based measures of monetary surprises often presuppose that private agents have access to perfect information ([Gertler and Karadi, 2015](#)), while narrative approaches assume that central banks are endowed with perfect information ([Romer and Romer, 2004](#)). Information asymmetries can lead to puzzling outcomes, such as the simultaneous movement of interest rates and stock prices following policy announcements. For instance, an unexpected tightening due to economic overperformance may drive up stock prices ([Jarociński and Karadi, 2020](#)). To disentangle the "information effect" from the pure recessionary shock, [Miranda-Agrippino and Ricco \(2021\)](#) have developed an instrument that directly controls for the signaling

channel of monetary policy. This instrument is derived by regressing high-frequency surprises from the FF4 indicator against the macroeconomic forecasts contained in the Greenbook, which are publicly released with a five-year delay, covering the period from January 1990 to December 2017.

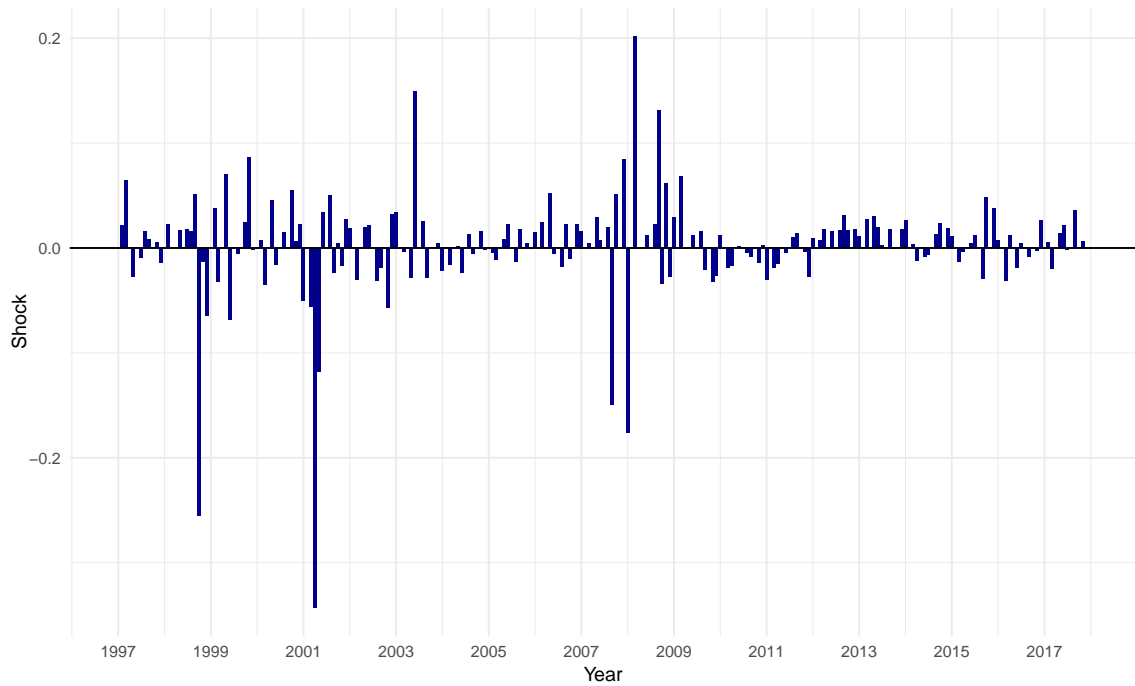
We choose to use the US monetary policy instrument developed by [Miranda-Agrippino and Ricco \(2021\)](#) shown in Figure 4 due to (i) its comparability, as it uses the benchmark FF4 shocks; (ii) its ability to isolate the pure recessionary shock from the central bank’s information shock; (iii) its adoption of the Fed’s private (Greenbook) forecasts as in [Romer and Romer \(2004\)](#), thus combining the narrative and high frequency approaches; (iv) its use in related literature for examining the international transmission of US monetary policy, which facilitates cross-country comparability ([Degasperi et al., 2020](#)).

3.3. Empirical methodology

We derive impulse response functions using local projections (LP) following the approach developed by [Jordà \(2005\)](#). Unlike panel data approaches, we estimate individual country-specific IRFs, as this allows us to assess the effect of U.S. monetary policy spillovers independently for each country. This is crucial for comparing our results with the findings of [Degasperi et al. \(2020\)](#), who use a similar approach. The LP method is favored for its straightforward nature in estimation and structural interpretation, as pointed out by [Stock and Watson \(2018\)](#). This iterated approach also yields more efficient parameter estimates compared to Vector Autoregressive (VAR) models, which are prone to bias escalation in cases of model misspecification. Furthermore, while both approaches have been shown to provide the same impulse responses ([Plagborg-Møller and Wolf, 2021](#)), the LP method’s resilience to model misalignment is particularly advantageous, given the difficulties in consistently achieving accurate specification, especially within typically low-order autoregressive models ([Marcellino et al., 2006](#); [Miranda-Agrippino and Ricco, 2021](#)).⁶ Finally, LP

⁶The LP method, which involves incorporating an external instrument such as the US monetary policy shock, is comparable to the standard Structural Vector Autoregression (SVAR) methods that employ Choleski decomposition ordering the monetary policy shock first.

Figure 4: US monetary policy shock



Note: This Figure illustrates the shock identified by [Miranda-Agrippino and Ricco \(2021\)](#), which displays a correlation of 0.69 with the shock identified by [Jarociński and Karadi \(2020\)](#). These high frequency shocks, recognized as the industry standard in recent monetary policy research, specifically address the information effect.

Source: Shock available at <https://github.com/riccardo-degasperi/info-policy-surprises> from [Degasperi et al. \(2020\)](#).

inference remains robust when dealing with two common features in macroeconomic applications: highly persistent data and the estimation of impulse responses over long horizons (Montiel Olea and Plagborg-Møller, 2021).

We begin by estimating the following linear model for each country in our sample:

$$y_{t+h} = \alpha_h + \sum_{s=1}^h \delta'_s y_{t-s} + \beta_h USMP_t^{shock} + \sum_{s=1}^h \gamma'_s X_{t-s} + \varepsilon_{t+h} \quad (1)$$

Where y_t is the dependent variable, y_{t-s} represents the lagged dependent variable, and \mathbf{X}_t is a vector of domestic variables. The identified US monetary policy shock is denoted by $USMP_t^{shock}$. Hence, the coefficient β_h measures the impact of a policy change at time t on the dependent variable h periods ahead. We consider $s = 12$ lags, following the common practice in monthly specifications and consistent with the approaches of Ramey (2016), Degasperi et al. (2020), and Bauer and Swanson (2023).

We estimate Equation (1) using the LP approach across a dataset spanning from January 1997 to December 2017, covering 240 monthly periods.⁷ Our country-specific sample size ($T = 240$) is comparable to that of Jordà ($T = 300$), thereby reducing the risk of small-sample bias (Herbst and Johannsen, 2021). By plotting β_h against h , we obtain the impulse response function.

The LP estimator is potentially more robust to inaccuracies in the specification of the actual data generation process compared to the SVAR specification, due to its greater flexibility (Nakamura and Steinsson, 2018b). However, since the error term ε_{t+h} is expected to exhibit serial correlation for all horizons $h > 0$ (Ramey, 2016), we estimate Equation (1) using OLS and apply the Newey and West (1987) correction to appropriately address this serial correlation.

For each country, we consider the following monthly variables: (i) remittance inflows (credit) or outflows (debit) in US\$; (ii) nominal short-term interest rate; (iii)

⁷The data regarding the US monetary policy shock developed by Miranda-Agrippino and Ricco (2021) is available until December 2017.

Nominal Effective Exchange Rate (NEER) ; (iv) trade balance with the US (scaled to GDP) (v) Consumer Price Index (CPI); (vi) real output; and (vii) real domestic credit. Except for short-term interest rates and the trade balance with the US, all variables are seasonally adjusted using the X-12-ARIMA method (Findley et al., 1998) and undergo logarithmic transformation. Further details regarding the data sources for each series are provided in Table A.3 in Appendix A.

We classify countries as remittance senders or receivers based on their net debtor or creditor status in the personal transfers account of the balance of payments' secondary income. A country is identified as a sender if it holds a net debtor position for at least two-thirds of the sample periods, and as a receiver if it maintains a net creditor position for the same duration.

4. Results employing median-group local projections

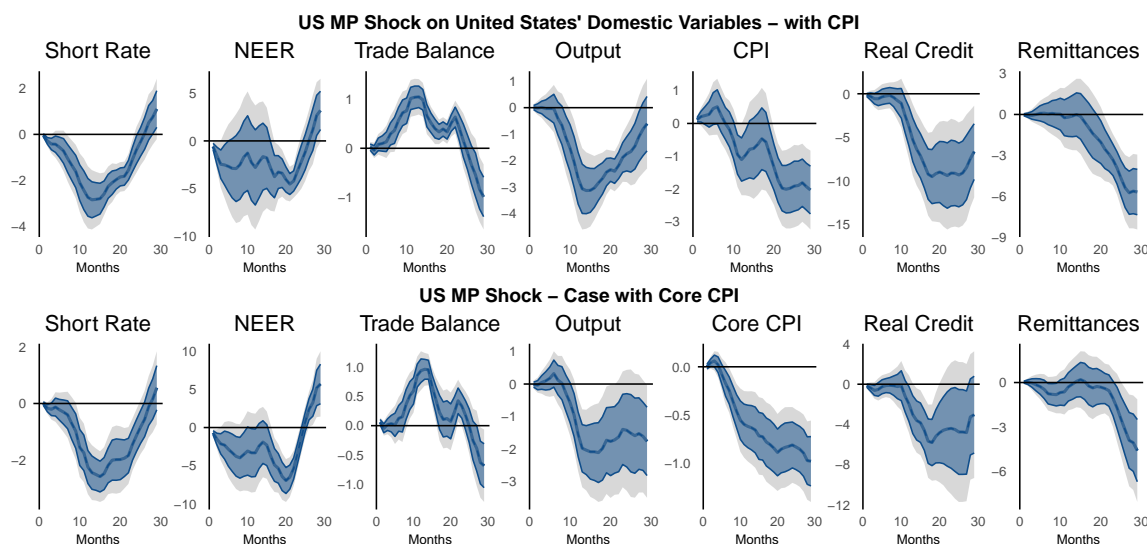
While the impact of US monetary policy shocks on the US is direct, we assess the median dynamic responses for remittance-sending and -receiving countries separately. To achieve this, we compute the median response by horizon across groups of countries from the individual impulse response functions from the local projections, which are performed at the individual country-level. Our goal is to assess how a “median” economy, representing each group, would respond to such shocks. This method is especially valuable in datasets with outliers or high variability. By focusing on the median rather than the mean, the analysis becomes more resilient to extreme values, offering a clearer picture of the typical response. However, recognizing that this measure does not capture the full range of responses, we also report in Figure B.2 in Appendix B the 25th, median (50th percentile), and 75th percentile responses for both sending and receiving countries, to give a more comprehensive picture of the impacts across countries.

4.1. Benchmark results for the United states

In response to a contractionary monetary policy shock, the United States exhibits a pronounced downturn, with significant recessionary effects on real economic vari-

ables—such as output, prices, and credit— reflecting an overall slowdown in the business cycle, as illustrated in Figure 5.

Figure 5: US business cycle responses to a US monetary policy shock



Note: Impulse responses of domestic endogenous US variables to a contractionary one standard deviation US monetary policy shock, resorting to local projections with 12 lags and Newey-West corrected standard errors. Shaded areas correspond to 68 and 90 percent confidence intervals. Monthly sample 1997:01-2017:12.

Indeed, following an unexpected tightening shock, we observe a significant decrease in output. The estimated impulse response function indicates that, while the effect may not be immediate, it becomes pronounced within one to two quarters, leading to a contraction in output of nearly 3 percent and a considerable reduction in real domestic credit. The impact on remittances, although delayed, culminates in a 6 percent decrease in remittance outflows by the end of the cycle, reflecting households' response to the economic downturn as prices adjust downward.

Figure B.1 in Appendix B provides additional evidence, offering further insight into how rising unemployment and falling asset prices contribute to the transmission of monetary policy effects to households. This finding is consistent with the literature on the macroeconomic determinants of remittance outflows, which suggests that

households tend to remit based on their economic circumstances, influenced by their income levels, unemployment, and wealth ([Hathroubi and Aloui, 2016](#); [Vargas-Silva and Huang, 2006](#)).

In response to the economic downturn, there is a gradual decrease in the short-term interest rate. This reduction exerts downward pressure on the nominal effective exchange rate, leading to an improvement in the trade balance as imports collapse faster than exports. These dynamics are consistent with the findings of [Ramey \(2016\)](#) and [Degasperi et al. \(2020\)](#) for the US and align with the mechanisms outlined in the literature.

A key aspect to consider is the impact of a contractionary monetary policy shock on inflation. Our analysis reveals a more pronounced and significant effect on the core CPI compared to the overall CPI, as illustrated in the second row of Figure 5.⁸ The discrepancy arises because the total CPI may respond more sluggishly, influenced by external factors affecting commodity prices ([De Gregorio, 2012](#)). However, focusing solely on the core CPI may overlook second-round effects, which can have significant consequences.

In the analysis of countries other than the US, it is advisable to prioritize the overall CPI rather than the core CPI. This recommendation is based on previous research concerning the impact of US monetary policy on commodity prices and its broader implications for global inflation ([Breitenlechner et al., 2022](#); [Miranda-Pinto et al., 2023](#)).⁹ Therefore, using the CPI that encompasses all items, capturing a wider range of goods and services, provides a more comprehensive measure for evaluating the influence of monetary policy on international inflation trends.

⁸The core CPI denotes the Consumer Price Index for All Urban Consumers: All Items Less Food and Energy, whereas the CPI index represents the Consumer Price Index: All Urban Consumers, All Items, calculated by the US Bureau of Labor Statistics.

⁹In particular, [Miranda-Pinto et al. \(2023\)](#) show that nearly half of the impact of US monetary policy on other countries is mediated through headline inflation.

4.2. US monetary policy transmission to remittance senders

So far, we have demonstrated the significant impact of US monetary policy shocks on the US economy. We now shift our focus to exploring the detailed mechanisms through which these shocks are transmitted to the global economy. As the world's largest economy and a major driver of financial markets, the US exerts a significant influence on the business cycle of other nations (Bekaert et al., 2013; Bruno and Shin, 2015; Rey, 2016). Consequently, the transmission of US monetary policy to other advanced economies, which are also major sources of remittances, likely plays a crucial role in shaping the global business cycle.

Figure 6 displays the median impulse response functions for the 8 remittance-sending countries in our sample, along with the previous results for the US for easier comparison.

We observe a pattern similar to that in the US: initially, short-term interest rates exhibit a brief upward trend before ultimately declining into negative territory, indicating a time delay in the transmission of US monetary policy to the global economy. Additionally, key economic indicators, such as output, inflation, and real credit, experience contractions similar to those observed in the US (Crespo-Cuaresma et al., 2016; Degasperis et al., 2020). The most notable finding is the substantial reduction in remittance outflows. This reduction is not only statistically significant but also more pronounced than the corresponding decrease in the US. Specifically, following a tightening of US monetary policy, remittance outflows contract by 20 percent within one year.

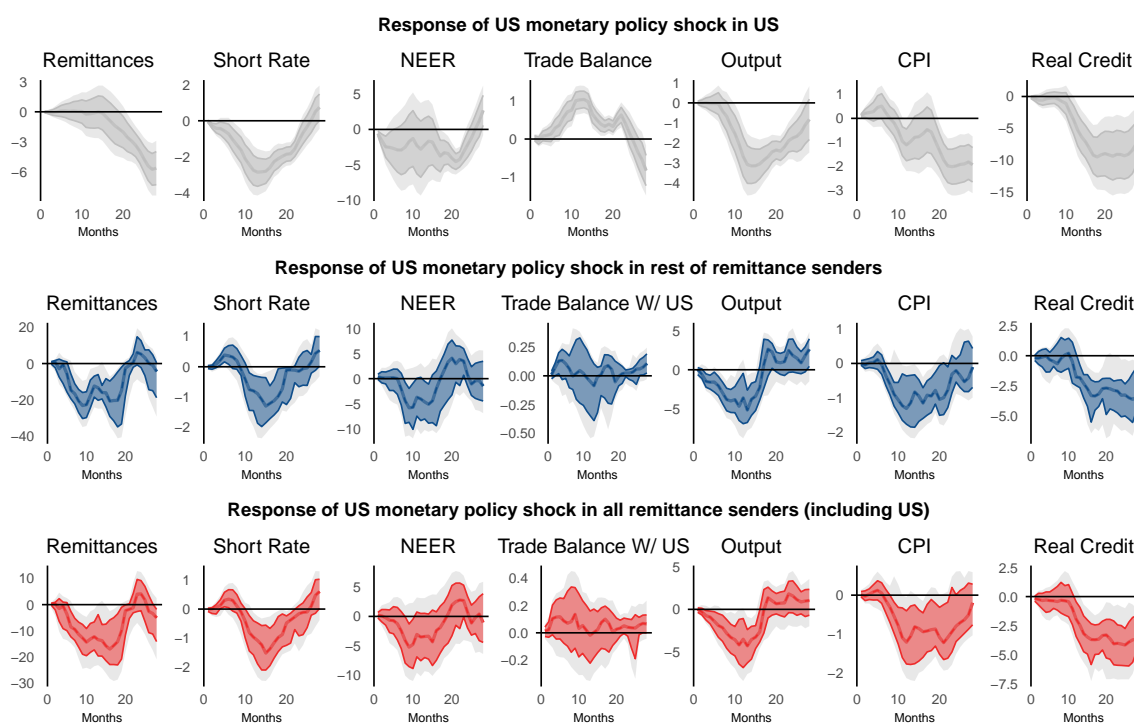
4.3. US monetary policy transmission to remittance recipients

After exploring the dynamics in remittance-sending countries, we now turn our attention to how US monetary policy shocks affect remittance-receiving countries.

Figure 7 presents the median IRFs for all recipient countries. This initial analysis reveals no strong statistical significance, except for a modest increase in the short-term interest rate and a slight decrease in output and prices.

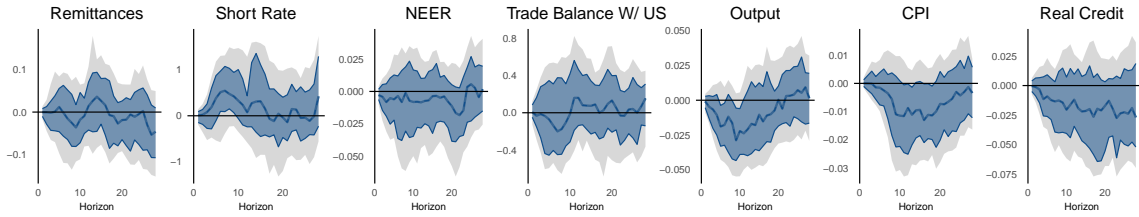
We then estimate the response of each endogenous variable to a US monetary policy shock on a country-specific basis throughout the business cycle. Table B.1 in Ap-

Figure 6: Responses of remittance senders to a US monetary policy shock



Note: This chart provides a clear depiction of two distinct country clusters. The first cluster focuses on the US IRF. The second one presents a comprehensive overview of major net remittance-sending nations, deliberately excluding the US. This includes South Korea (KR), Japan (JP), Canada (CA), Russia (RU), Australia (AU), the Euro-area (EZ) and the United Kingdom (GB). The final grouping encompasses all remittance-sending countries, integrating the US. Median of country-by-country responses of endogenous variables to a contractionary one standard deviation US monetary policy shock, resorting to local projections with 12 lags and Newey-West corrected standard errors. Shaded areas correspond to 68 and 90 percent confidence intervals. Monthly sample 1997:01-2017:12.

Figure 7: Response of all remittance recipient countries to a US monetary policy shock



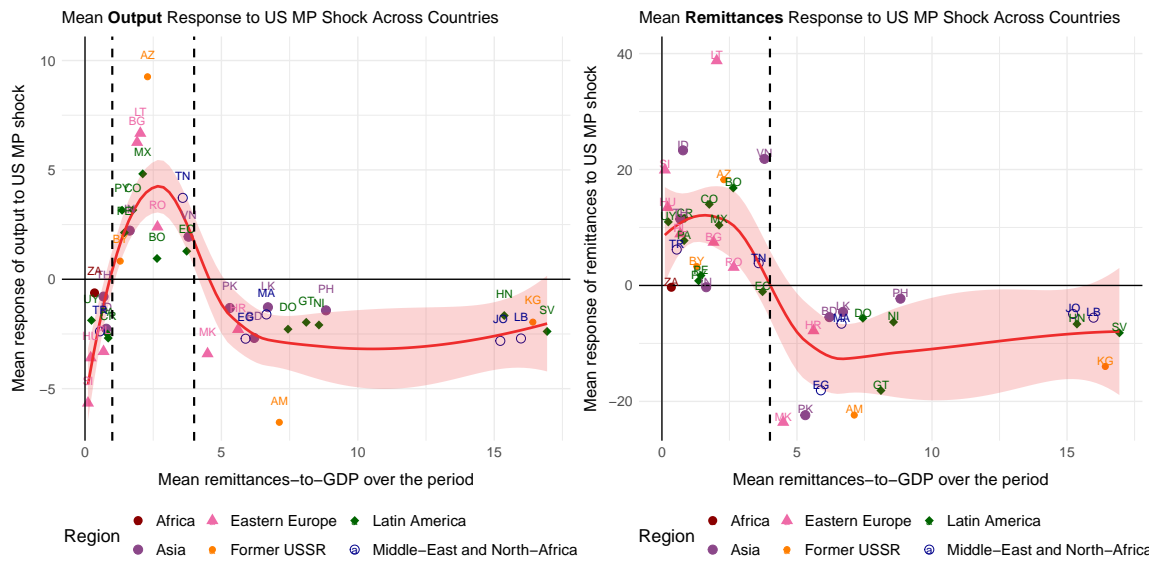
Note: Median of country-by-country responses to a contractionary one standard deviation US monetary policy shock resorting to local projections with 12 lags and Newey-West corrected standard errors. Shaded areas correspond to 68 and 90 percent confidence intervals. Monthly sample 1997:01-2017:12.

pendix C summarizes the responses that are statistically significant at the 90 percent confidence level over a continuous period of at least three months. Responses with a positive average are marked in green, while those with a negative average are marked in red. This table includes data for both remittance-receiving and remittance-sending countries. Remittance-receiving countries are listed in descending order according to their average remittance-to-GDP ratios for the period 1997-2017. This table illustrates the varied responses in output and remittances across recipient countries, whereas responses from sending countries appear more uniform.

To delve deeper into the analysis, we present the average responses of output and remittances at the individual country level, alongside the distributions of the coefficients representing the 25th and 75th percentile responses over the horizon. These are analyzed as a function of the average remittances-to-GDP ratio over the period, as depicted in Figures 8 and 9.

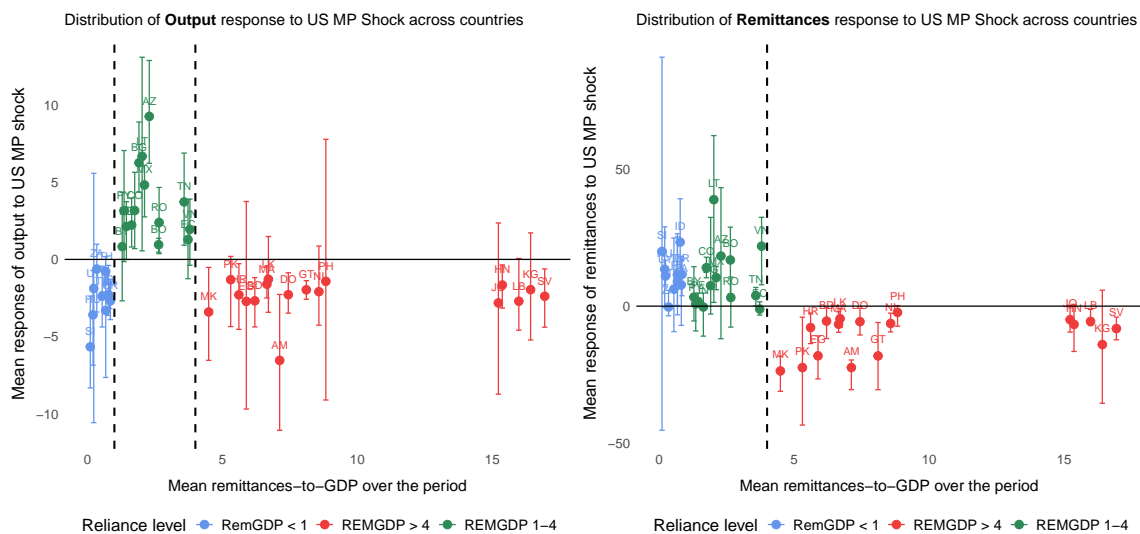
The figures clearly demonstrate that when remittance flows account for between 1 and 4 percent of GDP, the patterns of remittances and output undergo distinct changes in response to a US monetary policy shock. Furthermore, these observed effects are not contingent upon geographical regions, underscoring the broad applicability of the identified threshold levels across diverse economic contexts.

Figure 8: Responses of recipient countries to a US monetary policy shock, by level of reliance to remittances



Note: Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period. Mean output and remittances responses to a contractionary one standard deviation US monetary policy shock. Sample 1997:01- 2017:12. Each dot corresponds to the mean IRF response of output/remittances to a US MP shock over the horizon $t = 24$. Vertical dashed lines at 1 and 4 percent show the threshold levels. Furthermore, the red line represents the non linear trend line while the red shade correspond to the corresponding loess standard errors.

Figure 9: 25th, Mean and 75th Response of Output and Remittances to US Monetary Policy Shock by Level of Reliance to Remittances



Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period. Mean output (lhs) and remittances (rhs) responses to a contractionary one standard deviation US monetary policy shock. Sample 1997:01- 2017:12. Vertical dashed lines at 1 and 4 percent show the threshold levels. Each dot corresponds to the mean response, with the 25th and 75th percentile response over the period. For instance, the dot representing AM in the left hand graph corresponds to the mean IRF response of output to a US MP shock over the horizon $t = 24$. The box plot represent the 25th and 75th percentile distributions of the coefficient.

To confirm the statistical reliability and validate the accuracy of these thresholds, we utilize two statistical tests, as outlined in Table 1: the t-test and the Mann-Whitney U-test. These tests specifically assess the statistical differences in the responses of groups categorized by their reliance on remittances to a US monetary policy shock. By applying these tests, we ensure that our threshold selections are not solely based on stylized facts but are also supported by robust statistical evidence, thereby enhancing the credibility of our findings.

Table 1: *T-test of output and remittance coefficients*

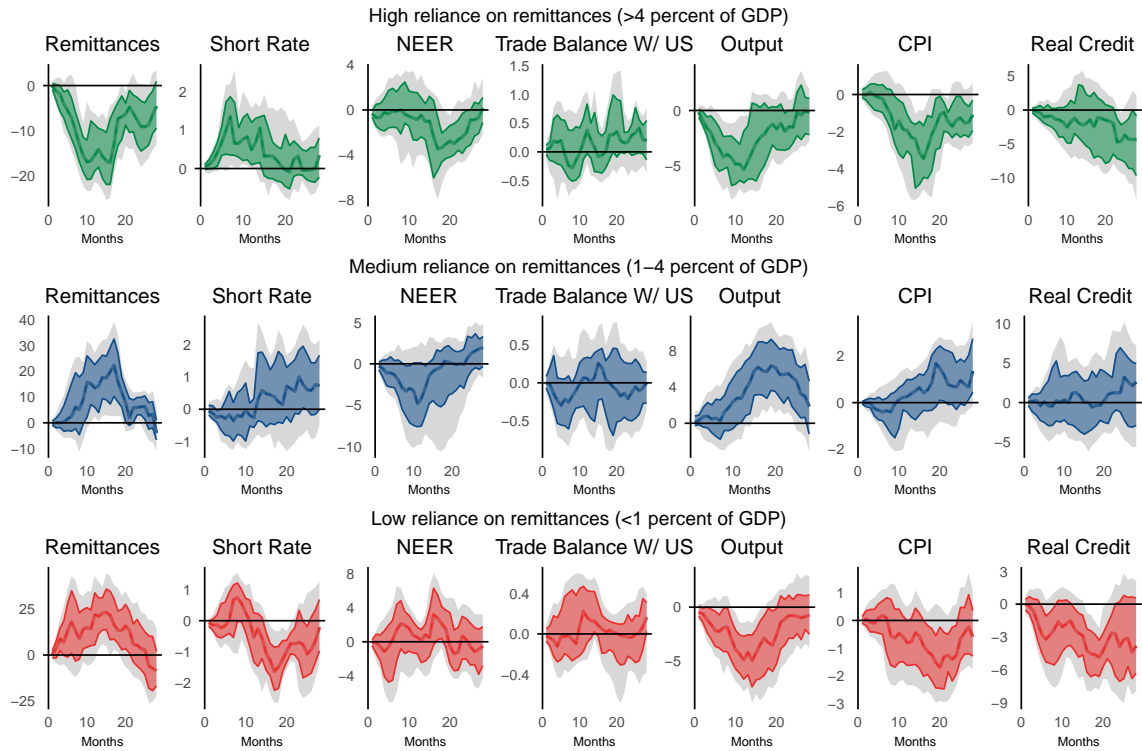
	Output coefficients		Remittance coefficients	
	T-test	U-test	T-test	U-test
Remittances-to-GDP < 1 versus Remittances-to-GDP 1-4	0.00002***	0.000001***	0.8147	0.4031
Remittances-to-GDP < 1 versus Remittances-to-GDP >= 4	0.8937	0.7114	0.00181***	2.0×10^{-7} ***
Remittances-to-GDP 1-4 versus Remittances-to-GDP >= 4	0.000006***	8.0×10^{-9} ***	0.000003***	7.0×10^{-9} ***

Note: Pairwise t-tests were conducted to compare estimated coefficients between groups categorized by their reliance on Remittances-to-GDP. The t-statistic measures the difference in means, while the p-value assesses statistical significance. A small p-value (< 0.05) indicates significant differences between groups.

The results clearly indicate significant differences between countries with moderate remittance-to-GDP ratios (1-4 percent of GDP) and other groups of countries. While the remittance coefficients are not statistically significant, the output coefficients show a significant difference between these countries and those with low remittance inflows (< 1 percent of GDP). Moreover, both test metrics are statistically significant, highlighting clear and significant differences in the remittances and output coefficients between these countries and those with high remittance-to-GDP ratios (> 4 percent). These findings suggest that as remittance inflows exceed the thresholds of 1 percent and 4 percent of GDP, the impact of a US monetary policy shock on the economy undergoes significant changes.

Figure 10 presents the median outcomes for 41 recipient countries, categorized by their average remittances-to-GDP levels based on the thresholds previously defined.

Figure 10: *IRF median responses by degree of exposure to remittance flows*



Note: Median of country-by-country responses to a contractionary one standard deviation US monetary policy shock resorting to local projections with 12 lags and Newey-West corrected standard errors. Shaded areas correspond to 68 and 90 percent confidence intervals. Monthly sample 1997:01-2017:12. Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period. This graph presents the average remittances as a percentage of GDP for various countries from 1997 to 2017. Countries with remittances exceeding 4 percent include Guatemala (GT), Nicaragua (NI), Philippines (PH), Honduras (HN), Lebanon (LB), Jordan (JO), El Salvador (SV), Kyrgyzstan (KG), Croatia (HR), North Macedonia (MK), Dominican Republic (DO), Armenia (AM), Morocco (MA), Ecuador (EC), Egypt (EG), Pakistan (PK), Bangladesh (BD), and Sri Lanka (LK). Countries where remittances average 1-4 percent of GDP include Bulgaria (BG), Belarus (BY), Peru (PE), Colombia (CO), Mexico (MX), Bolivia (BO), Tunisia (TN), Vietnam (VN), Paraguay (PY), Romania (RO), Lithuania (LT), Azerbaijan (AZ), and India (IN). Conversely, countries where inflows represent less than 1 percent on average include Thailand (TH), Indonesia (ID), Turkey (TR), Uruguay (UY), South Africa (ZA), Slovenia (SI), Poland (PL), Hungary (HU), Panama (PA), and Costa Rica (CR).

The results indicate that following a tightening of US monetary policy, remittance inflows experience a statistically significant increase in recipient countries where remittances account for less than 4 percent of their GDP on average over the period. This increase amounts to nearly 20 percent, peaking after one year. Another notable observation is that output declines across all categories except for countries where remittances constitute 1-4 percent of GDP over the period. For all other categories, output decreases by an average of 5 percent over the initial 12 months. In contrast, the output response in Row (2) of Figure 10 shows a minimal effect during the first 12 months, followed by a 6 percent increase, peaking at 20 months after the monetary policy shock.

CPI responses also vary among recipient countries. In countries heavily reliant on remittances, a noticeable decline in the CPI is observed. However, the surge in remittance inflows for less dependent economies appears to lead to a divergence from the overall decrease in inflation observed in other countries, including those sending remittances. This divergence is particularly pronounced in countries where remittances make up less than 4 percent of GDP. By considering the classic channels of international monetary policy transmission outlined by Taylor (1995) –specifically the exchange rate and interest rate channels (the “money view”) and the bank-lending channel (the “credit view”)– we can evaluate the full impact of the remittance channel while also accounting for spillovers into these other channels (Acosta et al., 2009; Barajas et al., 2018).¹⁰

When analyzing the median IRFs across countries where remittances represent at least 4 percent of GDP, several key observations emerge. Firstly, an unexpected tightening of US monetary policy results in a nearly 20 percent reduction in remittance inflows, peaking after 12 months. This decline can be attributed to households in sending countries experiencing decreased incomes, rising unemployment, and asset

¹⁰The “money view” focuses on how monetary policy influences the prices and returns of financial assets. In our model, this is represented by the short-term interest rate and NEER. On the other hand, the “credit view” emphasizes the importance of the balance sheet and bank-lending channels. In our model, this is represented by the real credit variable.

depreciation, consistent with prior research ([Machasio and Tillmann, 2023](#)). Following this reduction, we observe a subsequent depreciation of the NEER, primarily because remittances often constitute a significant source of foreign currency reserves. Consequently, a decrease in remittances diminishes the demand for the local currency, leading to its depreciation.

These changes have a significant impact on the real economy, resulting in nearly a 6 percent decline in output and a 3 percent reduction in the price index. Interestingly, the short-term interest rate rises after a monetary tightening shock. This may seem counterintuitive, as short-term rates are generally expected to decrease following a contractionary shock to stimulate economic activity—similar to what is observed in remittance-sending countries, which are mainly advanced economies—. However, in countries highly dependent on remittances, the decline in remittance inflows, combined with the depreciation of the exchange rate, exerts upward pressure on short-term interest rates. This increase aims to counter capital outflows and stabilize the economy, but it further weakens economic activity. [De Leo et al. \(2024\)](#) attribute this response to emerging economies' banking sector relying on international markets for dollar funding, often supported by remittance inflows, which impairs the transmission of monetary policy ([Barajas et al., 2018](#)). Consequently, a significant drop in remittances in economies heavily reliant on these inflows triggers an increase in short-term interest rates. The trade balance with the US does not seem to have a significant overall impact.

Countries with moderate dependence on remittances experience a significant rise in these remittance flows, whereas the opposite is observed in countries heavily reliant on remittances. This difference in remittance responses can be attributed to the fluctuating nature of this income source, which can exhibit both pro-cyclical and counter-cyclical behaviors, as depicted in [Figure B.4](#) in [Appendix B](#). [Rapoport and Docquier \(2006\)](#) provide a detailed classification of individuals' decisions to remit funds to their home countries, including altruism, insurance, and strategic considerations leading to counter-cyclical remittances, as well as exchange, inheritance, and investment, which contribute to pro-cyclical remittance flows. Communities with

large migrant populations who regularly send significant amounts each month may reduce their remittances during a crisis due to having fewer savings to compensate. On the other hand, migrants who don't typically engage in these transactions may be willing to allocate a portion of their income or savings to support their relatives during challenging times. This behavior can be influenced by factors such as consumption smoothing by migrant workers (Sayan, 2006). Acosta et al. (2009) and Giuliano and Ruiz-Arranz (2009) demonstrate that the counter-cyclicality of remittances tends to increase with income, being most pronounced in upper-middle-income countries and in countries with more developed financial systems.

Therefore, a crucial aspect of the global transmission mechanism may be the divergent impact on immigrants living in sender economies (AEs), whose remittance behaviors are shaped by previous levels of remittances. Individuals with a history of high remittance flows are likely to decrease their outflows in response to a tightening in US monetary policy. Conversely, those who previously sent fewer remittances might increase their outflows, potentially as a counter-cyclical response. These dynamics result in various outcomes on real domestic variables in recipient countries. For example, Kpodar et al. (2023) investigates the diverging trends in US remittance outflows during the early stages of the COVID-19 pandemic, highlighting the perplexing effect resulting from various immigrant communities sending funds back home. The study specifically examines two comparable countries with predominantly low-skilled immigrant populations, observing a notable increase in remittances to Mexico juxtaposed with a sharp decline to El Salvador. This discrepancy can be attributed to a higher propensity among Central American immigrants to send remittances –nearly 50 percent– compared to 30 percent for Mexican immigrants, a finding supported by Bidawi et al. (2022).

5. Robustness checks

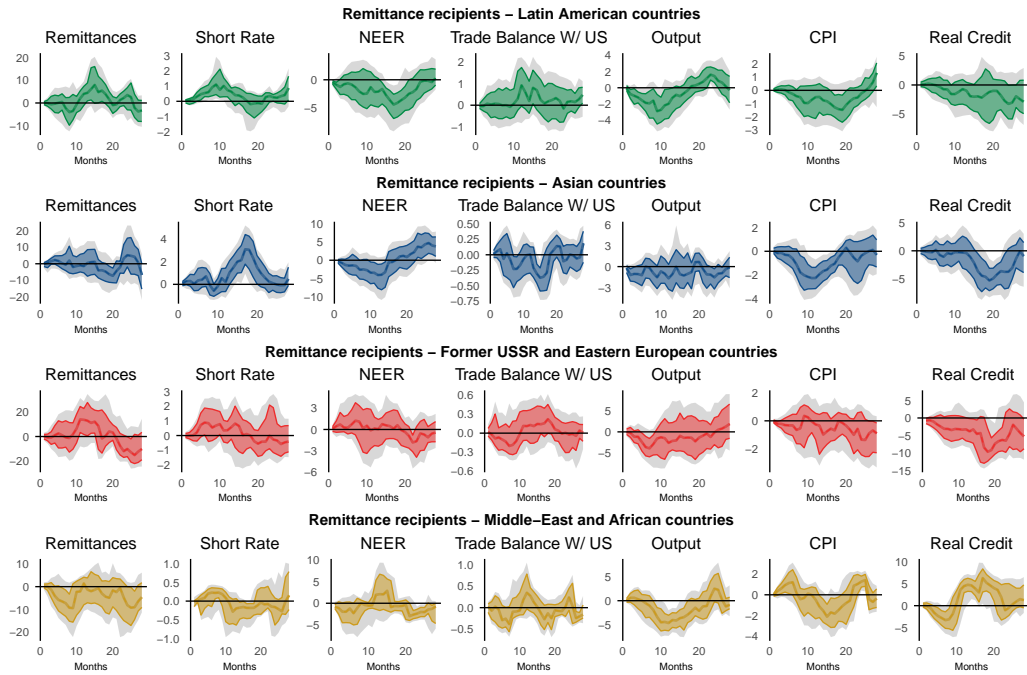
In this section, we conduct several robustness checks to ensure the reliability of our findings. These include performing a placebo test, analyzing an alternative high-frequency shock, examining various lag structures, and estimating a panel local

projection model.

5.1. Implementing a placebo test

As a placebo test, we use an alternative categorization of countries by grouping them by geographical areas, as depicted in Figure 11. Our aim is to determine whether our results are driven by reliance on remittances rather than by geographical factors. We observe a marked negative impact of monetary tightening on output exclusively in Middle-Eastern and African countries, while Latin America experiences a subtler effect. Despite the broad geographical scope of our analysis, a consistent pattern in the effects of a US monetary policy shock across regions remains elusive. Notably, the impact on remittance inflows is indistinct across any specific region. Thus, categorizing recipient countries based on geographical location does not straightforwardly lead to general conclusions about the cross-border effects of a US monetary policy shock.

Figure 11: Median IRF responses by geographical region



Note: Median of country-by-country responses –grouped by geographical region– to a contractionary one standard deviation US monetary policy shock resorting to local projections with 12 lags and Newey-West corrected standard errors. Shaded areas correspond to 68 and 90 percent confidence intervals. Monthly sample 1997:01-2017:12. Latin American countries regroup : El Salvador (SV), Honduras (HN), Guatemala (GT), Nicaragua (NI), Dominican Republic (DO), Ecuador (EC), Brazil (BR), Paraguay (PY), Uruguay (UY), Colombia (CO), Bolivia (BO), Peru (PE), Mexico (MX) and Costa Rica (CR). Asian countries comprise: the Philippines (PH), Sri Lanka (LK), Bangladesh (BD), Pakistan (PK), Vietnam (VN), India (IN), Indonesia (ID) and Thailand (TH). Eastern Europe/Former USSR regroups the following countries: North Macedonia (MK), Croatia (HR), Hungary (HU), Romania (RO), Poland (PL), Kyrgyzstan (KG), Belarus (BY), Bulgaria (BG), Slovenia (SI), Armenia (AM), Lithuania (LT). Finally, Middle Eastern and African countries comprise Lebanon (LB), Jordania (JO), Morocco (MA), Tunisia (TN), Turkey (TR), South Africa (ZA) and Egypt (EG).

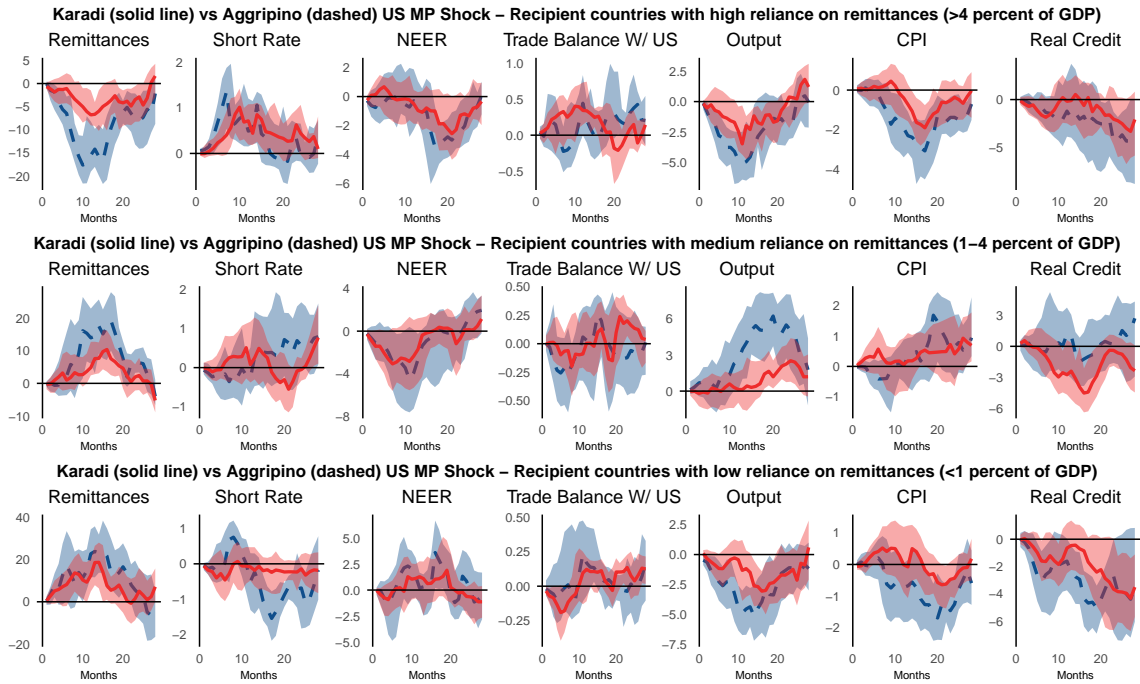
5.2. Using an alternative high-frequency shock and control variables

Figure 12 provides a comparative analysis of the effects of different monetary shocks. It contrasts the alternative high-frequency shock introduced in Section 2.2, which incorporates the information effect —specifically, the shock described by [Jarociński and Karadi \(2020\)](#) (represented by colored and solid lines)— against the high-frequency instrument proposed by [Miranda-Agrippino and Ricco \(2021\)](#) (depicted with dashed and grey lines).

A key finding from this comparison is the consistent median IRFs across both shocks, supporting the reliability of our conclusions. Although the results vary slightly with the [Jarociński and Karadi \(2020\)](#) shock, particularly for countries where remittances-to-GDP ratios are below 1 percent, the overall findings align with our initial analysis. Specifically, for countries with remittances-to-GDP ratios above 4 percent, both measures of shock indicate a decrease in remittances and economic output, along with a rise in short-term interest rates, highlighting the vulnerability of these economies to sudden changes in US monetary policy. For countries with remittances-to-GDP ratios between 1 and 4 percent, the analysis consistently shows positive impacts on remittances and economic output from both shocks.

In addition to the alternative high-frequency shock, we also use control variables to test the robustness of our results. Figure C.1 in Appendix C controls for the commodities cycle, while Figure C.2 controls for financial crises throughout the Financial stress index ([Ahir et al., 2023](#)). Figure C.3 controls for the excess bond premium as outlined by [Gilchrist and Zakrajšek \(2012\)](#), and Figure C.4 controls for foreign exchange reserves held by central banks. All these specifications are consistent with the benchmark results, showing an inverse U-shaped effect of the US tightening shock on output, depending on the reliance on remittances as a share of GDP, and a negative effect on remittances in countries that are highly dependent on them.

Figure 12: Robustness to high frequency US monetary policy shock :*Jarociński and Karadi (2020)* vs *Miranda-Agrippino and Ricco (2021)* - Median IRF responses by degree of reliance to remittances as a share of GDP

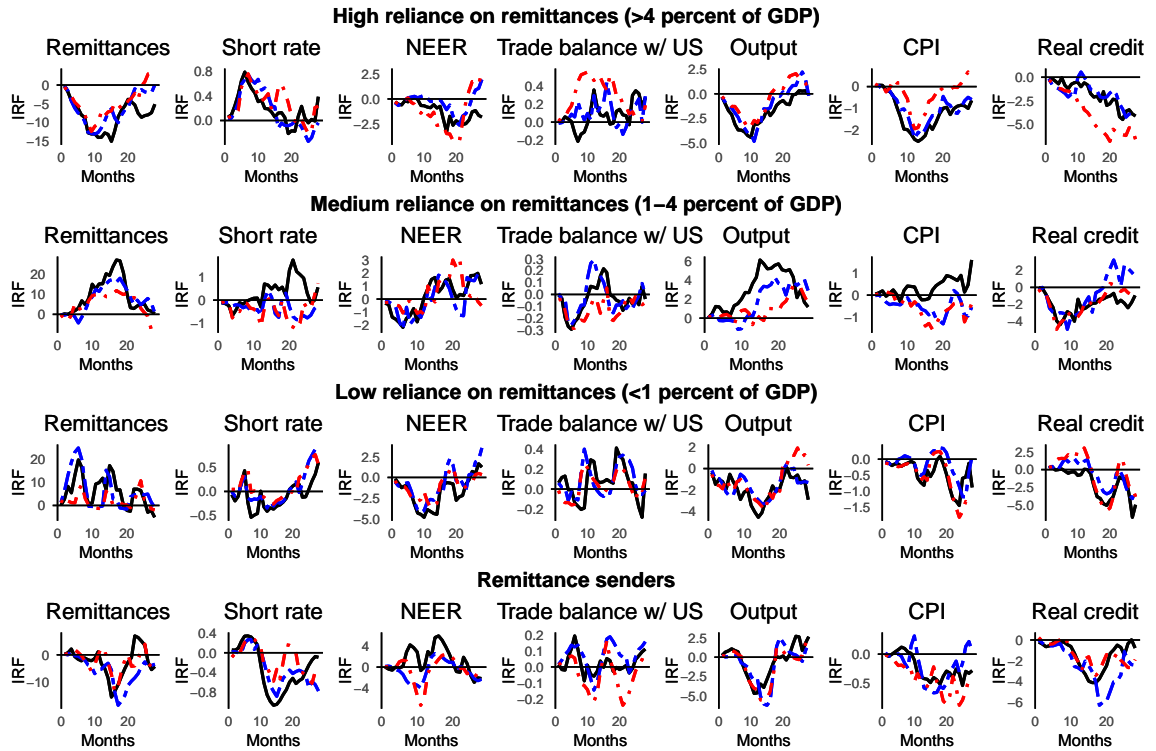


Note: Median of country-by-country responses to a contractionary one standard deviation US monetary policy shock resorting to local projections with 12 lags and Newey-West corrected standard errors and 1 standard deviation error bands. Monthly sample 1997:01-2017:12. Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period. In each graph we show the median and standard errors for the US monetary policy shock estimated by *Jarociński and Karadi (2020)* (solid line and color shade) and the previous one estimated by *Miranda-Agrippino and Ricco (2021)* (dash line and gray shade). Countries with remittances exceeding 4 percent include Guatemala (GT), Nicaragua (NI), Philippines (PH), Honduras (HN), Lebanon (LB), Jordan (JO), El Salvador (SV), Kyrgyzstan (KG), Croatia (HR), North Macedonia (MK), Dominican Republic (DO), Armenia (AM), Morocco (MA), Ecuador (EC), Egypt (EG), Pakistan (PK), Bangladesh (BD), and Sri Lanka (LK). Countries where remittances average 1-4 percent of GDP include Bulgaria (BG), Belarus (BY), Peru (PE), Colombia (CO), Mexico (MX), Bolivia (BO), Tunisia (TN), Vietnam (VN), Paraguay (PY), Romania (RO), Lithuania (LT), Azerbaijan (AZ), and India (IN). Conversely, countries where inflows represent less than 1 percent on average include Thailand (TH), Indonesia (ID), Turkey (TR), Uruguay (UY), South Africa (ZA), Slovenia (SI), Poland (PL), Hungary (HU), Panama (PA), and Costa Rica (CR).

5.3. Sensitivity to the choice of lag length

Figure 13 investigates the impact of lag length on our findings, systematically presenting the results from employing different lag lengths —6, 9, and 12— in our LP analysis.

Figure 13: Robustness to lag specification (6, 9 and 12 lags) - Median IRF responses by degree of reliance to remittances as a share of GDP



Note: Median of country-by-country responses to a contractionary one standard deviation [Miranda-Agrippino and Ricco \(2021\)](#) US monetary policy shock resorting to local projections with 12 (black, solid), 9 (blue, twodash) and 6 (red, dotdash) lag specifications and Newey-West corrected standard errors. Monthly sample 1997:01-2017:12. Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period while the last row corresponds to remittance-sending countries.

The main insight from this analysis is the remarkable consistency of the results across various lag configurations. Whether we use 6, 9, or 12 lags, our core conclusions remain unchanged, indicating that our findings are robust and not contingent upon

a specific lag length. However, given that our dataset includes monthly observations, the 12-lag structure uniquely allows for a comprehensive capture of annual dynamics, which are crucial for analyzing macroeconomic indicators.

5.4. Estimating panel local projections

Finally, we employ an alternative econometric approach by applying panel LP to various subsamples. This method allows us to evaluate the effectiveness of using median responses from specific subgroups for analysis. Specifically, we estimate a linear panel model for each group of countries, categorized according to their dependence on remittances:

$$y_{i,t+h}^{(v)} = \alpha_{i,h}^{(v)} + \sum_{s=1}^h \delta_h^{(v)} y_{i,t-s}^{(v)} + \beta_h^{(v)} USMP_{i,t}^{shock} + \lambda_i + \varepsilon_{i,t+h}^{(v)} \quad (2)$$

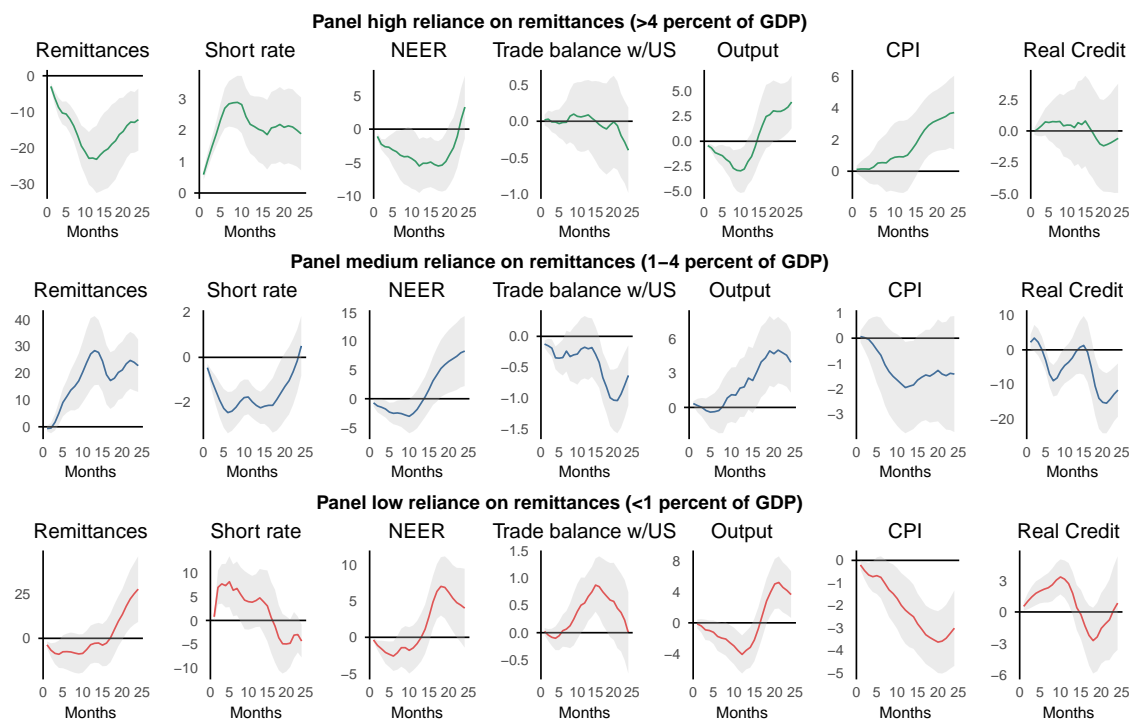
Where v represents each of the dependent variables: *Remittances*, *Short rate*, *NEER*, *Trade balance with the US*, *Output*, *CPI*, and *Real credit*. $y_{i,t+h}^{(v)}$ is the dependent variable, $y_{i,t-s}^{(v)}$ is the lagged dependent variable, and λ_i corresponds to the country fixed effects. The identified US monetary policy shock is denoted by $USMP_{i,t}^{shock}$. Thus, the coefficient $\beta_h^{(v)}$ measures the impact of a policy change at time t on the dependent variable v h periods ahead. We also consider $s = 12$ lags.

We estimate Equation (2) using the LP approach over a sample period from January 1997 to December 2017, resulting in 240 monthly periods.¹¹ We employ [Driscoll and Kraay \(1998\)](#) robust standard errors to account for cross-sectional and serial correlation in panel models .

Figure 14 clearly illustrates how different levels of reliance on remittances affect economic indicators, corroborating our initial findings with median IRFs on a country-by-country basis.

¹¹Due to data availability of the monetary policy instrument.

Figure 14: Robustness to panel local projections, by degree of reliance to remittances as a share of GDP



Note: Responses to a contractionary one standard deviation US monetary policy shock resorting to panel local projections with 12 lags and Driscoll and Kraay’s corrected standard errors along with 1 standard deviation error bands. Monthly sample 1997:01-2017:12. Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period.

For the panel of countries with a remittances-to-GDP ratio exceeding 4 percent, there is a noticeable drop in remittances accompanied by a downturn in economic performance, confirming our previous results about these economies’ vulnerability to external financial shifts. These countries also exhibit a significant decline in their NEER despite a rise in short-term interest rates, leading to an increase in the CPI. In contrast, the panel of countries with a remittances-to-GDP ratio of 1 to 4 percent shows a different pattern, with increases in both remittance inflows and economic output, alongside a decrease in short-term interest rates. This improvement is accompanied by a rise in NEER and a slight decrease in CPI.

For the panel of countries with a remittances-to-GDP ratio below 1 percent, the effects are subtler and less clear-cut. After a short-lived decline in remittances, they recover over the following months, while short-term rates gradually fall, output contracts and prices decrease. This ambiguity may indicate either a lesser reliance on remittances within these economies or a complex interplay of economic variables that the panel model may not fully capture.

Overall, the panel data evidence supports the validity of our analysis for these countries by shedding light on the underlying mechanisms. The only substantial difference noted is a decrease in short-term rates for countries with moderate reliance on remittances, following an increase in remittance flows. This finding emphasizes the impact of remittances on the monetary policy autonomy of emerging markets.

6. Conclusion

This article expands the empirical evidence supporting the existence of a “global financial cycle” linked to economic conditions in the “center country” (Rey, 2015), with a particular focus on the unique role of remittance dependence within this framework. As remittances have now surpassed foreign direct investment and development aid in numerous countries, they have become a critical driver of growth and stability for recipient economies. Moreover, they serve as a significant transmission channel through which US monetary policy influences other nations’ economies.

We identify a threshold of remittance inflows that shapes the spillover effects of a US monetary policy shock. When remittances constitute a moderate portion of a country’s GDP—less than 4 percent—they tend to follow a counter-cyclical pattern after US monetary tightening. Specifically, for flows between 1 and 4 percent of a country’s GDP, remittances can help soften and even counteract the global downturn triggered by tighter US monetary policy. On the other hand, countries more dependent on remittances—exceeding 4 percent of their GDP—face significant recessionary effects, with adverse impacts on various economic indicators, including remittances, output, prices, and credit. These results remain robust across various robustness checks, including placebo tests, alternative high-frequency shocks, differ-

ent lag structures, and panel local projection model estimates.

We explain these different patterns by linking the reliance on remittance inflows to immigrants' likelihood of sending remittances. Following a downturn caused by US monetary tightening, aggregate outflows of immigrants from countries with high remittance-to-GDP ratios tend to decrease their transfers, while those from countries with lower ratios are more likely to increase them.

Our findings highlight the risks associated with heavy reliance on remittance flows. Contrary to earlier assumptions, such dependence can exacerbate economic downturns and heighten vulnerability. A significant drop in remittances can immediately weaken domestic demand and output. Moreover, the resulting decline in foreign currency reserves may prompt counter-cyclical increases in short-term interest rates to prevent sharp currency depreciation, further deepening economic instability. Additionally, remittances can influence the stability of the financial sector, underscoring the need for regulatory oversight similar to that applied to other capital flows. For policymakers, it is crucial to recognize these risks and implement regulatory frameworks that reduce vulnerabilities associated with excessive dependence on remittances, thereby safeguarding monetary policy autonomy and economic stability.

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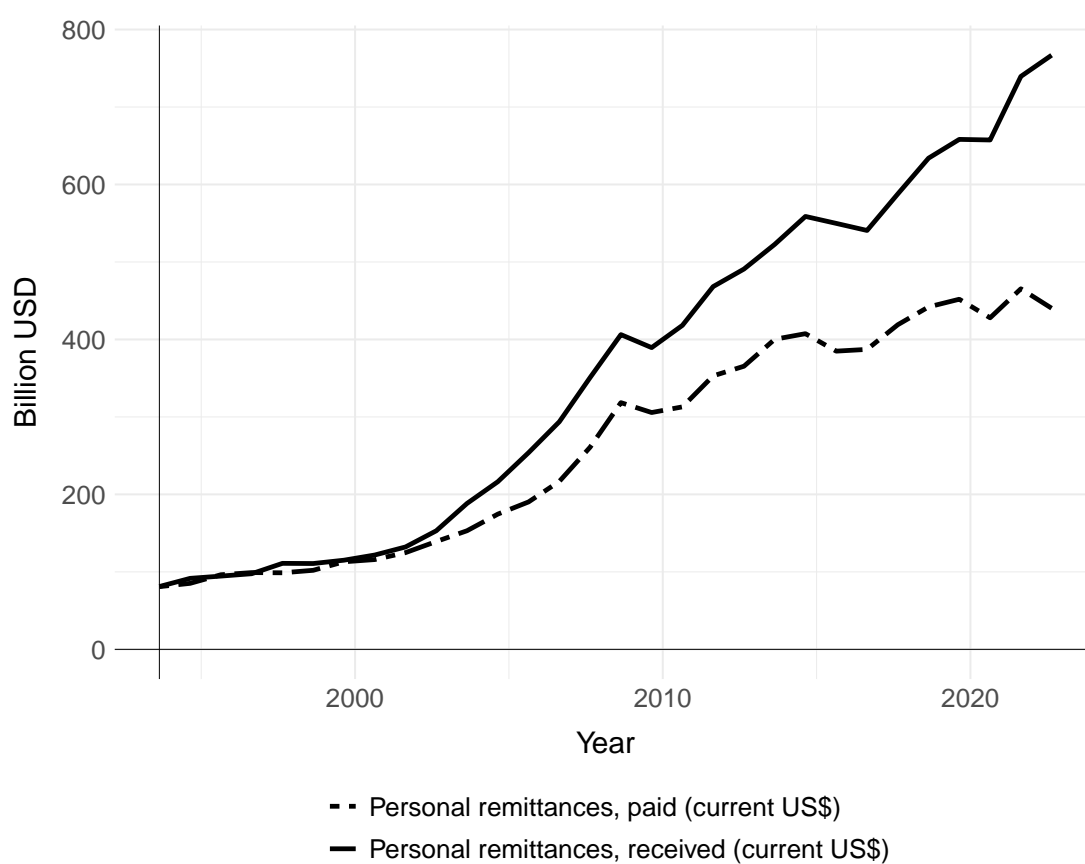
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Appendices

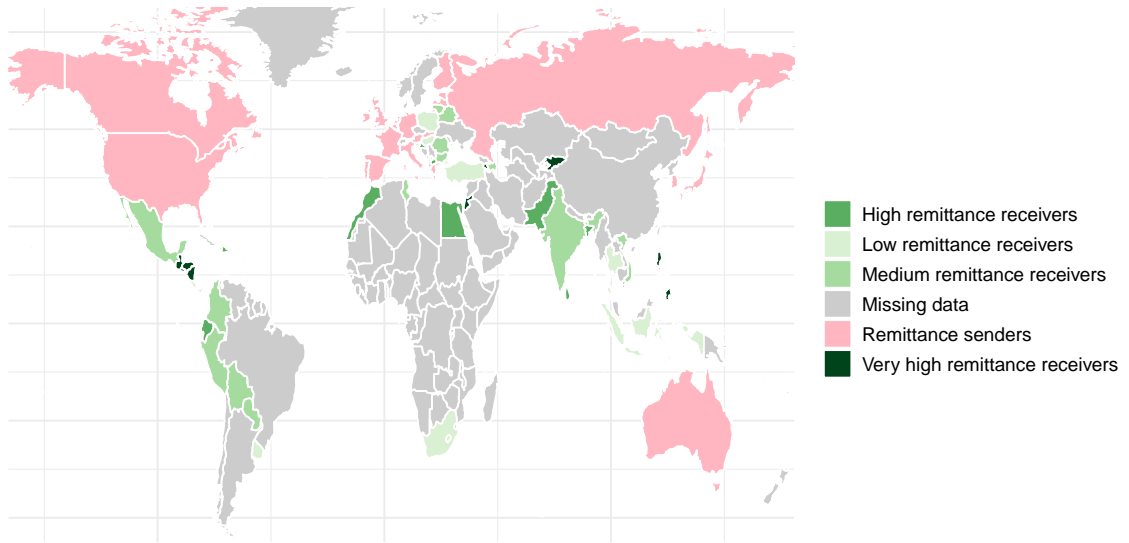
Appendix A - Data and sample

Figure A.1: Remittance reporting gap



Note: The figure reports personal remittances paid (dashed line) and received (solid line) in billions current US\$. Total personal remittances data extracted from <https://data.worldbank.org/indicator/BM.TRF.PWKR.CD.DT>.

Figure A.2: Countries in the sample



Note: The world map represents the countries included in the sample, colored by the average level of remittances-to-GDP over the 1997-2017 period.

Table A.1: Descriptive statistics - Recipient countries

	Country	Remittance position	Remittances -to-GDP	ER Arrangement	KA openness	GDP PC ppp	Average inflation	Average monthly growth	Trade balance -to-GDP	Trade balance with US (percent GDP)	Share of trade with US	Trade openness
KG	Kyrgyzstan	Inflow country	16.2	Floating ERA	Open capital account	3811.4	7.8	0.8	-29	-1.2	1.9	70.8
SV	El Salvador	Inflow country	17.5	Fixed ERA	Open capital account	7218	2.6	0.2	-20.8	-0.6	43	54.2
LB	Lebanon	Inflow country	16.8	Fixed ERA	Open capital account	15905.2	2.8	0.5	-2.9	-2.7	6.4	42.9
HN	Honduras	Inflow country	13.8	Intermediate ERA	Closed capital account	4654.7	7.9	0.6	-25.9	1.9	96.5	57.3
JO	Jordan	Inflow country	15.6	Intermediate ERA	Open capital account	10071.6	3.4	0.2	-38.4	-0.1	10.7	67.4
PH	Philippines	Inflow country	9.9	Floating ERA	Closed capital account	5598.5	4.4	0.2	-3.4	2.5	20.2	53.7
GT	Guatemala	Inflow country	8.4	Intermediate ERA	Open capital account	6945.9	5.9	0.4	-13.6	0.2	41.7	42.4
NI	Nicaragua	Inflow country	8.4	Intermediate ERA	Open capital account	4561.9	8	0.3	-24.2	10	48.2	50.3
AM	Armenia	Inflow country	8.1	Intermediate ERA	Open capital account	8053.6	4.1	1.8	-24.2	-0.7	4.4	45.7
DO	Dominican Republic	Inflow country	7.3	Intermediate ERA	Open capital account	11737.6	8.7	0.5	-15.4	-1.9	51.3	43.1
LK	Sri-Lanka	Inflow country	7	Intermediate ERA	Closed capital account	8498.4	8.5	0.6	-9.1	5.8	14.2	39.8
BD	Bangladesh	Inflow country	7.2	Intermediate ERA	Closed capital account	3288.2	6.7	1.4	-7.3	3.4	13.7	27.9
MA	Morocco	Inflow country	6.8	Intermediate ERA	Closed capital account	6245.9	1.6	0.2	-15.9	-0.6	4.6	46
EG	Egypt	Inflow country	5.4	Intermediate ERA	Open capital account	9844.1	9	0.3	-1.3	-1.9	11.1	33.2
PK	Pakistan	Inflow country	4.9	Intermediate ERA	Closed capital account	4237.5	7.5	0.5	-6.1	1.1	11.3	21.3
HR	Croatia	Inflow country	5.4	Intermediate ERA	Closed capital account	22475.6	2.3	0.1	-17.9	0.2	2	50.8
MK	North Macedonia	Inflow country	4.5	Intermediate ERA	Closed capital account	13162.2	1.9	0.1	-20.8	1.3	2.7	77.2
EC	Ecuador	Inflow country	4.5	Fixed ERA	Open capital account	9942.4	15.4	0.3	0.8	5	37.4	38.1
VN	Vietnam	Inflow country	4	Intermediate ERA	Closed capital account	5485.8	6.4	2.1	-5.1	6.9	9.9	84.7
TN	Tunisia	Inflow country	3.6	Intermediate ERA	Closed capital account	9369.4	3.8	0.1	-12	-0.3	2.6	62.8
BO	Bolivia	Inflow country	3.3	Intermediate ERA	Open capital account	6344.4	5	0.4	1.3	0.5	11.1	45.6
BG	Bulgaria	Inflow country	2	Fixed ERA	Open capital account	14375	70.8	0.30	-11.6	0.70	54.5	51.5
IN	India	Inflow country	1.7	Floating ERA	Closed capital account	3556.4	6.8	0.7	-5.2	1.1	8	24.2
RO	Romania	Inflow country	3.2	Floating ERA	Open capital account	7930	21.3	0.5	-9	0.5	2.4	55.9
MX	Mexico	Inflow country	1.9	Floating ERA	Open capital account	18065.1	6.5	0.1	-0.8	5.3	68.3	44.9
CO	Colombia	Inflow country	1.7	Floating ERA	Closed capital account	11486.7	6.7	0.3	-1.2	1.6	36.1	23.3
AZ	Azerbaijan	Inflow country	2.3	Intermediate ERA	Closed capital account	12369	5.6	0.3	12.8	0.7	5.9	46.1
PE	Peru	Inflow country	1.6	Floating ERA	Open capital account	8958.1	3.3	0.3	2.1	0.4	22.7	30.9
LT	Lithuania	Inflow country	2.4	Fixed ERA	Open capital account	23507	2.4	0.6	-10.7	0.8	3.1	93.6
PY	Paraguay	Inflow country	1.4	Floating ERA	Open capital account	9748.5	6.8	0.4	-8.3	-5.7	12.4	45.7
BY	Belarus	Inflow country	1.3	Floating ERA	Closed capital account	16103.4	45	0.5	-8.3	0.7	1	96.9
ID	Indonesia	Inflow country	0.9	Floating ERA	Open capital account	7645	10.2	0.4	7	2.8	11.1	35.7
CR	Costa Rica	Inflow country	0.9	Intermediate ERA	Open capital account	15148.2	8.2	0.2	-8.9	3.5	50.9	57.1
TH	Thailand	Inflow country	0.6	Floating ERA	Closed capital account	12910.3	2.5	0.1	1.5	5.8	12.3	88.4
PL	Poland	Inflow country	0.7	Floating ERA	Closed capital account	21472.1	3.9	0.8	-4.9	0.2	2.1	53.8
TR	Turkey	Inflow country	0.5	Floating ERA	Closed capital account	19238.7	25.5	0.3	-8.2	-0.2	5.9	31.8
ZA	South Africa	Inflow country	0.3	Floating ERA	Closed capital account	12642	5.9	0.1	-0.8	0.7	9.9	34.3
HU	Hungary	Inflow country	0.2	Floating ERA	Open capital account	24554.4	5.9	0.4	0.3	2.1	3.4	106.6
SI	Slovenia	Inflow country	0.10	Fixed ERA	Open capital account	29852.40	3.90	0.20	-3.40	0.70	1.90	87.50
PA	Panama	Inflow country	0.8	Fixed ERA	Open capital account	19598.9	2.4	0.9	-19.8	-13.9	63.8	23.2
UY	Uruguay	Inflow country	0.3	Floating ERA	Open capital account	17069.8	8.9	0.2	-3.7	-0.8	11.5	26.7

Note: All data extracted from IHS Markit, national Central Bank data, SPGlobal and StLouis FRED.

Table A.2: Descriptive statistics - Sending countries

	Country	Remittance position	Remittances -to-GDP	ER Arrangement	KA openesss	GDP PC ppp	Average inflation	Average monthly growth	Trade balance -to-GDP	Trade balance with US (percent GDP)	Share of trade with US	Trade openesss
KR	South Korea	Outflow country	0.7	Floating ERA	Closed capital account	30146.2	2.8	0.6	3.1	1.7	8.4	54.1
JP	Japan	Outflow country	0.1	Floating ERA	Open capital account	37865.9	0.1	0	0.8	1.5	18	19.6
RU	Russia	Outflow country	0.8	Floating ERA	Closed capital account	20561.4	16	0.4	10.4	1.1	5.4	34.4
AU	Australia	Outflow country	0.1	Floating ERA	Open capital account	37980.2	2.5	0.2	-0.4	-1.2	10.6	26.3
GB	United Kingdom	Outflow country	0.1	Floating ERA	Open capital account	41584.8	2	0.1	-5.4	0.2	10.9	30.8
CA	Canada	Outflow country	0.4	Floating ERA	Open capital account	44189.2	1.8	0.1	2	4.1	71.7	47.9
US	United States	Outflow country	0.9	Floating ERA	Open capital account	53279.6	2.2	0.1	-3.5	-3.5	100	17
EZ	Euro area	Outflow country	0.1	Floating ERA	Open capital account	31548.3	1.7	0.1	1.1	0.7	3.7	53.2

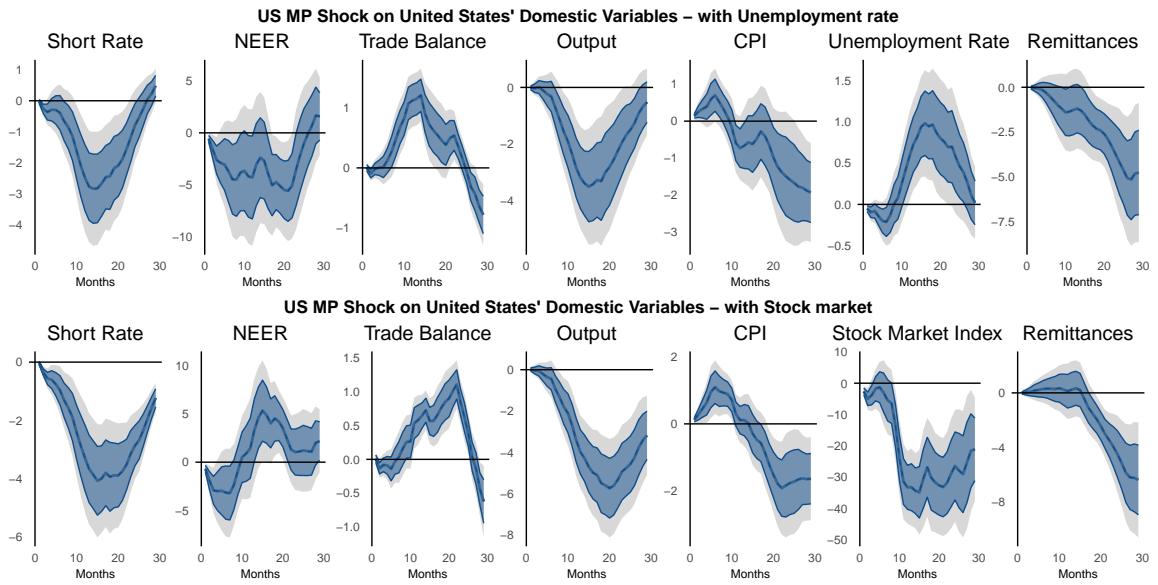
Note: All data extracted from IHS Markit, national Central Bank data, SPGlobal and StLouis FRED.

Table A.3: Data description for monthly time series

Variable	Description	Source	Coverage
Output	Production index, industry, harmonized / Coincident economic activity index based on data availability	IHS Markit, national central bank data	1997m1 - 2017m12
CPI	Harmonized Index of Consumer Price (HICP)	IHS Markit	1997m1 - 2017m12
Remittances	Secondary income, financial corporations, non-financial corporations, households and nphishs, personal transfers, credit(debit), BOP, US\$, Millions	IHS Markit	1997m1/1999m6 - 2017m12
NEER	Nominal effective exchange rates (51 trading partners considered)	See Darvas, Zsolt (2021)	1997m1 - 2017m12
REER	Real effective exchange rates (51 trading partners considered)	See Darvas, Zsolt (2021)	1997m1 - 2017m12
Short rate	Interest rate, short term rate - which consists of the Treasury Bill Yield under 365 Days (aop) or the Short-Term Money Market Rate (aop) - based on data availability	IHS Markit	1997/2000m1 - 2017m12
Real domestic credit	Depository Corporations, Claims on Other Sector, Claims on Private Sector (Local currency Unit), Inflation-Adjusted	IHS Markit	1997m1 - 2017m12
Trade balance with US	Monthly merchandise trade balance with US –Imports from country (CIF, MUSD) minus Exports to country (FAS, MUSD)– expressed as a percentage of nominal GDP in USD	IHS Markit/U.S Census Bureau	1997m1 - 2017m12
Trade balance	Monthly merchandise trade balance	IHS Markit/IMF	1997m1 - 2017m12
US MP instrument	High-frequency instrument for monetary policy	Degasperi and Ricco (2021)	1997m1 - 2017m12
ER classification	Fine and coarse de facto exchange rate classification	Ilzetzki, Reinhart and Rogoff (2021)	1997m1 - 2017m12
Capital account openness	Chinn-Ito index (KAOPEN) measuring a country's degree of capital account openness	Chinn and Ito (2006)	1997m1 - 2017m12
Core CPI	Consumer Price Index Excluding Energy and Food	IHS Markit	1997m1 - 2017m12

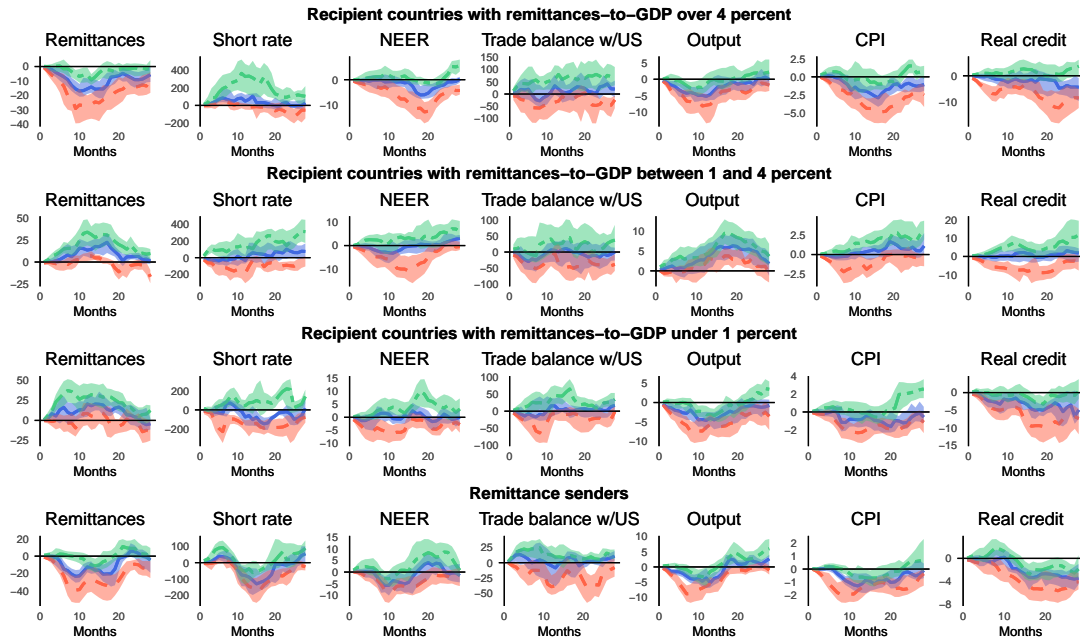
Appendix B - Additional results

Figure B.1: *Robustness including the unemployment rate and the stock market index*



Note: Impulse responses of domestic endogenous US variables to a contractionary one standard deviation US monetary policy shock, resorting to local projections with 12 lags and Newey-West corrected standard errors. The unemployment rate corresponds to the U-3 rate reported by the Bureau of Labor Statistics. The stock market index corresponds to the S percentP 500 Composite Index. Shaded areas correspond to 68 and 90 percent confidence intervals. Monthly sample 1997:01-2017:12.

Figure B.2: IRF 25th, median and 75th percentile responses by degree of exposure to remittance flows



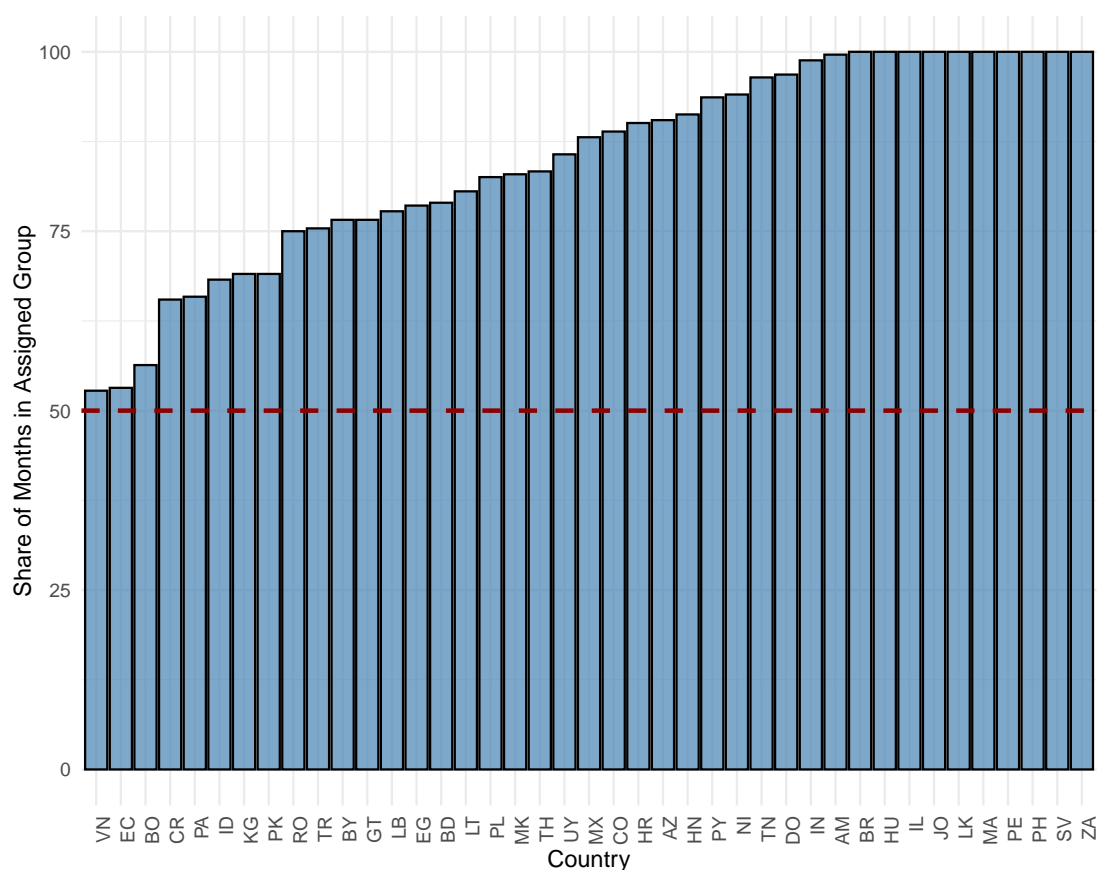
Note: Median of country-by-country responses to a contractionary one standard deviation US monetary policy shock resorting to local projections with 12 lags and Newey-West corrected standard errors. We report the results for the 68 percent confidence intervals. Monthly sample 1997:01-2017:12. Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period. In each graph we show the median (grey shade), 25th (red shade) and 75th (blue shade) percentiles of the endogenous variables responses and standard errors from each group of countries.

Table B.1: IRF Responses and Significance for All Countries in the Sample

Country ISO code	Signs: Shock on remittances	Shock on output	Shock on CPI	Shock on NEER	Shock on short rate	Shock on real credit	Shock on trade balance w/US
Remittance receivers							
SV (El Salvador)	-	+	-	-	-	-	+
LB (Lebanon)	-	-	-	+	-	+	+
KG (Kyrgyzstan)	-	+	-	-	-	-	-
JO (Jordan)	-	+	-	-	-	-	+
HN (Honduras)	-	+	-	+	-	-	+
PH (Philippines)	-	+	-	-	-	-	-
NI (Nicaragua)	-	+	-	+	-	+	-
GT (Guatemala)	-	+	-	+	-	-	-
AM (Armenia)	-	+	-	-	-	-	-
DO (Dominican Republic)	-	+	-	+	-	+	-
BD (Bangladesh)	-	-	+	-	-	-	-
LK (Sri Lanka)	-	-	+	+	-	-	+
MA (Morocco)	-	+	-	+	-	-	-
EG (Egypt)	-	-	-	-	-	-	+
HR (Croatia)	-	+	-	+	-	+	+
PK (Pakistan)	-	-	+	+	-	-	-
EC (Ecuador)	-	-	-	-	+	-	+
MK (North Macedonia)	-	+	-	+	-	-	-
VN (Vietnam)	+	+	-	-	+	+	+
TN (Tunisia)	+	-	-	-	+	+	+
BO (Bolivia)	+	-	+	+	-	+	-
RO (Romania)	+	-	+	+	+	+	-
LT (Lithuania)	+	-	+	+	+	-	+
AZ (Azerbaijan)	+	+	+	+	-	-	-
BG (Bulgaria)	+	+	+	-	+	+	+
MX (Mexico)	+	+	-	+	+	+	+
CO (Colombia)	+	+	-	-	+	+	+
IN (India)	-	+	-	-	+	+	-
PE (Peru)	+	-	-	+	+	-	-
PY (Paraguay)	+	+	+	+	+	-	-
BY (Belarus)	+	+	-	+	+	+	-
CR (Costa Rica)	+	-	-	+	-	-	-
ID (Indonesia)	+	+	-	+	-	+	-
PA (Panama)	+	+	+	+	-	-	-
PL (Poland)	+	-	+	-	-	-	-
TH (Thailand)	+	-	+	-	-	-	-
TR (Turkey)	+	+	+	+	-	-	+
ZA (South Africa)	-	-	+	-	-	-	-
UY (Uruguay)	+	-	+	-	-	-	-
HU (Hungary)	+	+	-	+	-	+	-
SI (Slovenia)	+	-	+	-	-	-	-
Remittance senders							
AU (Australia)	-	+	+	+	-	-	+
CA (Canada)	-	-	-	-	-	-	-
EZ (Eurozone)	-	-	-	+	+	+	-
GB (United Kingdom)	-	-	-	-	-	+	-
JP (Japan)	-	-	+	-	-	-	-
KR (South Korea)	-	+	+	-	-	-	-
RU (Russia)	-	+	+	-	-	-	-
US (United States)	-	-	-	+	-	-	-

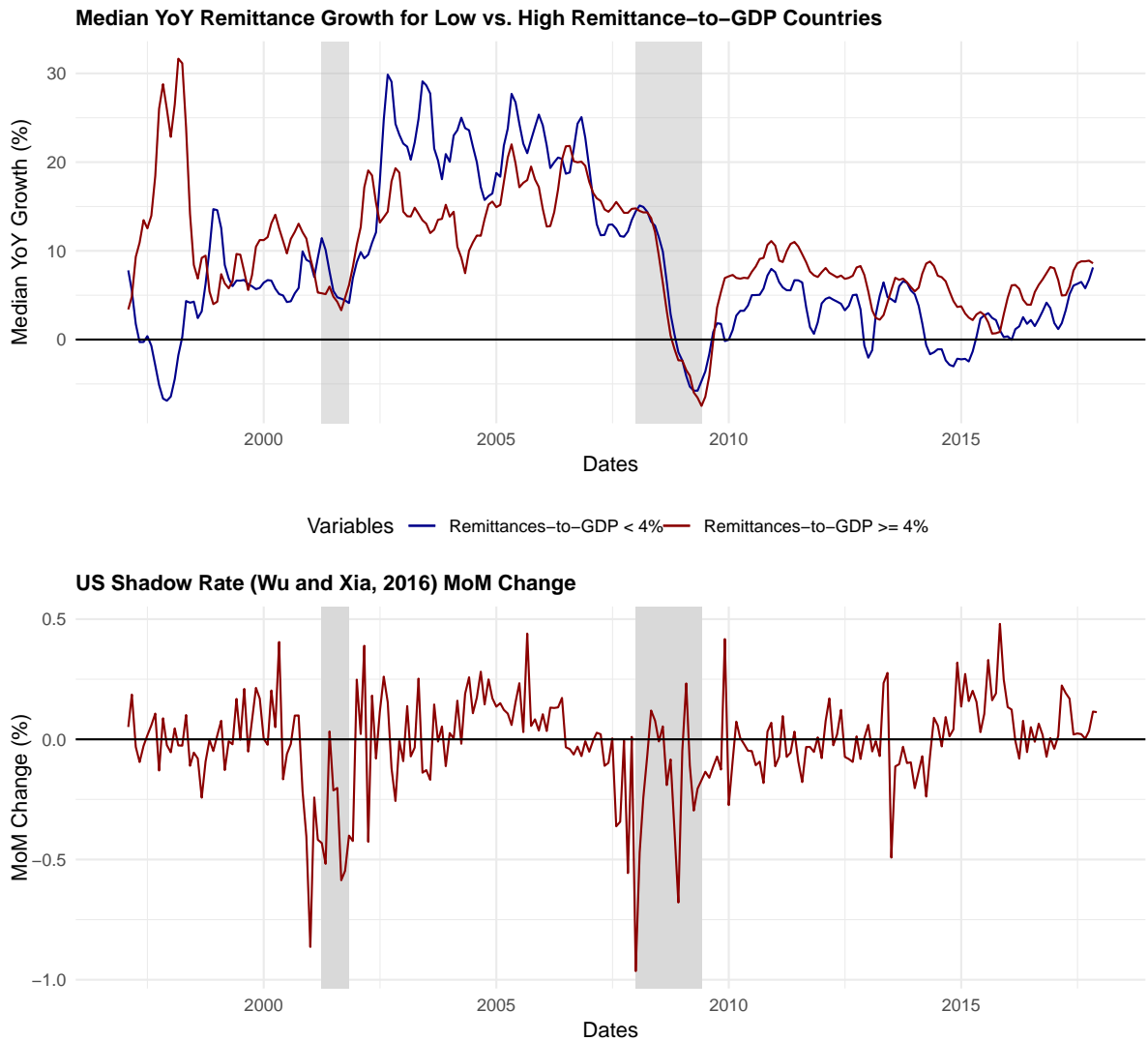
Note: The sign corresponds to the average IRF response of each country and each variable to a US monetary policy shock over the period. Whenever the cell is colored, it indicates that the response is significant for at least 3 consecutive periods at the 90 percent confidence interval.

Figure B.3: Stability of group categories based on average remittances-to-GDP over period 1997-2017



Note: Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period. The histogram shows the average share of months in which each countries' remittance-to-gdp ratio is within its whole period average group. For instance El Salvador has a remittance-to-gdp ratio over 4 percent of GDP over the whole sample period.

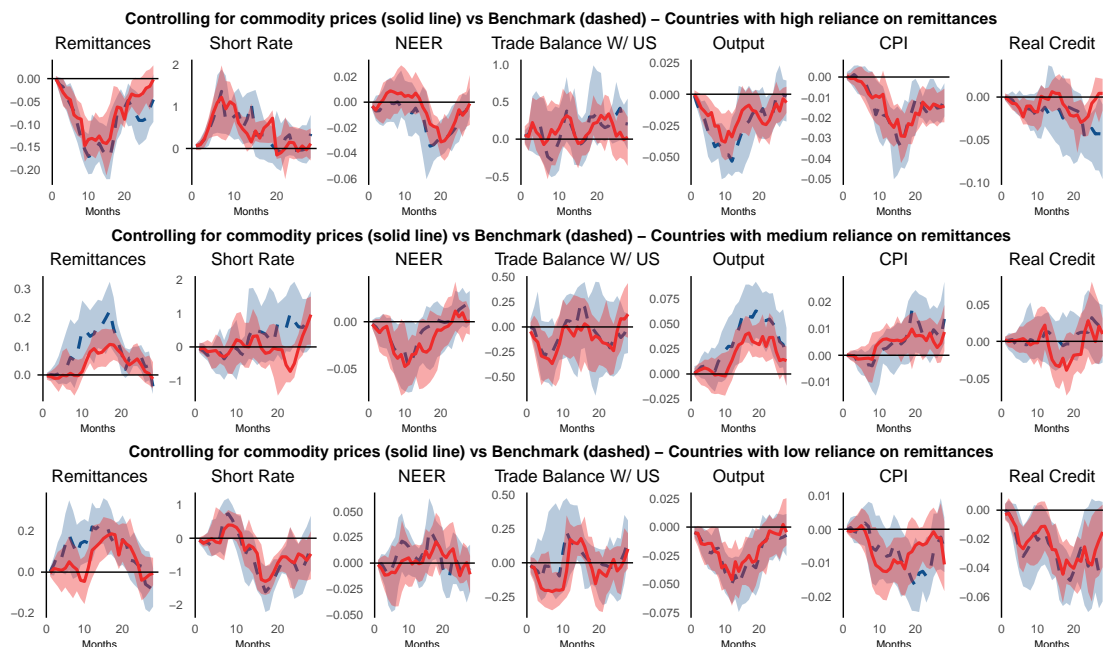
Figure B.4: Divergence in remittance inflows, by degree of GDP-weighted exposure



Note: Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period. Shaded area corresponds to the NBER based Recession Indicators for the US from the period following the peak through the trough, retrieved from <https://fred.stlouisfed.org/series/USREC>.

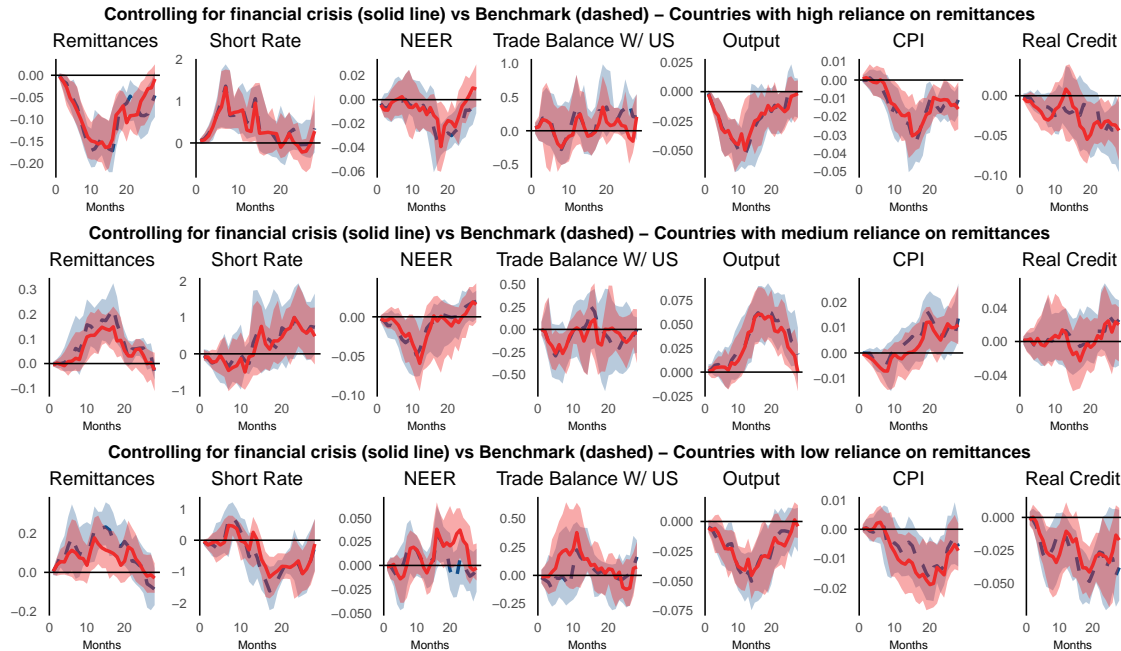
Appendix C - Robustness checks

Figure C.1: Robustness to controlling for commodities - Median IRF responses by degree of reliance to remittances as a share of GDP



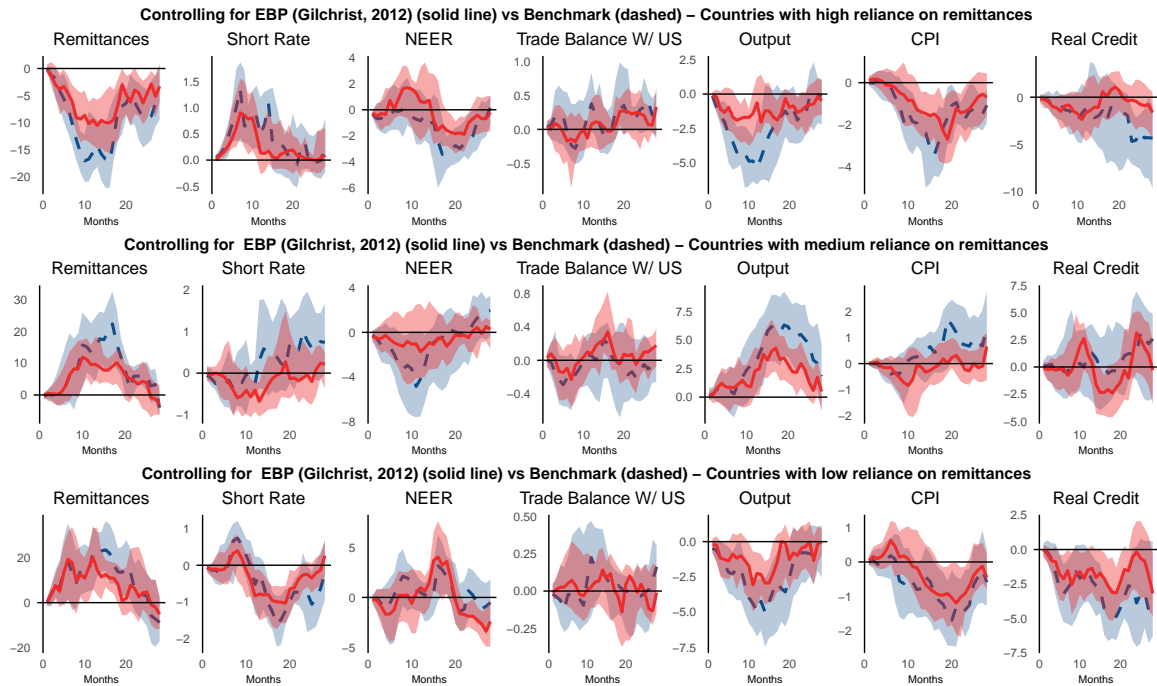
Note: Median of country-by-country responses to a contractionary one standard deviation US monetary policy shock resorting to local projections with 12 lags and Newey-West corrected standard errors and 1 standard deviation error bands. Monthly sample 1997:01-2017:12. Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period. In each graph we show the median and standard errors for the US monetary policy shock estimated by including the world bank real commodity price index (solid line and red shade) and the benchmark without controls (dash line and blue shade). Countries with remittances exceeding 4 percent include Guatemala (GT), Nicaragua (NI), Philippines (PH), Honduras (HN), Lebanon (LB), Jordan (JO), El Salvador (SV), Kyrgyzstan (KG), Croatia (HR), North Macedonia (MK), Dominican Republic (DO), Armenia (AM), Morocco (MA), Ecuador (EC), Egypt (EG), Pakistan (PK), Bangladesh (BD), and Sri Lanka (LK). Countries where remittances average 1-4 percent of GDP include Bulgaria (BG), Belarus (BY), Peru (PE), Colombia (CO), Mexico (MX), Bolivia (BO), Tunisia (TN), Vietnam (VN), Paraguay (PY), Romania (RO), Lithuania (LT), Azerbaijan (AZ), and India (IN). Conversely, countries where inflows represent less than 1 percent on average include Thailand (TH), Indonesia (ID), Turkey (TR), Uruguay (UY), South Africa (ZA), Slovenia (SI), Poland (PL), Hungary (HU), Panama (PA), and Costa Rica (CR).

Figure C.2: Robustness to controlling for financial crisis - Median IRF responses by degree of reliance to remittances as a share of GDP



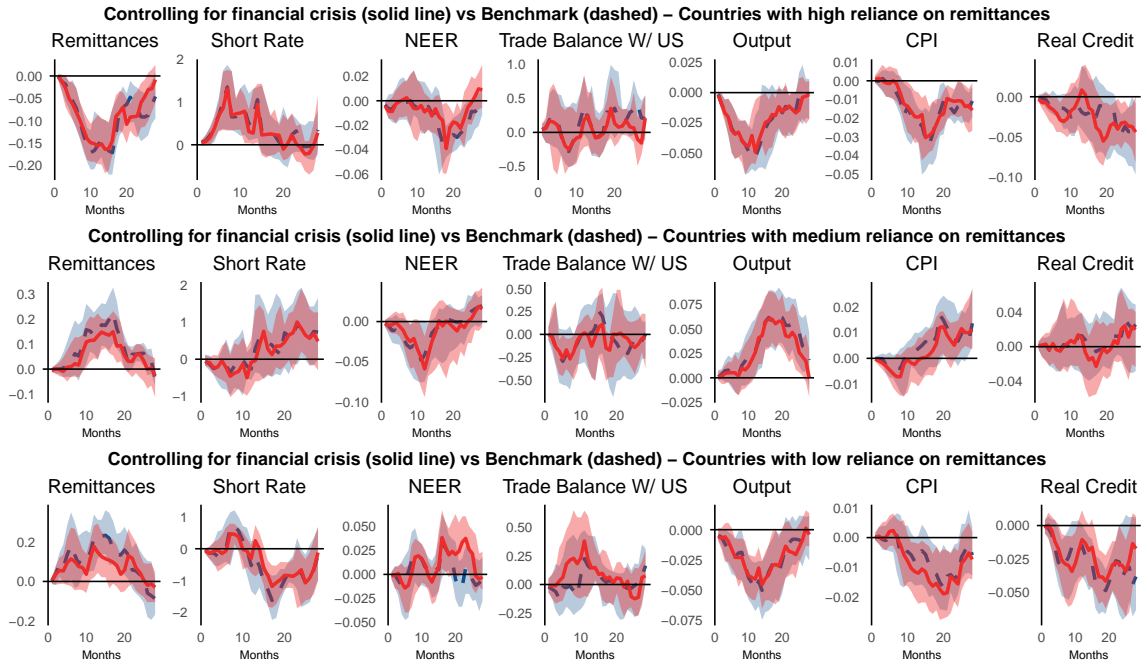
Note: Median of country-by-country responses to a contractionary one standard deviation US monetary policy shock resorting to local projections with 12 lags and Newey-West corrected standard errors and 1 standard deviation error bands. Monthly sample 1997:01-2017:12. Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period. In each graph we show the median and standard errors for the US monetary policy shock estimated by including the Financial Stress Indicator (solid line and red shade) and the benchmark without controls (dash line and blue shade). Countries with remittances exceeding 4 percent include Guatemala (GT), Nicaragua (NI), Philippines (PH), Honduras (HN), Lebanon (LB), Jordan (JO), El Salvador (SV), Kyrgyzstan (KG), Croatia (HR), North Macedonia (MK), Dominican Republic (DO), Armenia (AM), Morocco (MA), Ecuador (EC), Egypt (EG), Pakistan (PK), Bangladesh (BD), and Sri Lanka (LK). Countries where remittances average 1-4 percent of GDP include Bulgaria (BG), Belarus (BY), Peru (PE), Colombia (CO), Mexico (MX), Bolivia (BO), Tunisia (TN), Vietnam (VN), Paraguay (PY), Romania (RO), Lithuania (LT), Azerbaijan (AZ), and India (IN). Conversely, countries where inflows represent less than 1 percent on average include Thailand (TH), Indonesia (ID), Turkey (TR), Uruguay (UY), South Africa (ZA), Slovenia (SI), Poland (PL), Hungary (HU), Panama (PA), and Costa Rica (CR).

Figure C.3: *Robustness to controlling for the Excess Bond Premium (Gilchrist and Zakrajšek, 2012) - Median IRF responses by degree of reliance to remittances as a share of GDP*



Note: Median of country-by-country responses to a contractionary one standard deviation US monetary policy shock resorting to local projections with 12 lags and Newey-West corrected standard errors and 1 standard deviation error bands. Monthly sample 1997:01-2017:12. Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period. In each graph we show the median and standard errors for the US monetary policy shock estimated by including the world bank real commodity price index (solid line and red shade) and the benchmark without controls (dash line and blue shade). Countries with remittances exceeding 4 percent include Guatemala (GT), Nicaragua (NI), Philippines (PH), Honduras (HN), Lebanon (LB), Jordan (JO), El Salvador (SV), Kyrgyzstan (KG), Croatia (HR), North Macedonia (MK), Dominican Republic (DO), Armenia (AM), Morocco (MA), Ecuador (EC), Egypt (EG), Pakistan (PK), Bangladesh (BD), and Sri Lanka (LK). Countries where remittances average 1-4 percent of GDP include Bulgaria (BG), Belarus (BY), Peru (PE), Colombia (CO), Mexico (MX), Bolivia (BO), Tunisia (TN), Vietnam (VN), Paraguay (PY), Romania (RO), Lithuania (LT), Azerbaijan (AZ), and India (IN). Conversely, countries where inflows represent less than 1 percent on average include Thailand (TH), Indonesia (ID), Turkey (TR), Uruguay (UY), South Africa (ZA), Slovenia (SI), Poland (PL), Hungary (HU), Panama (PA), and Costa Rica (CR).

Figure C.4: Robustness to controlling for foreign reserves - Median IRF responses by degree of reliance to remittances as a share of GDP



Note: Median of country-by-country responses to a contractionary one standard deviation US monetary policy shock resorting to local projections with 12 lags and Newey-West corrected standard errors and 1 standard deviation error bands. Monthly sample 1997:01-2017:12. Countries are classified based on the average remittances-to-GDP ratio over the 1997-2017 period. In each graph we show the median and standard errors for the US monetary policy shock estimated by including the Financial Stress Indicator (solid line and red shade) and the benchmark without controls (dash line and blue shade). Countries with remittances exceeding 4 percent include Guatemala (GT), Nicaragua (NI), Philippines (PH), Honduras (HN), Lebanon (LB), Jordan (JO), El Salvador (SV), Kyrgyzstan (KG), Croatia (HR), North Macedonia (MK), Dominican Republic (DO), Armenia (AM), Morocco (MA), Ecuador (EC), Egypt (EG), Pakistan (PK), Bangladesh (BD), and Sri Lanka (LK). Countries where remittances average 1-4 percent of GDP include Bulgaria (BG), Belarus (BY), Peru (PE), Colombia (CO), Mexico (MX), Bolivia (BO), Tunisia (TN), Vietnam (VN), Paraguay (PY), Romania (RO), Lithuania (LT), Azerbaijan (AZ), and India (IN). Conversely, countries where inflows represent less than 1 percent on average include Thailand (TH), Indonesia (ID), Turkey (TR), Uruguay (UY), South Africa (ZA), Slovenia (SI), Poland (PL), Hungary (HU), Panama (PA), and Costa Rica (CR).