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Do Remittances Enhance Financial Inclusion in LMICs and in Fragile States?

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Abstract

This paper explores the relationship between remittances and financial inclusion for a sample of 187 countries over the period 2004-2015, using cross-country as well as dynamic panel GMM regressions. At low levels of remittances-to-GDP, these flows act as a substitute to formal financial channels, thereby reducing financial inclusion. In contrast, when remittance-to-GDP ratio is high, above 13% on average, they tend to complement formal access and usage channels, thus enhancing financial inclusion. This "U shaped" relationship highlights the role of remittance flows in financing household consumption at low levels, while raising formal household bank savings and allowing for more intermediation, at high levels of remittance-to-GDP.

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I. INTRODUCTION

The recent decade witnessed a substantial increase in remittance inflows to low and middle-income countries (LMICs) reaching 491 USD billion in 2018. Remittances are the second most important source of foreign finance for these countries, ranking second to FDI inflows since 1996, in either percent of GDP or in billions USD, ahead of official aid and portfolio inflows (see Figures 1 and 2). In fact, for low-income countries (LICs), remittance inflows have now surpassed FDIs since 2015.

The increasing importance of remittances has raised interest in studying their development impact. The contributions span several dimensions, including growth (Chami et al., 2015, among others),[2] poverty (Adams, 2004 and 2006; Acosta et al., 2007, among others), education (Yang, 2008; Adams and Cuecuecha, 2010; and Bredl, 2011), labor supply (Kim, 2007; Rodriguez and Tiongson, 2011; Chami et al., 2018); health (De and Ratha, 2012), and entrepreneurship (Amuedo-Dorantes and Pozo, 2006; Yang, 2008).

Another strand of the literature highlighted the effect of remittances on financial sector development (Martínez Pería, Mascaró, and Moizeszowicz, 2008; Gupta, Pattillo, and Wagh, 2009; Aggarwal, Demirgüç-Kunt, and Martínez Pería, 2011; Chowdhury, 2011; Cooray, 2012, Barajas et al., 2018). This literature suggests that remittances are likely to promote financial development if these flows are transformed into available loanable funds for the private sector through financial intermediaries.

However, it is worth noting that promoting financial development does not necessarily mean that remittances induce more inclusiveness in the financial sector (Anzoategui, Demirgüç-Kunt and Martínez Pería, 2014). Remittances are likely to improve formal financial access and inclusiveness when unbanked recipient households deposit their money in the financial sector and benefit from the multitudes of financial services offered by formal institutions (Inoue and Hamori, 2016). The topic of financial inclusion has gained importance since it has been integrated in the development agenda by the G20 in 2013. The percentage of people with bank accounts across the world remains relatively low in some regions: 55 percent in East Asia, 39 percent in Latin America, 35 percent in Eastern Europe, 33 percent in South East Asia and 25 percent in Sub Saharan Africa (Aga and Martínez Pería, 2014).

The literature on remittances and financial inclusion follows two strands. The first one comprises papers based on household surveys while the second uses cross-country studies. The literature using household surveys generally finds that remittances are positively and significantly correlated with whether a household has a bank account or savings account, but finds no significant correlation with whether a household requests a loan.

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[2] On growth, see also Cáceres and Saca (2006), Barajas et al. (2008), Mundaca (2008), Giuliano and Ruiz-Arranz (2009), Barajas et al. (2009), and Chami, Hakura and Montiel (2009). On poverty, see Anyanwu and Erhijakpor (2010), Inoue (2011), and Inoue and Hamori (2012).

Anzoategui, Demirgüç-Kunt, and Martínez Pería (2014) uses household level data in El Salvador for the years 1996, 1998, 2000, and 2002 to explore the relationship between remittances and financial inclusion. They find that remittances are positively and significantly correlated with households' use of deposit accounts, but not significantly correlated with their demand and use of formal loans. Aga and Martínez Pería (2014) use World Bank survey data covering 10,000 households in five Sub-Saharan African counties (Burkina Faso, Kenya, Nigeria, Senegal and Uganda) to test the impact of remittances on household financial inclusion. They find that, in the presence of remittances, the probability of opening a bank account increases. Ambrosius and Cuecuecha (2016) uses data from Mexico for 7,572 households for 2002 and 2005 to investigate the effect of remittances on the use of formal and informal financial services. They find that remittances are positively and significantly correlated with the ownership of savings accounts and recent borrowing. However, the authors point out that informal finance seems to play an important role in accounting for the remittances and borrowing nexus, which highlights the deficiencies of the formal banking market. Demirgüç-Kunt, Lopez-Córdova, Martínez Pería, and Woodruff (2011) use municipality level data on the fraction of households receiving remittances in Mexico to investigate the effects of remittances on banking breadth and depth. They find that remittances are positively and significantly correlated with bank branches per capita, bank accounts per capita, and deposits to GDP.

The second strand of the literature focuses on cross-country empirical investigations. Aggarwal, Demirgüç-Kunt, and Martínez Pería (2011) use a panel of 109 countries over the period 1975–2007 to test the effect of remittances on financial development. They find that remittances are positively and significantly correlated with credit and deposits to GDP ratios. Inoue and Hamori (2016) test the impact of remittance inflows on access to formal financial services using a panel data of 38 developing countries in Asia and Oceania over the period 2001–12. The results highlight a robust positive impact of remittances on the branch network of commercial banks. Giuliano and Ruiz-Arranz (2005) use GMM dynamic panel estimations for 73 developing countries over the 1975–2002 to show that remittances are more effective in promoting growth in less financially developed countries. More recently, Tu et al. (2019) examine the nexuses between remittance inflows, financial inclusion, and economic development, using a large sample of countries over the period 2004–17. They find that higher remittances could provide more financial inclusion, which in turn could spur economic development in middle income countries. But, that effect seems to fizzle for high income countries.

In this paper, we attempt to reconcile these differing results, using an empirical model that allows for the presence of a non-monotonic relationship between remittances and financial inclusion. We focus our analysis on low and middle income countries (LMICs), and, to the best of our knowledge, this is a first such attempt at testing for the presence of non-linear relationship between remittance flows and formal financial inclusion.

We find that that indeed there is a "U" shaped relationship between workers' remittances and financial inclusion. The intuition for this non-monotonic and "U" shaped relationship is that at low levels of remittance-to-GDP, these flows are mainly used for consumption purposes by the liquidity-constrained households operating in countries characterized by credit market imperfections, and this also leads to a process of disintermediation. Mishra et al. (2012) and Barajas et al. (2018) point out that in many LMICs, financial markets are characterized by severe asymmetric information problems, borrower opaqueness, weak legal and institutional frameworks, and oligopolistic banking behavior—all leading to high cost of borrowing and credit rationing. Thus, remittances in this case, by alleviating credit-constraints for the household, are likely to be used by the latter to avoid using the formal financial system—leading to a process of disintermediation.[3] However, as remittance-to-GDP ratio rises, households are likely to save unused cash flows through the formal channels. Indeed, Barajas et al. (2018) find such evidence in their sample of countries, with time accounts increasing relative to demand deposits, as remittance inflows increase. This in turn allows banks to use such funds to provide financial services. As a result, beyond a certain threshold these flows seem to enhance inclusiveness in the financial sector.

This paper uses a large sample of 187 countries, including low, middle and high-income countries, and Generalized Method of Moments (GMM) regressions over the period 2004-2015, to show that financial inclusion starts being positive only when remittances reach the threshold of 13% of GDP in Low- and Middle-Income Countries (LMICs). This result is consistent with many measures of financial inclusion including the number of commercial bank branches per 100,000 adults (Branches) and Automatic Teller Machines per 100,000 adults (ATMs), the number of deposit accounts in commercial banks per 1,000 adults (Deposits), the average number of borrowers per 1,000 adults (Borrowers), and a weighted Financial Inclusion index (FII). These proxies are considered appropriate for representing financial access (Burgess and Pande, 2005; Beck, Demirgüç-Kunt, and Martínez Pería, 2007) and has little missing observations (Inoue and Hamori, 2016).

This study, to the best of our knowledge, is the first to use such a large sample with heterogenous countries classified according to their income levels. The reason for classification is that LMICs receive most of the remittances while in high income countries remittance flows are much lower than the LMICs average. Furthermore, in contrast to previous studies, this paper uses a macroeconomic approach to address the remittances and financial inclusion nexus; it focuses on the macroeconomic determinants of financial inclusion including remittances as a % of GDP. Financial inclusion is measured using the number of bank branches, deposits accounts, or borrowers.

The rest of the paper is organized as follows section 2 presents the methodology and discusses the results of the empirical investigation; and section 3 concludes the paper.

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[3] See Giuliano and Ruiz-Arranz (2005), who find that for low level of remittances, these flows act as substitutes for bank credit.

Figure 1. Inflows into Low and Middle-Income Countries (billions USD), 1990–2018
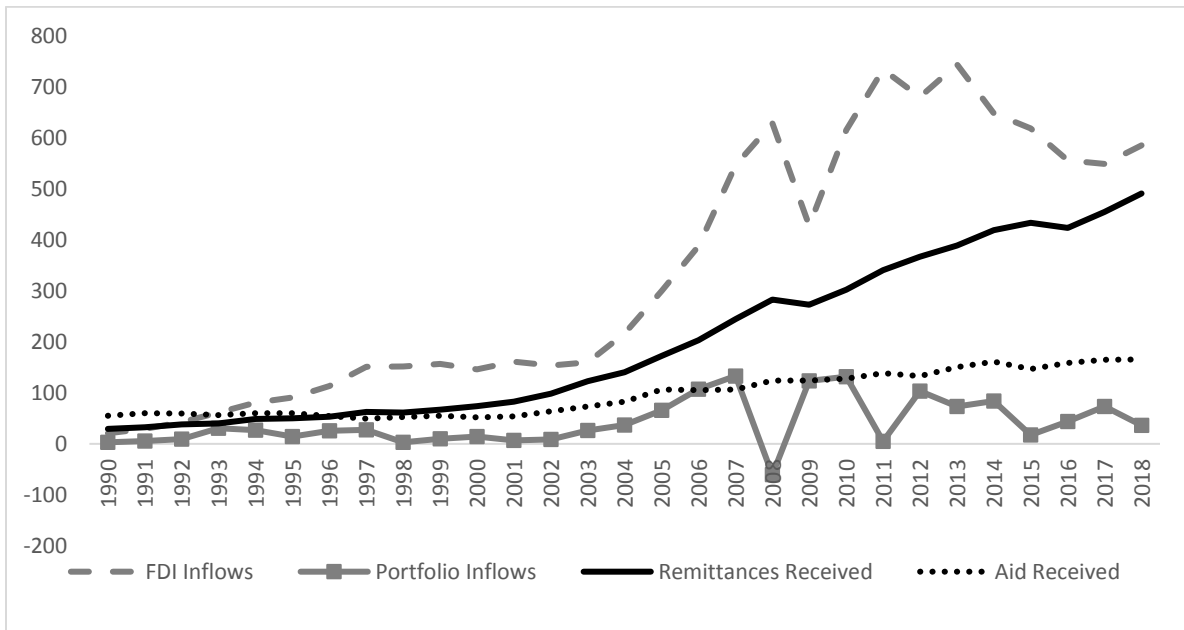
Source: World Development Indicators of the World Bank (2018)

Figure 2. Inflows into Low and Middle-Income Countries (% of GDP), 1990–2018
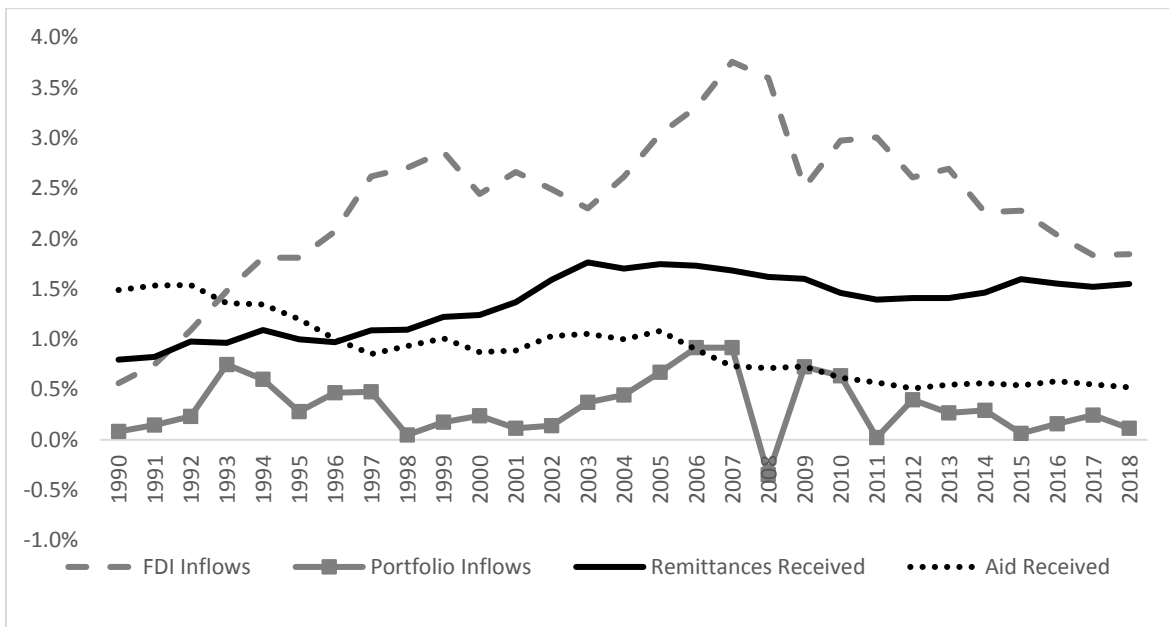
Source: World Development Indicators of the World Bank (2018)

II. METHODOLOGY AND DATA

The empirical relationship between workers' remittances and financial inclusion is based on the following equation:

$$FI_{i,t} = \alpha + \beta\, Remit_{i,t} + \delta X_{i,t} + \mu_i + \lambda_{i,t} + \varepsilon_{i,t} \tag{1}$$

Where $FI_{i,t}$ represents the level of financial inclusion for country i in year t, $Remit_{i,t}$ represents remittances received by country i in year t, $X_{i,t}$ represents a vector of control variables, μ_i country- specific effect, λ_t time specific effect and $\varepsilon_{i,t}$ as an error term. In Table 12 (see Appendices for all Tables) we find the definitions and sources of the all variables used in our estimations, while Table 13 provides the list of countries and periods. Tables 2 and 3 provide descriptive statistics and correlations, respectively.

Following Wang and Guan (2017), we use two dimensions for measures of financial inclusion (*FI*). The first-dimension deals with the *access* to financial services with two indicators that assess the outreach of financial services through the demographic penetration of the banking system. The first one is the number (in log) of branches of commercial banks per 100,000 adults (*Branches*) and the second is the number of ATMs per 100,000 adults (*ATMs*).

The second dimension reflects the *usage* that everyone can have of financial services. Indicators of this dimension are the log of deposit accounts with commercial banks per 1,000 adults (*Deposits*) and the log of the number of borrowers at commercial banks per 1,000 adults (*Borrowers*). All the measures of *Branches*, *ATMs*, *Deposits* and *Borrowers* are collected from the Financial Access Survey carried out by the International Monetary Fund as specified in Table 12. The two dimensions (access and usage) and four indicators are summarized in Table 1.

As a last measure of financial inclusion, we use, following Wang and Guan (2017), a financial inclusion index (*FII*) based on the above indicators. We start by computing for each dimension (*i*= Access, Usage) and *FII* is calculated as follows:

$$FII_i = 1 - \frac{\sqrt{\sum_{j=1}^n w_{ij}^2(1-x_{ij})^2}}{\sqrt{\sum_{j=1}^n w_{ij}^2}} \tag{2}$$

Where x_{ij} is the transformed value of each indicator j relative to dimension i as follows:

$$x_{ij} = 1 - \frac{X_{ij} - Min_{ij}}{Max_{ij} - Min_{ij}} \tag{3}$$

X_{ij} is the actual value of the indicators j and *Max* and *Min* are the maximum and minimum of X_{ij}, respectively. w_{ij} are the weights of each indicator j relative to each dimension i and is defined as follows:

$$w_{ij} = \frac{CV_{ij}}{\sum_{j=1}^{n} CV_{ij}} \tag{4}$$

CV is the coefficient of variation of the indicator and is defined, following the ratio of standard deviation (σ) to the mean value (μ). Thus, the weights w_{ij} are defined as the ratio of each indicator's coefficient of variation CV to the sum of all indicators' CV.

The financial inclusion index for all dimensions (*FII*) is therefore as follows:

$$FII = 1 - \frac{\sqrt{w_1^2(1-FII_1)^2 + w_2^2(1-FII_2)^2}}{\sqrt{w_1^2 + w_2^2}} \tag{5}$$

Where *FII₁* and *FII₂* are the financial inclusion indices for dimensions 1 and 2 (access and usage). w_1 and w_2 are the weights of the two dimensions. Wang and Guan (2017) calculated *FII* only 2011, while in this paper the effort consists in computing the indices for each year of the period 2004–15. We also exclude the last indicator in Table 1 (*Borrowers*) from the *FII* because of data availability.

Workers' remittances are measured as the ratio of remittances inflows to GDP, using the World Development Indicators of the World Bank (2018), and are based on averages for the period 2004–15 and as percentages of GDP. For example, among the largest recipients of remittances, Tajikistan receives 35.0 percent, Bermuda 31.6 percent, Tonga 28.2 percent, and Kyrgyz Republic 22.9 percent (See Figure 3).

The matrix X in equation (1), refers to a set of control variables that are used as regressors. The first one is the logarithm of the GDP per capita (LGDPPC) expressed in 2010 US $ as a proxy of the level of economic development. This variable is included on the ground that higher income levels would have a positive effect on financial inclusion as it is expected to increase the demand for formal deposits and the available financial instruments in the banking sector (Sahay et al., 2015; Inoue and Hamori, 2016).

The second control variable is inflation and is measured as the percentage annual change of the consumer price index. Higher inflation is expected to push households to rely more on real assets to hedge against financial assets erosion and would end up hindering financial inclusion. This is also the case when it comes to financial deepening (Boyd et al. (2001)).

Figure 3. The 10 Largest Recipients of Remittances (in % of GDP), 2004–18
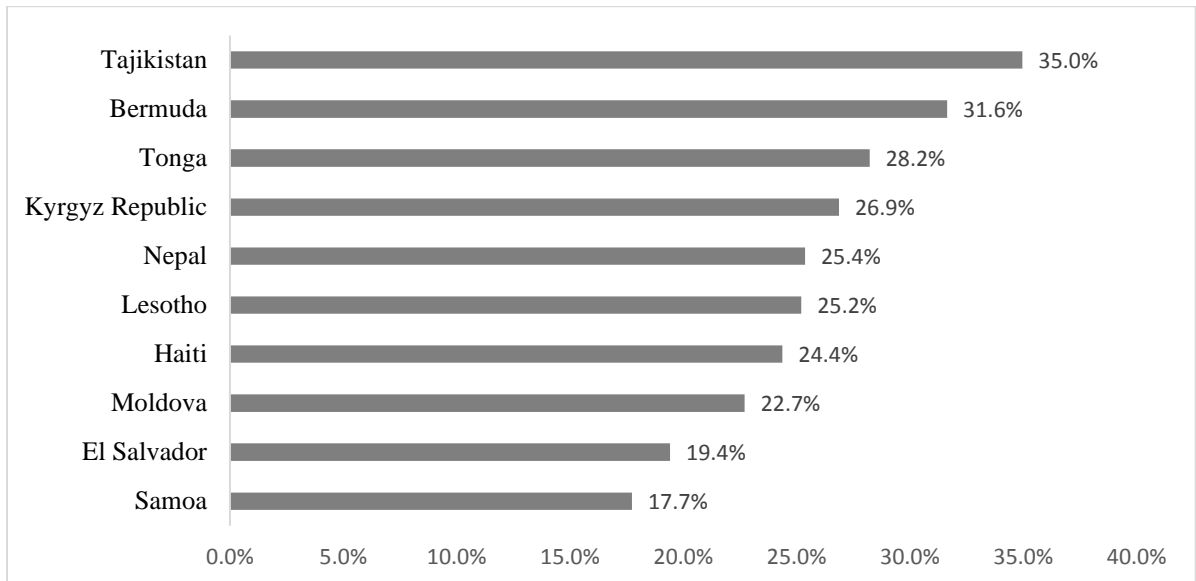
Source: World Development Indicators of the World Bank (2018)

The third regressor included is *Trade* which is measured as the ratio of the sum of exports and imports to GDP ((X+M)/GDP). Higher volumes of trade are likely to generate more payments to exporters and importers and create higher demand for financial instruments and more inclusion in the banking sector. Thus, the coefficient of *Trade* is expected to be positive in equation (1).

The last variable among the regressors is the state of financial openness and is measured by the Chinn and Ito's capital account openness index, generally known with the acronym of *kaopen* (Chinn and Ito, 2011). This index, initiated by Chinn and Ito (2006), is based on binary dummy variables setting codes on the restrictions on external accounts reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) for each country.

The index takes high values to indicate more openness of the economy to cross-border capital flows. More financial openness is expected to have a positive effect on financial inclusion and any increase in capital inflows in recipient countries is likely to increase the demand for financial products at formal institutions. The literature has already established a positive relationship between capital account liberalization and financial development (Summers, 2000; Klein and Olivei, 2008; Chinn and Ito, 2002; Chinn and Ito, 2006; Eichengreen, Gullapalli and Panizza, 2011).

The estimation of equation (1) is carried out using the dynamic panel GMM techniques, following Inoue and Hamori (2016), Aga and Martínez Pería (2014), Anzoategui, Demirgüç-

Kunt, and Martínez Pería (2014) and Ambrosius and Cuecuecha (2016). Specifically, we use the GMM estimator in system as follows:

$$FI_{i,t} = \alpha\, FI_{i,t-1} + \beta\, Remit_{i,t} + \delta\, X_{i,t} + \mu_i + \lambda_{i,t} + \varepsilon_{i,t} \tag{6}$$

$$\Delta FI_{i,t} = \alpha\, \Delta FI_{i,t-1} + \beta\, \Delta Remit_{i,t} + \delta\, \Delta X_{i,t} + \Delta\lambda_{i,t} + \Delta\varepsilon_{i,t} \tag{7}$$

Where $FI_{i,t-1}$ is the lagged dependent variable and Δ is the first difference operator. Equations (6) and (7) are estimated using a GMM panel estimator that combines the regressions in differences with those in levels, following Arellano and Bover (1995) and Blundell and Bond (1998). This estimator uses instruments to deal with the issue of endogeneity of explanatory variables and the correlation between the lagged dependent variable ($\Delta FI_{it-1} = FI_{i,t-1} - FI_{i,t-2}$) and the error term ($\Delta\varepsilon_{it} = \varepsilon_{i,t} - \varepsilon_{i,t-1}$). It is known as a *system* GMM estimator which improves the efficiency (Blundell, Dearden, Goodman, & Reed, 2000).

Two tests are used to check for the consistency of the system represented by equations (6) and (7). The first one is the autocorrelation test AR(2) for the autocorrected disturbances in equation (7). The second test is the validation of the instruments in the GMM system and it is carried out using the Hanson test of over-identifying restrictions. Finally, the panel used in the empirical investigation is composed of 187 countries over the period 2004–15.

III. EMPIRICAL RESULTS

A. Results

Table 4 displays the GMM dynamic panel estimates using the same proxies of financial inclusion for the whole panel. Column (1) shows the coefficients of the regression with *Branches* as a measure for financial inclusion. The coefficient of remittances (*Remit*) is positive (0.0007) and statistically insignificant at standard confidence levels with a robust Hansen test of the overidentifying restrictions (+0.12). This means that higher workers' transfers are not likely to increase the number of commercial banks' branches per 100,000 adults. In other words, more transfers from expats are not found to encourage banking institutions to create more branches to allow recipient households to access more services from these institutions.

The coefficient of the GDP per capita is (*Lgdppc*) is positive but insignificant at the 99 percent confidence level (+0.0331) which does not confirm the above assumptions about the role of economic activity in boosting financial inclusion. This means that higher income is not likely to increase either the demand for deposits or other financial instruments for investment purposes.

The rest of the variables in column (1) show correct coefficients for inflation where the coefficient is negative and significant at the 1 percent level, confirming the above predictions

of the literature. Openness to trade is found to have the expected positive effect on financial inclusion as the coefficient of *Trade* is positive and significant at standard risk levels. This means that allowing enterprises to be more involved in the exchange of commodities and services is likely to increase the demand for financial services from formal financial institutions. In the same vein, the coefficient of financial openness (*kaopen*) is positive but insignificant meaning that more capital inflows in the recipient countries are not likely to produce higher demand for financial services and more inclusion accordingly.

The second proxy of financial inclusion in the access dimension is *ATMs*; it is used in column (2). The obtained results show a positive but insignificant coefficient for remittances (+0. 0032). In addition, the coefficients of inflation (*Inf*), trade openness (*Trade*) and financial openness (*Kaopen*) are also insignificant at standard risk levels.

Regarding the usage of financial services, the estimations show positive but insignificant effect of remittances on both usage indicators (*Deposits* and *Borrowers* in (columns (3) and (4)) at the 10% level of risk. This means that households' deposits in banks coming from remittances are not likely to develop more financial services linked to savings or loans, which is contradicting the conclusions of Inoue and Hamori (2016) and Ambrosius and Cuecuecha (2016). The picture is not much different when using the financial inclusion index (*FII*) (column (5)), as the regression does not show a different pattern.

In column (6), the financial inclusion proxy is replaced with financial development (*FD*) that is measured by total credit to the private sector (%) of GDP. The objective to test if remittances are likely to have a positive effect on financial development. The estimated coefficient is positive (+0.4930) and significant at the 1% risk level and is in line with the literature on remittances and financial development nexus (Aggarwal, Demirgüç-Kunt, and Martínez Pería, 2011).

In Table 5, we split the whole sample into two sub-groups as we estimate the impact of remittances on financial inclusion for low- and middle-income countries (LMICS) and high-income countries (HICs). Column (1) shows the regression results carried out for LMICs with *branches* as a measure of financial inclusion and they look like those obtained with the whole sample (+0.0003). The results for high-income countries (HICs) do not show a different picture as the coefficient of *Remit* is negative and insignificant at standard risk level (-0.0036). For the rest of financial inclusion proxies, *Deposits* and *Borrowers*, the coefficients of remittances are very low (+0.0001) and +0.001, respectively and insignificant for the case of LMICs. With the financial inclusion index (*FII*), the coefficient of remittances is still positive and insignificant for LMICs but turns to be negative in the case of HICs.

Thus, the results of Table 5 are not different when we split the whole sample into low- and middle-income countries (LMICs) and high-income countries (HICs). They point, overall, to an insignificant effect of remittance inflows on all measures of financial inclusion.

This result may seem surprising as one would expect that remittance flows play a positive role in promoting financial inclusion. Ambrosius and Cuecuecha (2016) claim that "*the effect of remittances on access and the use of financial services is not straightforward…In particular, research so far failed to provide a clear picture on whether remittances have positive impact on access to and the use of credit.*" As mentioned earlier, if receiving households have limited access to formal loans, this result may not be too surprising. In other words, if the households only use these few dollar flows for consumption purposes, then the expected impact on financial inclusion will be very weak or even insignificant.

Thus, to observe a significant effect on financial inclusion there would need to be enough transfers to households through the banking sector, which are then likely to boost savings and help develop financial services for households, allowing them to access more loans. This explanation might be a reason behind the different results between the positive effect of remittances on financial development (Column 6 in Table 4) and the absence of any significant effect on financial inclusion (Ansoategui, Demirgüç-Kunt and Martínez Pería, 2014). In other words, remittances are likely to improve the access to and usage of financial services only if these flows are deposited in the financial sector so that recipient households can benefit from these institutions (Inoue and Hamori, 2016).

In fact, the claim that remittances play the role of a substitute for credit in the sense that when households are credit constrained, they tend to use income transfers from abroad to fill consumption and investment gaps, finds support in the literature, for example Giuliano and Ruiz-Arranz (2005), Calero, Bedi and Sparrow, (2009), and Taylor & Wyatt, (1996). Thus, because of credit market imperfections, poor households use remittances to overcome liquidity constraints that restrict their access to formal loans to finance investment in physical and human capital.

The role of remittances in boosting the amount of bank deposits also finds support in the literature. Banking institutions have an interest in targeting remittances given that they are a cheap source of deposit flows (see Barajas et al., 2018), and for remittance receiving households they represent unearned income from abroad, which is likely to increase their demand for savings, see for example Aggarwal, Demirgüç-Kunt, and Martínez Pería, 2011; Ashraf, Aycinena, Martínez, Yang, 2015; Barajas et al., 2018).

These conflicting views in the literature provide support for the above explanation of the absence of positive effect of remittance inflows on financial inclusion, when using GMM dynamic panel estimations. The above explanation implies that the effect of remittances on the access and use of financial services could be conditional on some pre-requisites and conditions. Specifically, the idea that a positive effect of remittances on inclusiveness would require *enough* remittance inflows into the economy, means the possibility of a threshold above which we expect financial inclusion to be increasing with remittances. This means that the relationship between remittances and financial inclusion might be non-linear. This is what we investigate next.

One way to take into consideration such a threshold is to add the squared remittances (*Remit²*) to the of determinants of financial inclusion in equations (6) and (7) as follows:

$$FI_{i,t} = \alpha\, FI_{i,t-1} + \beta\, Remit_{i,t} + \gamma\, Remit_{it}^2 + \delta\, X_{i,t} + \mu_i + \lambda_{i,t} + \varepsilon_{i,t} \qquad (8)$$

$$\Delta FI_{i,t} = \alpha\, \Delta FI_{i,t-1} + \beta\, \Delta Remit_{i,t} + \gamma\Delta Remit_{it}^2 + \delta\, \Delta X_{i,t} + \Delta\mu_i + \Delta\lambda_{i,t} + \Delta\varepsilon_{i,t} \quad (9)$$

According to the above intuitive explanation, we expect financial inclusion to be increasing with remittances only after a given level of remittances (as a % of GDP) represents a minimum.

This means that the coefficient of *Remit²* should be positive while the coefficient of *Remit* is negative. With such specification, we have a "U" shaped relationship between remittances and financial inclusion, and the remittances threshold $Remit_{it}^*$ is obtained by deriving $FI_{i,t}$ with respect to *Remit_{i,t}* and will as follows:

$$Remit_{it}^* = \frac{\beta}{2\gamma} \qquad (10)$$

This intuitive explanation should reconcile the two views in the literature presented above. For low levels of remittances ($Remit_{it} < Remit_{it}^* = \frac{\beta}{2\gamma}$), there is a high likelihood that they would serve for consumption purposes for the receiving households without significant effects on financial inclusion, especially when these flows are carried out through informal channels. However, with remittance levels higher than the threshold ($Remit_{it} > Remit_{it}^* = \frac{\beta}{2\gamma}$), we expect higher savings and access to loans through formal banking institutions and thus higher financial inclusion.

Table 6 displays the results of the GMM dynamic panel estimates of the regressors in equation (6) and (7) augmented with the remittances squared (*Remit²*) to reflect the non-monotonic nature of the relationship between financial inclusion and remittances. The estimates are carried out using all proxies of financial inclusion for the whole panel.

In column (1) we use *Branches* as a proxy for financial inclusion for the whole sample, and indeed the coefficient of *Remit²* is positive and statistically significant at the 90 percent confidence level while the coefficient of *Remit* is negative and statistically significant at the same confidence level. Column (2) displays the estimated coefficient for *Remit²* with the *ATMs* as the dependent variable and is similar to those in column (1). The usage dimension indicators of financial inclusion, i.e. *Deposits* and *Borrowers*, do not display a different outcome as the coefficients of the quadratic term (*Remit²*) are positive and significant at standard confidence levels ((columns (3) and (4)). With the financial inclusion index (*FII*) in column (5), we find that the coefficients associated with the linear and Quadratic terms are significantly negative and positive, respectively. This means that the relationship between

financial inclusion and remittances tends to be non-monotonic and convex and takes a "U" shape with a threshold for remittances after which it impacts positively financial inclusion.

The bottom panel of Table 6 reports the standard tests relative to the GMM dynamic panel estimates and shows that all specifications do not reject the null of no second order correlation. Also, the Hanson tests of overidentifying restrictions provide support for the validity of the restrictions. The resulting thresholds from Table 6 estimates for the whole set of countries vary between 11.3 percent and 23.6 percent according to the used proxy for financial inclusion.

B. Does the Remittance-Recipient Country's Income Level Matter?

To explore the non-monotonic relationship between remittances and financial inclusion according to the level of income of countries, we estimate the determinants of financial inclusion represented by equations (7) and (8) separately for LMICs and HICs. Table 7 displays the output of the estimations for both subgroups.

In column (1) of Table 7, we estimate the quadratic relationship for the LMICs using *Branches* as a proxy of financial inclusion. The results look like those of Table 6 as the coefficients of the quadratic and linear terms (*Remit²* and *Remit*) are positive and negative and significant at the 10 percent risk level, respectively. This tends to corroborate the non-monotonic nature of the relationship in the case of LMICs with a threshold for remittances standing at a high of 15.7 percent. This means that only beyond such level of 15.7 percent for remittances (as a percent of GDP) in LMICs the relationship has an increasing slope. Regarding high-income countries (HICs), the estimates show that mostly the coefficients of *Remit* and *Remit²* are mostly non-significant at standard confidence levels though they display the right sign. This should not be surprising as HICs do not, in general, receive significant levels of remittance flows.

The second measure of financial inclusion (*ATMs*) in column (3) for LMICs also seems to produce similar results, providing support for the quadratic shape with positive and significant coefficient for *Remit²* at the 95 percent confidence level. The resulting threshold is also equal to 21.3 percent, and higher than the one in column (1).

In column (5) we use the number of deposit account holders at commercial banks and other resident banks, as a second proxy of financial inclusion (*Deposits*). The estimates also confirm the above results and the non-monotonic relationship between financial inclusion and remittances especially for LMICs. In fact, the results show that for these countries the threshold is lower than previous cases as it stands at a high of 13.28 percent. This means that only in countries with remittances (as percent of GDP) higher than 13.3 percent financial inclusion will be increasing with remittances. This result is not surprising for this proxy and reflects more the reality of LMICs. Having a high number of deposit account holders means

that there is a higher probability that they would be used for consumption as well as investment purposes.

Finally, for the second indicator in the usage dimension (*Borrowers*) in Column 7, the estimates show a similar trend for LMICs as they corroborate the non-monotonic nature of the relationship between financial inclusion and remittances with a threshold standing at a high of 22 percent. The financial inclusion index (*FII*) does not show a different picture though the threshold level is lower (13.0 percent).[4]

The results found in Table 7 seems to be corroborated by the data resulting from bank balance sheets. In fact, we display in Table 8, following Barajas et al (2018), the average of time, saving and foreign currency deposits (percent) GDP, demand deposits (DD) and credit to the private sector (CSP) as a percentage of GDP, according to different intervals of remittances. It would seem that more financial inclusion is equivalent to higher financial services by financial institutions, including more Time and saving deposits, which would lead to more loans for recipient households.

Data in Table (8) show that time, saving and foreign currency deposits in financial institutions are decreasing with remittances until the threshold of 12 percent. Starting from the level of 13 percent (Remit ≤ 13%), households' behavior changes as type of deposits switches as remittance flows increase, that is, from demand deposits to longer maturity ones. The longer duration of time deposits, in turn, allow banks to provide more credit. This might be considered as a confirmation of the of the "U" shape relationship between remittance inflows and financial inclusion.

C. Does the Remittance-Recipient Country's Level of Financial Development Matter?

To test the effect of financial development on the remittances and inclusion nexus, we split the LMICs sample into two sub-groups, less financially developed countries (*LFDCs*) and more financially developed countries (*MFDCs*). The LFDCs are economies whose credit to the private sector ratio (% of GDP) is below the median level while the MFDCs have a higher CPY level than the median[5]. The level of financial development is measured, following, Levine (1997) and De Gregorio and Guidotti (1995) by the credit to the private sector (% of GDP) (CPY). It is a widely used indicator in the empirical literature as it highlights the role of the banking sector in providing funding to private activities.

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[4] Countries with remittances-to-gdp higher than 13% include, for example, Tajikistan (35.0%), Bermuda (31.6%), Tonga (28.2%), Kyrgyz Republic (26.9%), Nepal (25.4%), Lesotho (25.2%), Haiti (24.4%), Moldova (22.7%), El Salvador (19.4%), Samoa (17.7%), Honduras (17.6%), Lebanon (17.2%), Armenia (16.5%), Kosovo (16.3%), Syrian Arab Republic (16.3%), Jamaica (15.9%), Jordan (14.1%), Marshall Islands (13.8%), Liberia (13.8%), Tuvalu (13.6%), and West Bank and Gaza (13.1%), among others.

[5] The median is equal to 26.8%

Table 9 displays the estimates of the non-monotonic relationship for LFDCs and MFDCs. The regressions are carried out with all the proxies of financial inclusion: *Branches, ATMs, Deposits, Borrowers and the composite index FII.* Column 1 shows the result of the regression using the *Branches* as dependent variable for *LFDCs*. The coefficient of remittances is negative and significant at the 10 percent risk level while the quadratic term $Remit_{it}^2$ is not significant. This latter becomes significant at the 90 percent confidence level in Column 2 when the regression is carried out for *MFDCs*. The picture does change when it comes to the rest of the proxies of financial inclusion, except for *Borrowers* (Columns 7 and 9) as the coefficients of *Remit_{it}* and $Remit_{it}^2$ are significant at standard risk levels and with expected signs.

Thus, the non-monotonic relationship between workers' remittances and financial inclusion tends to be corroborated when the financial system is developed enough to create more financial services for the economy, including new loans and credit facilities for businesses.

D. Does the Remittance-Recipient Country's Level of Financial Stability Matter?

To explore whether financial stability matters, we split the LMICs sample into two sub-samples composed of less financially stable countries (LFSCs) and more financially stable countries (MFSCs) based on the median of the Z-score financial stability indicator.[6] LFSCs have lower values of their Z-score than the median of the sample while MFSCs have higher values.

Table 10 shows the GMM dynamic panel regressions for both sub-groups with all financial inclusion proxies. The regressions tend to show that the non-linear relationship tends to be confirmed in countries with more stable financial countries (MFSCs). In fact, the coefficients of the quadratic terms are positive and significant at the 10 percent and 5 percent risk levels, respectively, and vary between 0.0001 and 0.0005, while the coefficients for the linear term (*Remit_{it}*) are negative and significant at standard risk levels.

E. Does the Efficiency of the Remittance-Recipient Country's Banking Sector Matter?

In this section we will test whether the efficiency of the financial sector is important in explaining the nonlinear relationship between remittance workers and financial inclusion. We split the LMICs sample between countries with less efficient banking sectors (*LEFSs*) and those with more efficient banking sectors (*MEFSs*), according to the median level of the interest rate spread (*spread*).[7] This latter is defined as the difference between lending and

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[6] The Z-score is defined as follows: Z= (ROA+CAP)/σROA, Where ROA stands for return on Assets and CAP is the capitalization ratio and equal to equity to Assets (Equity/Assets) and σ is the standard deviation. The median of the Z-score for the whole sample of countries is equal to 9.62.

[7] The median of the spread is equal to 6.53.

deposit interest rates. Thus, for LMICs countries with interest rate gap higher than the median level, they are considered as less efficient, while for countries with a spread lower than the median, they are considered as more financially efficient.

Table 11 displays the results of the GMM dynamic panel regressions of equations (8) and (9) for both sub-samples. In Column 1, we estimate the nonlinear relationship for *LEFSs* with branches as measure of financial inclusion, but it doesn't show any significant coefficient for either *Remit* or *Remit²*. However, in *LMICs* with more efficient banking sectors (Column (2)), the coefficients are significant at standard risk levels and with the expected signs for the quadratic and linear terms. Similar results are also found with access or usage measures of financial inclusion—all confirm the nonlinear result in *LIMCs* with efficient banking sectors.

Furthermore, if we take into consideration the thresholds, we find that the values are lower in general compared to those Tables 6 and 7). The intuition behind is that when we restrict the sub-sample of LMICs to those endowed with efficient banking sectors, the threshold level of remittances (*Remit**) beyond which remittance inflows have positive effects on financial inclusion should be lower. Efficient banking institutions are likely to make better use of deposits and offer more attractive services that would encourage unbanked recipient households to open accounts and benefit from offered services to start profitable projects. Indeed, the threshold is 10.9 percent with *branches* and 14.3 percent for *borrowers,* as measures of financial inclusion, respectively.

F.   Do Regional Features Matter?

In order to analyze the regional features of the relationship workers' remittances and financial inclusion, we follow Chami et al. (2018) , and use the approach that removes each region at a time and we calculate the difference between the coefficients of remittances in the LMICs sample (Columns 1, 3, 5, 7 and 9 in Table 7) and the one in the reduced sample. The specified regions are South Asia (SA), Middle East and North Africa (MENA), East Asia and Pacific (EAP), Sub Saharan African countries (SSA) and Latin America & Caribbean (LAC).

More specifically, we use the estimated coefficients of *Remit* and *Remit²* for LMICs with the different financial inclusion proxies to see whether they are higher or lower than the coefficients obtained for each region. Thus, for *Remit,²* if the resulting difference between the estimated coefficient for LMICs sample and the one for the sample that rules out the region is positive, this means that the exclusion of this latter has lowered the coefficient of *Remit²*. This should point to the importance of the countries in that region in the non-linear relationship between remittances and financial inclusion, if they were added to the sample. For *Remit*, a negative difference between the coefficients indicates that the region contributes to the effect by lowering the coefficient in absolute value (i.e., making it less negative). All

estimated coefficients are carried out using dynamic GMM panel approach and they are significant at standard levels.

Figures 4 to 8 show the difference in the coefficients of *Remit²* and *Remit* with five proxies of financial inclusion. Red bars, showing differences in coefficients for *Remit²*, are positive for specified regions with most financial inclusion measures. Removing one region at a time and re-estimating provides lower coefficients with respect to the full sample of LMICs and positive differences, accordingly. Blue bars relative to differences in coefficients for *Remit* are also negative for the same proxies and confirms lower coefficients with reduced sample of countries. This seems to be the case for most regions with *ATMs*, *Borrowers* and financial inclusion index (*FII*).

However, a closer inspection of figures 4 to 8 across regions reveals the absence of a pattern for Latin American & Caribbean (LAC) Countries as red bas are not always positive and some of them are absent because of insignificant coefficients with the reduced sample (i.e. with *branches* and *FII* proxies of financial inclusion).

In the case of Sub-Saharan African (SSA) countries, the results suggest that this region does not seem to have influence on the non-linear relationship between workers' remittances and financial inclusion.

All in all, the regional analysis of the non-linear relationship between remittances and financial inclusion is indicative of the importance of South Asia (SA) and East Asia & Pacific (EAP) in accounting for such relationship. Red and blue bars for these two regions with most financial inclusion proxies are positive and negative, respectively. Removing these countries of these from the basic sample of LMICs is likely to reduce key coefficients of the estimated equation. Asian countries in these two regions are well known for their high ratios of workers' remittances to GDP.

G. What About Fragile States?

This section investigates empirically the relationship between workers' transfers and financial inclusion for fragile states based on equation (1). However, the features of these countries, including the problems of data availability, impose empirical difficulties. Thus, we restrict our investigation to pooled OLS regressions because of lack of data which makes using other developed techniques difficult to achieve.[8]

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[8] GMM dynamic panel estimations of equation (1) did not bring significant results especially with "*usage*" indicators of financial inclusion because of low number of observations. The results are available upon request.

Remittances and Financial Inclusion by Region, Differences between the Estimated Coefficients of *Remit* and *Remit²* using GMM Dynamic Panel: 2004–15

Figure 4. Differences with *Branches*
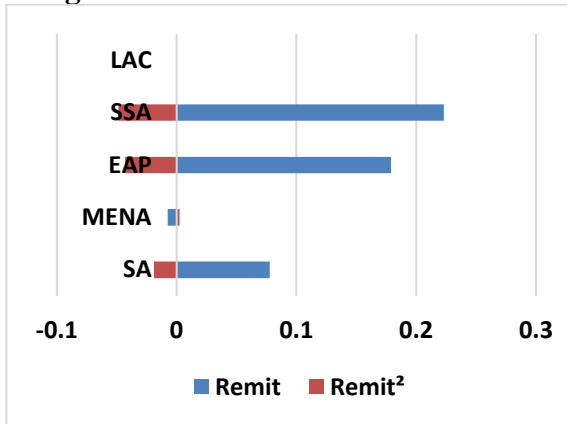
Figure 5. Differences with *ATMs*
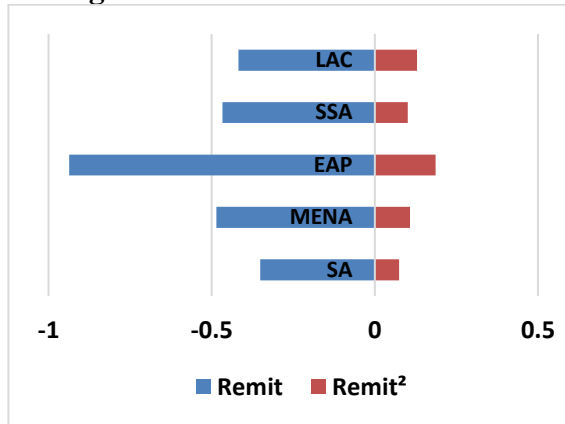
Figure 6. Differences with *Deposits*
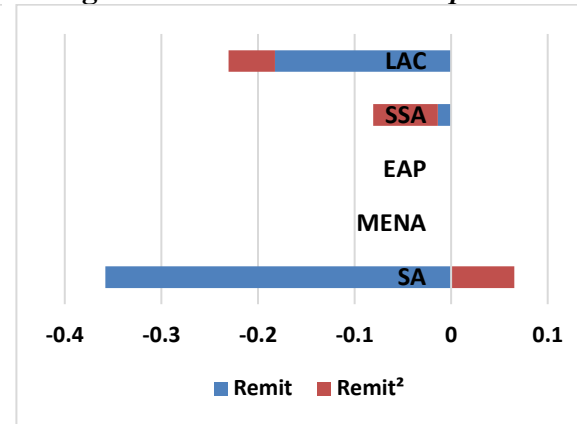
Figure 7. Differences with *Borrowers*
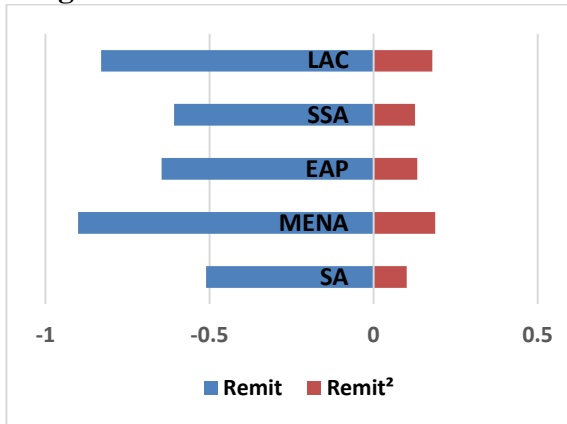
Figure 8. Differences with *FII*
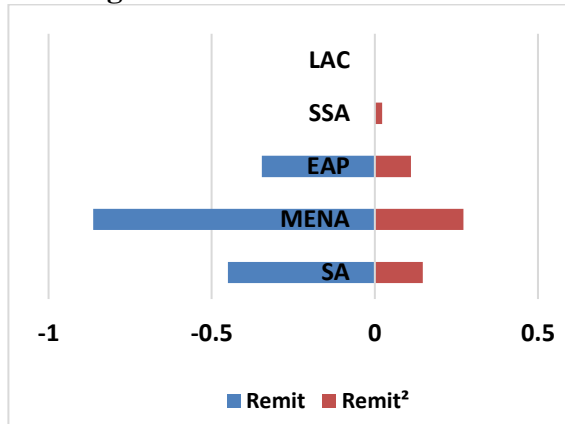
*Absent bars for LAC (Figures 4 and 8), EAP and MENA (Figure 6), LAC and SSA (Figure 8) is due to insignificant coefficients with GMM estimators.

Figure 9 displays the estimated coefficients of *Remit* using pooled OLS regressions for fragile states using IMF[11] and World Bank[12] approaches in defining Fragile states. Blue bars represent the estimated coefficients using the IMF approach in defining fragile countries, while red bars refer to estimated coefficients of World bank approach. The estimations are carried out using all the measures of the financial inclusion.

Results in figure 9 are indicative of a positive effect of remittances on financial inclusion with most indicators. This means that higher remittances contribute to the development of financial services in fragile economies. The negative sign found with the IMF approach as well as the absence of significant effect with the World Bank approach, when using *Borrowers* as a proxy for financial inclusion, might be explained by the weaknesses of the banking system in these to transform deposits into productive loans.

Figure 9. Remittances and Financial Inclusion in Fragile States, OLS Panel Estimates IMF and World Bank Approaches*
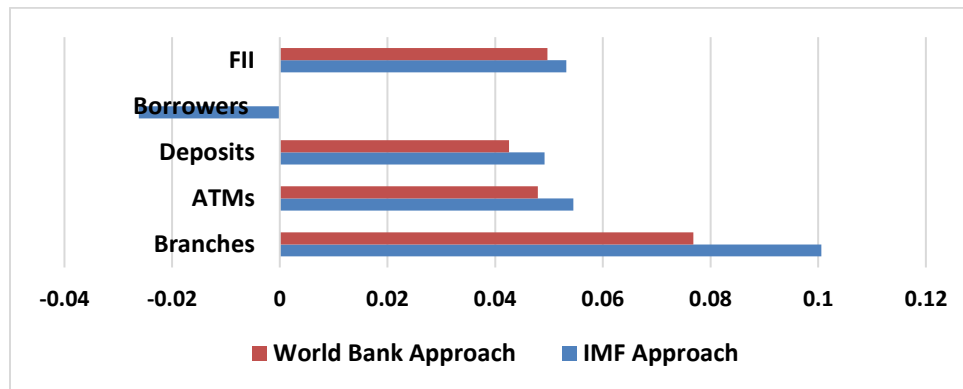
*All coefficients are significant at standard levels except for Borrowers with the World bank approach. Consequently, the red bar is removed.

[11] Fragile States are defined here, based on IMF (2017) as having either "*weak institutional capacity as measured by weak institutional capacity according to the World Bank's Country Policy and Institutional Assessment (CPIA) score (average of 3.2 or lower) and/or experience of conflict (signaled by presence of a peace-keeping or peace-building operation in the most recent three-year period),*" page 8. Almost 30 percent of IMF members are considered as "fragile" at some point" between 2006 and 2016. At end-2016, there were 39 countries and more than half of them are sub-Saharan African countries.

[12] The World Bank approach is based on the "*CPIA score against 16 criteria grouped in four clusters: economic management, structural policies, policies for social inclusion and equity, and public-sector management and institutions. Countries eligible for assistance under IDA1 are classified as fragile when they have a rating of 3.2 or less. The maximum score is 6.0,*" IMF (2017), page 8.

IV. CONCLUSION

While the development potential of workers' remittances continues to be investigated and debated, the effect of remittances on financial inclusion has not been thoroughly studied. For the most part, the research on the role of remittance flows in enhancing financial inclusion has mainly relied on within country surveys with few papers using cross-country data to tackle this issue.

The main result of the paper is that the relationship between remittances and financial inclusion is nonlinear, and takes a "U" shaped, and that remittances (as percent of GDP) positively impact financial inclusion only beyond a threshold ranging between 22 percent and 12.28 percent in LMICs with more sable, efficient and developed financial sectors. When countries receive low levels of remittances, such flows are used by credit-constrained recipients to smooth their consumption and to avoid having to use formal banking services. Banking services in many of the LMICs and fragile states are costly and may be unavailable to households due to informational and market distortions in such countries. In other words, LMICs countries characterized by low level of financial development, unstable financial sector and oligopolistic banking sectors, low level of remittance flows serves as a *substitute* to the formal financial sector, as they are a cheaper source of financing.

However, when these income flows are high enough, remittances increase the recipient's households' savings at formal banking institutions. The increase in the maturity of such deposits changes their nature from demand deposits to time deposits, and these, in turn, allow the banks in LMICs to use such funds to provide financial services, including loans. In other words, high remittance inflows, in this case, complement the formal financial services.

This result is robust to using different proxies for financial inclusion and regional distribution of countries, with the nonlinear effect being most significant in East and South Asia and Pacific regions. For fragile states, despite the data difficulty, we are still able to confirm the positive impact of remittances on financial inclusion, for the most part.

Finally, in terms of policy prescription for these countries, it would seem that efforts should focus on maintaining macroeconomic stability, providing regulatory framework that would reduce the cost of formal intermediation, removing distortions in the credit markets, including the pernicious problem of informational asymmetry (such as establishing credit rating bureaus), and on ensuring a more competitive banking system. These efforts are likely to lead to greater financial inclusion. These efforts should also go hand in hand with promoting financial education among the households.

Appendices

Table 1. Dimensions and Indicators of Financial Inclusion

Dimension	Indicators	
Access	*Branches*	Branches of commercial banks per 100,000 adults
	ATMs	ATMs per 100,000 adults
Usage	*Deposits*	Deposit accounts with commercial banks per 1,000 adults
	Borrowers	Borrowers at commercial banks per 1,000 adults

Table 2. Descriptive Statistics

	Obs.	Mean	Std. Dev	Min	Max
Branches	2108	19.54	26.69	0.12	289.83
ATMs	1947	41.40	44.32	0	290.14
Deposits	1205	1110.86	1195.67	1.25	12.420.85
Borrowers	973	178.00	210.70	0.01	1156.04
FII	1107	0,10	0.09	0	0.69
Remittances	2060	4.71	6.85	0.00	49.28
Log GDP per capita	2197	8.45	1.49	5.32	11.60
Inflation	2077	0.18	5.36	-0.35	244.11
Trade	2121	0.93	0.54	0.00	4.55
Kaopen	1877	4.27	1.60	-1.89	2.38

Source: Authors' computations.

Table 3. Correlation Matrix

	Branches	**ATMs**	**Deposits**	**Borrowers**	**FI Index**	**Remittances**	**GDP per capita**	**Inflation**	**Trade**	
Branches	1.00									
ATMs	0.52	1.00								
Deposits	0.46	0.69	1.00							
Borrowers	0.40	0.70	0.75	1.00						
FI Index	0.77	0.88	0.85	0.73	1.00					
Remittances	-0.01	-0.17	-0.03	-0.13	-0.08	1.00				
GDP per capita	0.49	0.73	0.71	0.70	0.78	-0.20	1.00			
Inflation	-0.03	-0.03	-0.04	-0.04	-0.04	-0.03	-0.06	1.00		
Trade	0.12	0.20	0.47	0.20	0.32	0.14	0.33	0.001	1.00	
Kaopen	0.30	0.42	0.40	0.39	0.45	-0.06	0.47	-0.07	0.15	

Source: Authors' Computations.

Table 4. Remittances and Financial Inclusion, GMM Dynamic Panel Estimates for the Whole Sample: 2004–15

	Dependent variable					
	Branches	*ATMs*	*Deposits*	*Borrowers*	*FII*	*FD*
	(1)	(2)	(3)	(4)	(5)	(6)
L.Branches1	0.9180*** (18.55)					
L.ATMs		0.8465 *** (33.82)				
L.Deposits			0.7815*** (12.02)			
L.Borrowers				0.7961*** (11.46)		
L.FII					0.7723*** (15.84)	
L.FD						0.7671*** (15.69)
Remit	0.0007 (0.72)	0. 0032 (1.09)	0.0002 (0.04)	0.0013 (0.55)	0.0005 (0.14)	0.0031*** (2.85)
LGDPPC	0.0331 (0.48)	0.0799*** (3.35)	0.1231** (2.34)	0.1435* (1.82)	0.1768*** (3.02)	0.1214*** (3.89)
Inf	-0.0259*** (-3.00)	-0.0001 (-1.38)	0.0077 (0.98)	-0.0735*** (-6.66)	-0.0022*** (-6.42)	-0.2644* (-1.75)
Trade	0.0463* (1.79)	0.0112 (0.53)	0.0651* (1.80)	0.0699 (1.23)	0.0773** (2.05)	0.0423* (1.91)
Kaopen	0.0086 (0.70)	0.0010 (0.10)	0.0021 (0.13)	0.0005 (0.03)	-0.0964*** (-2.66)	-0.0116 (-1.06)
Constant	-0.1817 (-0.32)	-0.2233 (-1.14)	0.3778** (2.33)	-0.2372 (-0.65)	-2.0691*** (-3.36)	-0.1778*** (-1.32)
Observations	1323	1276	762	558	741	1450
AR (2) test. p-level	0.765	0.457	0.769	0.941	0.486	0.776
Hansen test, p-level	0.120	0.121	0.385	0.362	0.222	0.508
*t-statistic in parentheses; * significant at 10%, ** significant at 5%, *** significant at 1%*						

Table 5. Remittances and Financial inclusion, GMM Dynamic Panel Estimates: 2004–15

	Dependent Variable									
	Branches		ATMs		Deposits		Borrowers		FII	
	LMICs	HICs	LMICs	HICs	LMICs	HICs	LMICs	HICs	LMICs	HICs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
L.Branches	0.8310*** (19.97)	0.9976*** (59.95)								
L.ATMs			0.7819*** (16.23)	0.8376*** (16.25)						
L.Borrowers					0.6165*** (12.55)	0.9892*** (39.54)				
L.Deposits							0.8274*** (10.90)	0.8793*** (16.54)		
L.FII									0.8759*** (26.6)	0.9632*** (24.83)
Remit	0.0003 (0.14)	-0.0182 (-1.18)	0.0012 (0.55)	-0.0105 (-1.13)	0.0001 (0.03)	-0.0055 (-0.40)	0.0010 (0.40)	-0.0207 (-1.25)	0.0014 (0.63)	-0.0121 (-1.32)
LGDPPC	0.0571* (1.67)	-0.0331 (-0.92)	0.1199** (2.04)	-0.0361 (-0.64)	0.2716*** (4.93)	0.0002 (0.01)	0.1458 (1.50)	0.0357 (0.61)	0.0781* (1.78)	-0.0256 (-1.27)
Inf	-0.0426** (-2.31)	0.3115 (1.18)	-0.0001 (-0.38)	0.2989 (1.09)	-0.0027*** (-7.71)	0.2471 (1.24)	-0.0616*** (-6.68)	-0.0015 (-1.17)	-0.0017*** (-8.45)	0.3109 (1.66)
Trade	-0.0447 (-0.54)	0.0001 (0.01)	0.0838 (1.30)	0.1122** (2.04)	0.1918** (2.33)	0.0005 (0.01)	0.0983 (1.11)	0.0005 (1.40)	0.0075 (0.28)	0.0042 (0.30)
Kaopen	0.0519 (1.11)	-0.0211 (-0.63)	0.0146 (1.11)	0.0484** (2.05)	0.0201 (0.91)	-0.0169 (-0.86)	0.0183 (1.07)	0.0046 (0.17)	0.0044 (0.59)	0.0058 (0.55)
Constant	-0. 1685 (-0.66)	0.3982 (1.23)	-0.3365 (-0.85)	1.1096 (2.27)	0.1381 (0.53)	0.1251 (0.48)	-0.3880 (-0.77)	0.3115 (0.50)	-2.9392** (-2.12)	0.1752 (0.76)
Observations	887	290	874	326	614	128	457	103	553	187
AR (2) test. p-level	0.796	0.820	0.490	0.238	0.695	0.712	0.95	0.300	0.498	0.098
Hansen test, p-level	0.316	0.373	0.601	0.676	0.234	0.905	0.382	0.949	0.348	0.945

*t-statistic in parentheses; * significant at 10%, ** significant at 5%, *** significant at 1%*

Table 6. Remittances and Financial Inclusion, GMM Dynamic Panel Estimates of the "U" Relationship: 2004–15

	Dependent Variable				
	Branches	*ATMs*	*Deposits*	*Borrowers*	*FII*
	(1)	(2)	(3)	(4)	(5)
L.Branches1	0.9431***				
	(46.32)				
L.ATMs		0.8491***			
		(22.72)			
L.Deposits			0.8122		
			(12.81)		
L.Borrowers				0.8948***	
				(16.10)	
L.FII					0.7900***
					(22.44)
Remit	-0.0189**	-0.0208**	-0.0181*	-0.0179**	-0.0171*
	(-2.14)	(-2.44)	(-1.87)	(2.43)	(-1.69)
Remit²	0.0004*	0.0005**	0.0008**	0.0004**	0.0007**
	(1.93)	(2.20)	(2.43)	(2.55)	(2.27)
LGDPPC	-0.0261	0.0333	0.0881*	0.0281	0.1125***
	(-1.35)	(0.94)	(1.71)	(0.51)	(3.21)
Inf	-0.0004	-0.0007***	0.0010	-0.0666***	-0.1188
	(-0.91)	(-3.18)	(0.14)	(-6.12)	(-0.43)
Trade	0.0456*	0.0129	0.0549**	0.0875	0.0165
	(1.69)	(0.53)	(2.07)	(1.62)	(0.77)
Kaopen	0.0125	0.0159*	0.0079	0.0116	0.0046
	(1.28)	(1.70)	(0.60)	(1.07)	(0.42)
Constant	0.3704***	0.3143	0.5239***	0.3189	-1.4430***
	(2.17)	(1.33)	(3.15)	(1.31)	(-3.63)
Observations	1266	1280	762	558	692
AR (2) test. p-level	0.897	0.473	0.681	0.86	0.378
Hansen test, p-level	0.173	0.116	0.461	0.724	0.27
Threshold	23.6%	20.8%	11.3%	22.4%	12.2%

Table 7. Remittances and Financial Inclusion According to Income Level, GMM Dynamic Panel Estimates of the "U" Relationship: 2004-15

	Dependent Variable									
	Branches		*ATMs*		*Deposits*		*Borrowers*		*FII*	
	LMICs	*HICs*	*LMICs*	*HICs*	*LMICs*	*HICs*	*LMICs*	*HICs*	*LMICs*	*HICs*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
L.Branches1	0.9395***	0.9880***								
	(26.54)	(32.21)								
L.ATMs			0.8263***	0.9142***						
			(15.92)	(29.90)						
L.Deposits					0.8411***	0.9955				
					(13.94)	(30.75)				
L.Borrowers							0.9135***	0.9915***		
							(20.36)	(7.52)		
L.FII									0.7747***	0.9765***
									(19.00)	(13.72)
Remit	-0.0378*	-0.0307	-0.0256**	-0.0191	-0.0186**	-0.0353	-0.0220***	-0.0729	-0.0235**	-0.0089
	(-1.94)	(-0.62)	(-2.28)	(-1.11)	(-2.25)	(-0.46)	(2.97)	(-0.70)	(-2.26)	(-0.18)
Remit²	0.0012*	0.0148	0.0006**	0.0028	0.0007***	0.0055	0.0005***	0.0081	0.0009***	-0.0002
	(1.71)	(0.75)	(2.20)	(1.24)	(2.63)	(0.32)	(3.15)	(0.47)	(2.80)	(-0.03)
LGDPPC	-0.0258	0.0276	0.1100*	-0.0272	0.0916*	0.0068	0.0170	0.0111	0.0111	-0.0284
	(-0.87)	(0.71)	(1.67)	(-1.34)	(1.73)	(0.17)	(0.29)	(0.07)	(0.07)	(-0.68)
Inf	-0.0383***	0.5408	-0.0003	0.1659	0.0025	0.2250	-0.0006***	-0.1481	-0.2887	0.6202
	(-4.13)	(1.19)	(-1.54)	(1.50)	(0.04)	(0.75)	(-6.19)	(-0.44)	(-0.87)	(1.40)
Trade	0.0037	-0.0051	0. 0753	-0.0253	0.0008**	0.0405	0.0012	0.0881	0.0540	0.0029
	(0.09)	(-0.31)	(1.30)	(-1.68)	(2.32)	(1.08)	(1.52)	(0.73)	(1.32)	(0.12)
Kaopen	0.0326**	-0.0397	0.0271	0.0053	0.0131	-0.0303	0.0236*	-0.0071	0.0179	0.0166
	(2.03)	(-1.51)	(1.65)	(0.63)	(1.06)	(-0.53)	(1.72)	(-0.14)	(1.33)	(0.38)
Constant	0.4421*	-0.1754	-0.2583	0.6969***	0.3191*	0.0073	0.3351	-0.0541	-1.9099	0.1955
	(1.85)	(-0.48)	(-0.62)	(3.75)	(1.99)	(0.01)	(1.01)	(-0.05)	(-3.94)	(0.51)
Observations	614	271	981	406	565	129	457	103	505	123
AR (2) test. p-level	0.237	0.840	0.804	0.435	0.704	0.462	0.851	0.510	0.374	0.665
Hansen test, p-level	0.345	0.439	0.270	0.998	0.813	0.898	0.983	0.949	0.949	0.962
Threshold	15.7%	-	21.3%	-	13.3%	-	22.0%	-	13.0%	-

*t-statistic in parentheses; * significant at 10%, ** significant at 5%, *** significant at 1%*

Table 8. Deposits and Credits in Bank Balance Sheets of LMICS

	Time, saving and foreign currency deposits (%) GDP	Demand Deposits (%) GDP	Total Deposits (%) GDP	Total credit as a (%) of GDP
Remit ≤ 1%	52.63	56.84	110.10	31.51
Remit ≤ 5%	35.67	31.49	66.77	28.77
Remit ≤ 10%	33.55	27.61	61.05	29.98
Remit ≤ 11%	33.28	27.29	60.46	29.86
Remit ≤ 12%	33.01	26.94	59.83	29.76
Remit ≤ 13%	**33.07**	26.64	59.61	**29.94**
Remit ≤ 14%	33.13	26.47	59.53	29.95
Remit ≤ 15%	33.38	26.30	59.66	30.13
Remit ≤ 20%	35.91	25.35	61.29	30.97
Remit ≤ 25%	37.15	24.79	61.96	31.20
Remit ≤ 30%	37.28	24.54	61.83	31.26

Source: Authors Computations

Table 9. Remittances and Financial Inclusion in LMICs, the Role of Financial Development, GMM Dynamic Panel Estimates: 2004–2015

	Dependent Variable									
	Branches		ATMs		Deposits		Borrowers		FII	
	LFDCs	HFDCs	LFDCs	HFDCs	LFDCs	HFDCs	LFDCs	HFDCs	LFDCs	HFDCs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
L.Branches1	0.7826***	0.9999***								
	(10.54)	(82.53)								
L.ATMs			0.7913***	0.8508***						
			(11.33)	(25.54)						
L.Deposits					0.7745***	0.9519***				
					(8.98)	(33.70)				
L.Borrowers							0.6926***	0.7394***		
							(13.47)	(13.53)		
L.FII									0.7899***	0.7567***
									(16.64)	(9.79)
Remit	-0.0191	-0.0071*	-0.0139	-0.0147**	-0.0113	-0.0132*	-0.0341	-0.0117*	0.0221*	-0.0364***
	(-1.02)	(-1.98)	(-0.96)	(- 2.58)	(-0.68)	(-1.84)	(-1.46)	(-1.78)	(1.69)	(-3.06)
Remit^2	0.0004	0.0001*	0.0003	0.0003**	0.0006	0.0003*	0.0008	0.0002*	-0.0006	0.0013*
	(1.06)	(1.69)	(1.12)	(2.15)	(0.93)	(1.72)	(1.64)	(1.96)	(-1.37)	(3.06)
LGDPPC	0.0336	-0.0255	0.1106*	0.1047*	0.1454**	-0.0214	0.2382**	0.1561**	0.1668***	0.1091
	(0.60)	(-0.91)	(1.80)	(1.86)	(2.57)	(-0.58)	(2.15)	(2.31)	(3.73)	(1.58)
Inf	-0.0280	0.0053	0.1253	-0.0005	0.0785	-0.0080**	-0.1851	-0.0013	0.0798	-0.0025***
	(-0.33)	(0.45)	(0.59)	(-2.22)	(1.29)	(-2.10)	(-1.57)	(-2.34)	(0.19)	(-9.07)
Trade	-0.1065	0.0003	0.0361	0.0714*	0.0085	0.0259	0.4440*	-0.0246	0.0236	-0.0179
	(-1.12)	(0.01)	(0.25)	(1.87)	(0.11)	(0.92)	(1.91)	(-0.37)	(0.23)	(-0.42)
Kaopen	0.0660**	0.0004	0.0408	-0.0063	0.0329	0.0016	0.0694*	0.0069	0.0042	0.0042
	(2.02)	(0.02)	(1.55)	(-0.57)	(1.27)	(0.18)	(1.72)	(0.35)	(0.25)	(0.25)
Constant	0.0403	0.2812	-0.2999	-0.2751	0.2534	0.5888	-0.8034*	0.1584	-2.0221**	-1.3287*
	(0.10)	(1.34)	(-0.78)	(-0.71)	(1.09)	(3.24)	(-1.08)	(0.44)	(-3.94)	(-1.72)
Observations	371	463	309	457	247	336	232	247	210	343
AR (2) test. p-level	0.959	0.344	0.262	0.282	0.978	0.587	0.302	0.202	0.382	0.219
Hansen test, p-level	0.668	0.467	0.812	0.337	0.956	0.810	0.989	0.945	0.994	0.708

*t-statistic in parentheses; * significant at 10%, ** significant at 5%, *** significant at 1%*

Table 10. Remittances and Financial Inclusion in LMICs, the Role of Financial Stability, GMM Dynamic Panel Estimates: 2004–15

	Dependent Variable									
	Branches		*ATMs*		*Deposits*		*Borrowers*		*FII*	
	LFSCs	*MFSCs*	*LFSCs*	*MFSCs*	*LFSCs*	*MFSCs*	*LFSCs*	*MFSCs*	*LFSCs*	*MFSCs*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
L.Branches1	0.9071***	0.9916***								
	(20.26)	(72.70)								
L.ATMs			0.8196***	0.6540***						
			(19.27)	(6.45)						
L.Deposits					0.7237***	0.8762***				
					(5.57)	(11.63)				
L.Borrowers							0.9128***	0.9494***		
							(25.05)	(18.87)		
L.FII									0.9081***	0.9414***
									(10.78)	(34.01)
Remit	-0.0177	-0.0119**	-0.0063	-0.0227**	-0.0028	-0.0167*	-0.0053	-0.0131**	-0.0118	-0.0058*
	(-1.04)	(-2.53)	(-0.76)	(-2.27)	(-0.16)	(-1.84)	(-0.33)	(-2.22)	(-0.90)	(-1.67)
Remit²	0.0004	0.0002*	0.0002	0.0005*	0.0004	0.0005**	0.0002	0.0003**	0.0004	0.0002*
	(1.07)	(2.20)	(1.03)	(1.93)	(0.84)	(2.11)	(0.73)	(2.25)	(1.19)	(1.71)
LGDPPC	-0.0090	-0.0440	0.1966***	0.2377*	0.2346*	0.0543	0.0380	0.0136	0.0785	0.0167
	(-0.25)	(-1.36)	(3.00)	(1.83)	(1.84)	(0.87)	(0.68)	(0.23)	(0.91)	(0.64)
Inf	-0.0332***	-0.0332	-0.2182	0.0001	0.010	-0.0037***	- 0.0603***	0.0456	0.1029	-0.2176
	(-4.12)	(-0.36)	(-1.00)	(0.20)	(0.93)	(-12.92)	(-4.47)	(0.10)	(0.32)	(-1.14)
Trade	-0.0145	0.1190	0.1047	0.0918	0.1091	0.0554	0.0796	0.0273	0.0303	0.0070
	(-0.24)	(1.59)	(1.64)	(1.06)	(1.42)	(1.06)	(0.81)	(0.49)	(0.57)	(0.27)
Kaopen	0.0393*	-0.0313	-0.0030	0.0305	0.0006	0.0153	0.0257	0.0090	0.0078	-0.0008
	(1.69)	(-1.22)	(-0.22)	(1.19)	(0.03)	(1.16)	(1.37)	(0.72)	(0.62)	(-0.17)
Constant	0.3215	0.4078	-0.9666**	-0.8966	-0.1340	0.4072**	0.1603	0.2315	-0.8037*	-0.2282
	(1.07)	(1.49)	(-2.16)	(-1.10)	(-0.39)	(2.18)	(0.47)	(0.66)	(-0.81)	(-0.76)
Observations	457	476	323	443	269	345	244	213	218	230
AR(2) test. p-level	0.266	0.340	0.137	0.197	0.869	0.675	0.792	0.759	0.367	0.491
Hansen test, p-level	0.461	0.407	0.671	0.918	0.958	0.478	0.991	0.997	0.995	1.000

*t-statistic in parentheses; * significant at 10%, ** significant at 5%, *** significant at 1%*

Table 11. Remittances and Financial Inclusion in LMICs, the Role of Financial Sector Efficiency—GMM Dynamic Panel Estimates: 2004–2015

	Dependent Variable									
	Branches		*ATMs*		*Deposits*		*Borrowers*		*FII*	
	LEFSs	*MEFSs*	*LEFSs*	*MEFSs*	*LEFSs*	*MEFSs*	*LEFSs*	*MEFSs*	*LEFSs*	*MEFSs*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
L.Branches1	0.8875***	0.9901***								
	(19.30)	(64.43)								
L.ATMs			0.7799***	0.9025***						
			(9.17)	(19.71)						
L.Deposits					0.7966	0.9789				
					(11.25)	(58.38)				
L.Borrowers							0.9101***	0.9887***		
							(12.73)	(26.02)		
L.FII									0.9100***	0.9722***
									(21.66)	(17.76)
Remit	-0.035	-0.0263**	-0.0205	-0.0115*	-0.0029	-0.0194**	-0.0119	-0.0086	-0.0032	-0.0083**
	(-0.30)	(-2.44)	(-1.62)	(-1.85)	(-0.24)	(-2.05)	(-1.29)	(-0.73)	(-0.19)	(-1.75)
Remit²	0.0008	0.0012**	0.0005*	0.0003*	0.0003	0.0004*	0.0003	0.0003	0.0001	0.0002*
	(0.33)	(2.54)	(1.75)	(1.96)	(1.15)	(1.89)	(1.66)	(1.09)	(0.23)	(2.28)
LGDPPC	0.0298	-0.0187	0.1787*	0.0208	0.1507**	-0.0552	0.0617	-0.0298	0.0643	0.0418
	(0.87)	(-1.15)	(1.83)	(0.37)	(2.36)	(-0.93)	(0.70)	(-0.55)	(1.57)	(0.64)
Inf	-0.0296***	-0.3772***	-0.0005	0.1522	0.0108	0.2992	0.0002	-0.0421	-0.0851	0.4299
	(-4.93)	(-2.60)	(-0.01)	(1.22)	(0.97)	(0.80)	(1.22)	(-0.08)	(-0.27)	(1.66)
Trade	*-0.0722*	*-0.0631*	*0.1012*	*0.0545*	*0.0228*	*0.1798**	*0.0504*	*0.0447*	*0.0063*	*0.0121*
	(-1.03)	*(-1.57)*	*(0.95)*	*(1.37)*	*(0.41)*	*(1.94)*	*(0.69)*	*(1.35)*	*(0.12)*	*(-0.26)*
Kaopen	0.0073	0.0159*	0.0261	0.0003	0.0055	0.0056	0.0164	0.0082	-0.0009	-0.0072
	(0.51)	(1.68)	(1.31)	(0.04)	(0.50)	(0.50)	(1.17)	(0.56)	(-0.07)	(-0.47)
Constant	0.0342	0.3563**	-0.7365	0.2104**	0.1055*	0.5354**	0.0121	0.3629	-0.6879**	-0.3509
	(0.14)	(2.41)	(-1.22)	(0.60)	(0.55)	(1.14)	(0.03)	(1.05)	(-1.42)	(-0.52)
Observations	521	224	475	291	357	208	323	172	312	172
AR(2) test. p-level	0.740	0.270	0.397	0.800	0.629	0.248	0.054	0.155	0.366	0.855
Hansen test, p-level	0.815	0.835	0.905	0.853	0.784	0.721	0.660	0.652	0.562	0.810

*t-statistic in parentheses; * significant at 10%, ** significant at 5%, *** significant at 1%*

Table 12. Variable Definitions

Variable	Definition and Calculation	Source
Branches of commercial banks per 100,000 adults (Branches)	Commercial bank branches are retail locations of resident commercial banks and other resident banks.	International Monetary Fund, Financial Access Survey.
Automatic Teller Machines per 100,000 adults (*ATMs*)	An automated teller machine (ATM) is an electronic banking outlet, that allows customers to complete basic transactions, including dispensing cash and accepting deposits, without the aid of a branch representative or teller.	International Monetary Fund, Financial Access Survey.
Deposit accounts with commercial banks per 1,000 adults (Deposits)	Depositors with commercial banks are the reported number of deposit account holders at commercial banks and other resident banks. For many countries, because of lack of information on account holders, the data cover the total number of deposit accounts. The deposits are composed of checking accounts, savings accounts, and time deposits.	International Monetary Fund, Financial Access Survey.
Borrowers at commercial banks per 1,000 adults (Borrowers)	Population in urban agglomerations of more than 1 million (% of total population)	International Monetary Fund, Financial Access Survey.
Financial Inclusion Index (*FII*)	Composite index based on three indicators (*Branches*, *ATMs*, *Deposits*)	Wang and Guan (2017)
Remittances (Remit)	Personal remittances received (% of GDP): Personal remittances are composed of personal transfers and compensation of employees. Data are the sum of two items defined in the sixth edition of the IMF's Balance of Payments Manual.	World Bank staff estimates based on IMF balance of payments data, and World Bank and OECD GDP estimates.
GDP per capita	GDP per capita (constant 2010 US$): GDP per capita is gross domestic product divided by midyear population. Data are in constant 2010 U.S. dollars.	World Bank national accounts data, and OECD National Accounts data files.
Inflation (Inf)	The annual change (%) of the consumer price index.	International Monetary Fund, International Financial Statistics and data files.
Trade Openness (Trade)	Trade (% of GDP): Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	World Bank national accounts data, and OECD National Accounts data files.
The financial openness state (Kaopen)	the Chinn and Ito's capital account openness index, generally known with the acronym Kaopen (Chinn and Ito (2011)).	(Chinn and Ito (2011))

Table 13. List of Countries and Periods

Country	Years	Country	Years	Country	Years
Afghanistan	2008-2015	Guinea	2004-2015	Pakistan	2004-2015
Albania	2004-2015	Guinea-Bissau	2004-2015	Palau	2005-2015
Algeria	2004-2015	Guyana	2004-2015	Panama	2004-2015
Angola	2008-2015	Haiti	2004-2015	Papua New Guinea	2004-2014
Antigua and Barbuda	2004-2015	Honduras	2004-2015	Paraguay	2004-2015
Argentina	2004-2015	Hong Kong SAR,	2004-2015	Peru	2004-2015
Armenia	2004-2015	Hungary	2004-2015	Philippines	2004-2015
Aruba	2004-2011	Iceland	2004-2015	Poland	2004-2015
Australia	2004-2015	India	2004-2015	Portugal	2004-2015
Austria	2004-2015	Indonesia	2004-2015	Qatar	2011-2015
Azerbaijan	2004-2015	Iran, Islamic Rep.	2004-2014	Romania	2004-2015
Bangladesh	2004-2015	Iraq	2005-2015	Russian Federation	2004-2015
Barbados	2004-2015	Ireland	2004-2015	Rwanda	2004-2015
Belarus	2004-2015	Israel	2004-2015	Samoa	2004-2015
Belgium	2004-2015	Italy	2004-2015	Sao Tome and Principe	2004-2015
Belize	2004-2015	Jamaica	2004-2015	Saudi Arabia	2005-2015
Benin	2004-2015	Japan	2004-2015	Senegal	2004-2015
Bhutan	2005-2015	Jordan	2004-2015	Serbia	2005-2015
Bolivia	2004-2015	Kazakhstan	2004-2015	Seychelles	2004-2015
Bosnia and Herzegovina	2004-2015	Kenya	2004-2015	Sierra Leone	2004-2015
Botswana	2004-2015	Kiribati	2005-2015	Slovak Republic	2004-2015
Brazil	2004-2015	Korea, Rep.	2004-2015	Slovenia	2004-2015

Country	Years	Country	Years	Country	Years
Bulgaria	2004-2015	Kosovo	2004-2015	Solomon Islands	2004-2015
Burkina Faso	2004-2015	Kuwait	2010-2015	South Africa	2004-2015
Burundi	2004-2015	Kyrgyz Republic	2004-2015	South Sudan	2014-2014
Cabo Verde	2004-2015	Lao PDR	2004-2015	Spain	2004-2015
Cambodia	2004-2015	Latvia	2004-2015	Sri Lanka	2004-2015
Cameroon	2004-2015	Lebanon	2004-2015	St. Kitts and Nevis	2004-2015
Canada	2004-2015	Lesotho	2004-2015	St. Lucia	2004-2015
Chile	2004-2015	Liberia	2004-2015	St. Vincent and the Grenadines	2004-2015
China	2004-2015	Libya	2004-2011	Sudan	2004-2015
Colombia	2004-2015	Lithuania	2004-2015	Suriname	2004-2015
Comoros	2004-2015	Luxembourg	2004-2015	Swaziland	2004-2015
Congo, Dem. Rep.	2005-2015	Macao SAR, China	2004-2015	Sweden	2004-2015
Congo, Rep.	2004-2007	Macedonia, FYR	2004-2015	Switzerland	2004-2015
Costa Rica	2004-2015	Madagascar	2004-2015	Syrian Arab Republic	2004-2007
Cote d'Ivoire	2004-2015	Malawi	2004-2015	Tajikistan	2004-2015
Croatia	2004-2015	Malaysia	2004-2015	Tanzania	2004-2015
Cyprus	2004-2015	Maldives	2004-2015	Thailand	2004-2015
Czech Republic	2004-2015	Mali	2004-2015	Timor-Leste	2005-2015
Denmark	2004-2015	Malta	2004-2015	Togo	2004-2015
Djibouti	2004-2015	Marshall Islands	2005-2015	Tonga	2004-2015
Dominica	2004-2015	Mauritius	2004-2015	Trinidad and Tobago	2004-2015
Dominican Republic	2004-2015	Mexico	2004-2015	Tunisia	2004-2015

Ecuador	2004-2015	Micronesia, Fed. States	2005-2015	Turkey	2004-2015
Egypt, Arab Rep.	2004-2015	Moldova	2004-2015	Uganda	2004-2015
El Salvador	2004-2015	Mongolia	2004-2015	Ukraine	2004-2015
Estonia	2004-2015	Montenegro	2005-2015	United Kingdom	2004-2015
Ethiopia	2004-2015	Morocco	2004-2015	United States	2004-2015
Fiji	2004-2015	Mozambique	2004-2015	Uruguay	2004-2015
Finland	2004-2015	Myanmar	2004-2015	Uzbekistan	2006-2015
France	2004-2015	Namibia	2004-2015	Vanuatu	2004-2015
Gabon	2004-2015	Nepal	2004-2015	Venezuela, RB	2004-2013
Gambia, The	2004-2015	Netherlands	2004-2015	Vietnam	2004-2015
Georgia	2004-2015	New Zealand	2004-2015	West Bank and Gaza	2004-2015
Germany	2004-2015	Nicaragua	2004-2015	Yemen, Rep.	2004-2015
Ghana	2004-2015	Niger	2004-2015	Zambia	2004-2015
Greece	2004-2015	Nigeria	2004-2015	Zimbabwe	2005-2015
Grenada	2004-2015	Norway	2004-2015		
Guatemala	2004-2015	Oman	2004-2015		

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