

Remittances and Financial Development in Latin America and the Caribbean countries: A dynamic approach

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Abstract:

Despite the importance of remittances in total international flows, the conclusion of the studies on the relationship between remittances and financial development, are still not completely unanimous, particularly in Latin America and the Caribbean. However, financial development matters for growth and poverty alleviation and financial inclusion have many beneficial effects for households. We examine the relationship between remittances and financial sector development with several dynamic panel data methods. We find a positive, significant, and robust bi-directional link between remittances and financial development with a parsimonious model and a positive impact of remittances for the panel of 39 countries, and particularly for the sample of countries with high ratio of remittances to GDP.

Keyword:

Remittances

Financial development

Latin America and Caribbean

1. Introduction

In 2014, international migrants from developing countries are expected to send \$436 billion in remittances to their home countries. Global remittances, including those to high-income countries, are estimated at \$581 billion this year, from \$542 billion in 2013 (World Bank, 2014). In 2013, remittance flows were generally robust in all regions except in Latin America and the Caribbean (LAC), saw decline in remittance inflows, partly due to removals and deportations from the US. The LAC region receives approximately three-quarters of its total remittances from the United States. Remittance flows to countries in the LAC region grew slightly by 1.9 percent in 2013 to reach \$61 billion.

This trend shows that remittances are more stable than other international financial flows (Ratha, 2004). During the 2008–2009 global financial crisis, remittances declined only 6.1 per cent and by 2010, they had almost recovered to their 2008 peak level (Ratha et al., 2010; World Bank, 2011). They have become the second largest source of external finance for developing countries after foreign direct investment (FDI) and represent about twice the amount of official aid received (Aggarwal et al., 2011). For many remittance-receiving developing economies, remittance flows exceed foreign direct investment, portfolio flows from financial markets and official development assistance. Some countries' total remittance receipts amount to a substantial portion of their imports and a nontrivial fraction of GDP (Chami et al., 2008). Officially recorded remittances are not completely full of remittances, they are generally underestimated (Reinke, 2007). Balance of payments data on remittances tend to record remittances sent via banks more accurately and, in some cases, ignore those sent via non-bank institutions (e.g., money transfer operators) and informal channels (e.g., family and friends). In some countries, migrants have tended to rely heavily on informal transfer channels rather than bank transfers, due to the lack of financial sector development in the remittance-receiving communities and the lower transaction costs and greater efficiency of informal transfer methods such as transfers by hand (Brown et al., 2013).

Despite this precision, some studies analyze the link between remittances and financial sector development. However, little attention has been paid to the question of whether remittances promote financial development across remittance-recipient countries and vice versa. This issue is very important because financial development has

been shown to foster growth and reduce poverty (Beck et al., 2007). Furthermore, the link between remittances and the banking sector is important because intermediating remittances through the banking sector may magnify the developmental impact of remittance flows (see World Bank, 2006). The receipt of remittances increasingly exposes households to the formal financial sector, which in turn induces households to make more use of formal bank services for their transfers and other financial transactions (Gupta et al., 2009; Demirgüç-Kunt et al., 2011; Aggarwal et al., 2011). This might potentially increase their demands for deposit accounts, since financial institutions offer households a safe place to store this temporary excess cash.

Financial systems perform the key functions of mobilizing and intermediating savings (Levine, 2005). By sending remittances, migrants play the role of financial intermediaries, enabling households and small-scale entrepreneurs to overcome credit constraints and imperfections in financial markets. In such cases, remittances may potentially contribute to raising the country's long-run growth through higher rates of capital accumulation (Mundaca, 2009). Moreover, remittances might increase household's likelihood of obtaining a loan. Processing remittances flows provides financial institutions with information on the income of recipient households. This information might make financial institutions better willing and able to extend loans to otherwise borrowers (Anzoategui et al. (2011)).

While remittances may lead to an expansion of banking sector, the causation may also go in the opposite direction (Demirgüç-Kunt et al., 2011). This interrelationship results in a reverse causality. Greater financial development might lead to larger measured remittances either because financial development enables remittance flows or because a larger percentage of remittances are measured when those remittances are channeled through formal financial institutions. In addition, financial development might lower the cost of transmitting remittances, leading to an increase in such flows (Aggarwal et al., 2011).

Despite the different considerations and the number of studies, there is still no consensus about the general or typical effects of remittances on financial development and vice versa. The differences in the empirical studies can be explained by the methodologies which are used, the diversity of the countries which are studied, and the data which are used. This paper contributes to the existing literature on remittances by

examining the relationship between remittances and financial development in Latin America and the Caribbean (LAC).

To our knowledge, very few studies attempt to study the “double correlation” (with remittances and financial development as dependent variable and explanatory variable) taking into account heterogeneity and endogeneity (to account for unobserved country characteristics and for common shocks and trends across countries) with a dynamic approach. We would like to generalize the relationship between remittances and financial development in a set of LAC countries, which is an area where this type of analysis is relatively small (for example, we can cite some studies with macrodata: Calderon et al. (2008), Mundaca (2009), Ramirez (2013); and with microdata: Demirgüç-Kunt et al. (2011) for Mexico, Anzoategui et al. (2014) for El Salvador).

We investigate the relationship between remittances and financial development with several methodologies (Granger causality test, panel non causality test, estimations with country and time fixed effects and dynamic GMM estimates) for a panel of LAC countries and two subsamples (differentiated by the level of remittances) to take into account the heterogeneity. We find evidence of a positive and significant link between financial development and remittances, irrespective of the different control variables and estimation techniques used. The results suggest that remittances may help foster financial development in LAC region, particularly in the countries with high ratio of remittances to GDP.

The rest of the paper is organized as follows. Section 2 discusses the methodology and the data used to study the link between remittances and financial development. Section 3 presents the empirical results, and Section 4 concludes.

2. Review of the Related Literature

Remittances could affect financial development but this effect is unclear and there is still no consensus, especially in LAC countries.

In general, remittances are expected to have a positive effect on the financial development of the recipient countries. Aggarwal et al. (2011) empirically explore the impact of remittances on financial system development, using a homogenous panel model of 99 developing countries. The authors find evidence that remittances promote financial

development by increasing the aggregate level of deposits and credits. Gupta et al. (2009) examine the influence of remittances on financial development on a panel sample of 44 Sub-Saharan African (SSA) countries. They find the same evidence that remittances help to promote financial development. Chowdhury (2011) considers a single equation approach of Aggarwal et al. (2011) to analyze the impact of remittances on financial development, by focusing exclusively on Bangladesh. Remittances have a significant positive effect on financial development in Bangladesh. Estimating a homogenous panel data model on annual data from 94 developing economies, Cooray (2012) finds that remittances increase financial sector size in countries with lower government ownership of banks, while they raise financial sector efficiency in countries with higher government ownership of banks.

However, the positive effects of remittances on financial development are not readily accepted by other scholars working on this topic. Brown et al. (2013) estimate the relationship between remittances and financial development using cross-section panel data. They find that after controlling for per capita GDP, other macroeconomic factors, and the countries' legal origin, remittances do not increase domestic credit to the private sector. Bettin et al. (2012) estimate a micro-behavioral model on remittances sent by legal immigrants who entered Australia between 1993 and 1995, and find that the degree of financial development does not influence the propensity to remit. Using the panel Granger causality test approach by Kónya (2006), Coulibaly (2015) investigates the causality between remittances and financial sector development in SSA countries. Based on liabilities as a proxy for financial sector development, remittances positively influence financial development only in four countries (Niger, Senegal, Sierra Leone and Sudan) and financial development positively impacts remittances only in Gambia.

Similarly, in the LAC countries, the findings of studies are divergent. Mundaca (2009) assess the impact of remittances on growth in selected countries in Central America. Remittances had a significant impact on the growth of these economies, and the impact was stronger when the financial sector was included in the model. Using household level data from El Salvador, Anzoategui et al. (2014) show that remittances have a positive effect on the likelihood that households have a bank account. Ramirez (2013) show that remittances have a positive and significant effect on economic growth in selected upper and lower income LAC countries over the 1990–2007 period. Demirgüç-Kunt et al. (2011) find evidence that remittances increase banking breadth and depth by rising the number

of branches and accounts per capita and the deposits in Mexico. From a contrasting perspective, Calderon et al. (2008), indicates remittances can reduce credit demands and “have dampening effect on the credit markets.” Like Giuliano and Ruiz-Arranz (2009), Ramirez and Sharma (2009) show migrants' transfers and the financial sector can be substitutes (estimation with an interaction term) on Latin American and Caribbean countries. In this case, the financial sector is well developed, credit constraints are removed and remittances received from relatives from abroad need not be used in a productive way.

3. Empirical methodology and data

Households who receive remittances are more exposed to the formal financial sector and hence tend to make more use of formal bank services. Therefore, we should observe a positive effect of the inflow of remittances on measures of financial development. Similarly, financial development might lead to larger measured remittances. To analyze the relationship between remittances and financial development in LAC countries with a dynamic approach, we use several methodologies: Granger causality test and panel non causality test (Dumitrescu and Hurlin, 2012), estimations with country and time fixed effects and dynamic system GMM estimates. We expect remittances and financial development to adjust with delay to changes in factors such as economic development, migration, recruitment in the financial sector, ... Then, we will analyze in greater detail whether remittances promote financial development across remittance-recipient countries of LAC with some dynamic approach.

Panel causality test

The different forms of panel causality tests differ on the assumptions made about the homogeneity of the coefficients across cross-sections. The first one is to treat the panel data as one large stacked set of data, and then perform the Granger Causality test in the standard way. The standard panel Granger causality approach allowed testing the existence and the direction of causality between variables. The second one is the panel non causality tests that consist in a simple test of the Granger (1969) non causality

hypothesis in a heterogeneous panel model. The use of a panel data methodology in this context can be justified by the same arguments as those used in the contemporary panel unit root tests literature. The first one is the power deficiencies of the pure time series-based tests of non causality in short sample. The second is the possibility to consider a heterogeneous model to test the non causality hypothesis. So, it is possible to test the relationship between remittances and financial development without considering the same dynamic model for all the countries of the sample.

Under the null hypothesis, we assume that there is no causal relationship from “remittances” to “financial development” (or vice et versa) for all the countries of the panel. We call this hypothesis the Homogeneous Non Causality (HNC) hypothesis. Under the alternative hypothesis, there is a causal relationship for at least one country of the sample. The approach used is then similar to that used by Im, Pesaran and Shin (2003) to test the unit root hypothesis. Two standardized statistics are then proposed: The \bar{W} statistic (based on the exact moments of the asymptotic moments of the individual Wald statistics) and the \bar{Z} statistic (based on approximated moments for finite T samples).

With two stationary variables, denoted x and y , observed on T periods and on N countries. For each country $i = 1, \dots, N$, at time $t = 1, \dots, T$, we consider the following heterogeneous autoregressive model:

$$y_{it} = \alpha_i + \sum_{k=1}^K \gamma_{ik} y_{i,t-k} + \sum_{k=1}^K \beta_{ik} x_{i,t-k} + \varepsilon_{it}$$

Individual effects α_i are assumed to be fixed. We assume that the lag-order K is common. The autoregressive parameters γ_{ik} and the regression coefficients slopes β_{ik} differ across countries. For each country $i = 1, \dots, N$, the innovations ε_{it} ; $\forall t = 1, \dots, T$ are i.i.d. $(0, \sigma_{\varepsilon,i}^2)$ and are independently distributed across groups. In this heterogeneous panel model, we propose to test the Homogenous Non Causality (HNC) hypothesis as follows:

$$H_0: \beta_i = 0 \text{ où } i = 1, \dots, N$$

Under the alternative hypothesis, there is a causality relationship from x to y for at least one cross-section unit:

$$\begin{aligned}\beta_i &= 0 \text{ o\`u } i = 1, \dots, N_1 \\ \beta_i &\neq 0 \text{ o\`u } i = N_1 + 1, N_1 + 2, \dots, N\end{aligned}$$

This test is calculated by simply running standard Granger Causality regressions for each cross-section individually.

Estimations in OLS and GMM

We model the financial development as a function of remittances following the same methodology as Aggarwal et al. (2011). The specification of the model is given below:

$$FD_{i,t} = \beta_1 Rem_{i,t-1} + \beta_2 X_{i,t-1} + \gamma_i + \delta_i + \varepsilon_{i,t} \quad (1)$$

In complement, we test the reverse relationship (only with GDP per capita like control variable (like Brown et al., 2013 or Coulibaly, 2015):

$$Rem_{i,t} = \beta_1 FD_{i,t-1} + \beta_2 X_{i,t-1} + \gamma_i + \delta_i + \varepsilon_{i,t} \quad (2)$$

where FD is financial development, Rem is the volume of remittances (relative to GDP) received by country i in year t , X is a vector of controls, γ is a country fixed effect, δ is a time fixed effect and ε is a noise. i refers to the country and t refers to the time period from 1970 to 2013. However, data for the complete time period are not available for all countries. A complete list of countries and years is given in Appendix (Table 11). The annual data is obtained from various World Bank data sources (Table 12), including World Development Indicators and International Financial Statistics (from IMF). Table 9 presents descriptive statistics and Table 10 shows correlations.

The empirical strategy is to start with estimating simple models: the relationship between financial development and remittances, with GDP per capita like a control variable. Then, we integrate more explanatory variables, always expressed in lagged

values. The empirical approach should take into account the problems related to causality and endogeneity.

Firstly, we estimate these models by running estimations with country and time fixed effects to control for unobserved country characteristics and for common shocks and trends across countries (note that descriptive statistics show also revealed some heterogeneity in the panel).

Secondly, the estimations can be biased by endogeneity between financial development and remittances because better-developed financial institutions can have a positive effect on remittances flowing through formal channels: banking development allows people to finance migration or the presence of financial institutions is associated with lower costs to send remittances. To tackle the potential bias due to reverse causality and endogeneity, we lag all regressors (one period) in our estimations in OLS and we conduct estimations using lagged values of the regressors as instruments in a GMM dynamic framework à la Arellano and Bover (1995). In GMM estimates, the process may be dynamic, with current realizations of the dependent variable influenced by past ones and some regressors may be endogenous. The process of adjustment to changes in these factors may depend both on the passage of time, which indicates lagged versions of these factors as regressors, and on the difference between equilibrium financial development and the previous year's actual level, which argues for a dynamic model, in which lags of the dependent variable are also regressors. Using lagged values of the regressors as instruments can help deal with the problem of reverse causality.

Data

Like Giuliano et al. (2009) and Aggarwal et al. (2011), *FD* correspond to financial development. We use a variety of measures to proxy for financial development as in the existing literature (Beck et al., 2000; Gupta et al., 2009; King and Levine, 1993). First, domestic credit to private sector by banks (*BANK/GDP*) refers to financial resources provided to the private sector by other depository corporations (deposit taking corporations except central banks), such as through loans, purchases of no equity securities, and trade credits and other accounts receivable, that establish a claim for repayment. Second, liquid liabilities of the financial system (*M2/GDP*) equal currency plus

demand and interest bearing liabilities of banks and non-bank financial intermediaries divided by *GDP*. It is considered the broadest measure of financial intermediation and includes three types of financial institutions: the central bank, deposit money banks, and other financial institutions. The data of the variables are obtained from the International Financial Statistics (IFS) of the International Monetary Fund and from the World Development Indicators (WDI) of the World Bank.

Rem refers to the ratio of remittances to GDP. This ratio can be very important (like in Haiti) or very small (like in Venezuela). The data on remittances are obtained from the World Economic Outlook (IMF) and from World Development Indicators (World Bank).

The matrix X in Eq. (1) refer to a set of variables respectively related to financial development and remittances. Concerning Eq. (1), like Aggarwal et al. (2011), we use the log of GDP per capita and the value added of the industry to evaluate the level of economic development. To estimate for the quality of legal institutions in the country, we use also GDP per capita which has been shown to have a positive impact on financial development and some indicators of political stability and corruption. The variable *Industry* represents the labor intensity and tradable sectors such as manufacturing (to oppose goods and services provided by micro-enterprises (for more details, see Rajan and Subramanian, 2005). We also control for inflation, measured as the annual percentage change in the GDP deflator. We include some variables to control for the degree of current account openness: exports of goods and services. We use the share of exports to GDP instead of the ratio of exports plus imports because we are concerned primarily with how trade openness can result in an increase in reserves and a potential inflow of funds into the financial sector. We also control for different capital inflow ratios: foreign direct investment flows to GDP and aid flows to GDP. To finish, we integrate in some estimations gross savings that are calculated as gross national income less total consumption, plus net transfers.

All in all, we have an unbalanced panel dataset of 32 countries from 1970 to 2013 (1031 observations).

4. Empirical results

Panel causality test

Before testing the causality between remittances and financial development, we check the stationarity of the variables (expressed in logarithm like other studies using such methodologies in this model (Coulibaly, 2015 for example). We use the main panel unit root tests based on homogeneous and heterogeneous models and on the cross-sectional independence assumption: Levin, Lin and Chu (LLC), Im, Pesaran and Shin (IPS) and Maddala and Wu (1999). The null hypothesis for all the tests is that the series contains a unit root. The results of these tests are reported in table 1. All these tests conclude to the rejection of the nonstationarity hypothesis.

Table 1

Panel Unit Root Tests

| Variables | LLC | IPS | Maddala-Wu |
|-------------|-------------|------------|------------|
| Remittances | -112.469*** | -32.597*** | 134.39*** |
| Bank / GDP | -1.73** | -2.069** | 90.66** |
| M2 / GDP | -1.59** | -1.470* | 82.68** |

Notes: *, ** and *** : significant at the 10%, 5% and 1% level.

We test the causality from remittances to financial development and the reverse causality relationship. In each case, we compute three statistics: the Fisher statistic for the Granger causality test with common coefficients, the Wald statistic and the Zbar statistic (based on the approximation of finite sample moments) for the Granger causality test with individual coefficients. In order to assess the sensitivity of our results to the choice of the common lag-order, we compute all these statistics for one and two lags.

We use the standard causality test of Granger (1969) and the simple test of the Homogeneous NonCausality (HNC) hypothesis (Dumitrescu and Hurlin, 2012). For the last one, under the null hypothesis, there is no causal relationship for any of the units of the panel. Under the alternative, there are two subgroups of cross-section units: one

characterized by causal relationships from x to y (even though the regression model is not necessarily the same) and another subgroup for which there is no causal relationship from x to y .

Table 2

Granger causality tests (common and individual coefficients).

| Variables | Stat. | Granger Causality Tests | | HNC Tests | |
|------------------|-----------|-------------------------|------------|------------|------------|
| | | K = 1 | K = 2 | K = 1 | K = 2 |
| Rem → Bank / GDP | F-Stat | 2.43201 | 8.36855*** | | |
| | W-Stat | | | 3.14019*** | 4.34284*** |
| | Zbar-stat | | | 6.94388*** | 4.61554*** |
| Bank / GDP → Rem | F-Stat | 0.02593 | 4.29927** | | |
| | W-Stat | | | 2.31572*** | 4.10467*** |
| | Zbar-Stat | | | 4.14945*** | 4.09601*** |
| Rem → M2 / GDP | F-Stat | 2.07689 | 2.04038 | | |
| | W-Stat | | | 1.97396*** | 4.30363*** |
| | Zbar-stat | | | 2.99109*** | 4.53000*** |
| M2 / GDP → Remi | F-Stat | 0.78287 | 0.31628 | | |
| | W-Stat | | | 2.31250*** | 3.12826** |
| | Zbar-stat | | | 4.13854*** | 1.96617** |

Notes: *, ** and *** : significant at the 10%, 5% and 1% level. This test assumes that the order of lags is common to all individuals of the panel; for more details, Dumitrescu and Hurlin, 2012.

The results of the standard causality test show evidence of reverse causality between remittances and financial development, but only for the variable *Bank/GDP* and a lag of two.

In addition, the HNC hypothesis is strongly rejected and this conclusion is robust to the choice of the lag-order and the financial indicator. The causal relationship between remittances and financial development differs across LAC countries. When we take into account the heterogeneity of countries, the past values of remittances are then useful when one comes to forecast the development of the financial system, in at least one country of the panel, and vice et versa. Therefore, the study confirms the need to take into account the heterogeneity assumption, in analyzing the link between remittances and financial development. Remittances Granger cause the two financial development indicators at 1% confidence level (or 5% for two coefficients) and financial development indicators Granger causes remittances. So, the flow of remittances is dependent on financial development.

Like several studies (for examples: Aggarwal et al., 2011 and Acosta et al., 2009), the results indicate the possibility of financial development leading to higher influx of remittances. The well-developed financial system facilitates channelling the remittances more efficiently to the productive investments. Note that Chowdhury (2011) and Coulibaly (2015) use also Granger Causality test to investigate the possible endogenous relationship between remittances and financial development. They also found significant results but only of remittances to financial development.

Estimations in OLS and GMM

The panel Granger causality approach assesses the significance of the direct lead-lag relationship between the series and allowed to test the existence and direction of causality between variables. However, the Granger causality framework does not take into account the indirect effects of other variables and does not provide comparative information about the strength of the relationship. However, the relationship between remittances and financial development can be ambiguous. The link is expected to be positive since increased flow of remittances may directly enhance deposit, credit and money availability. Nonetheless, steady flow of remittances may decrease the saving efforts of the recipient families and hinder the intermediation of the financial sector.

So, in continuation of previously conducted tests, we estimate the models (1) and (2) to verify the existence of a bilateral relationship. We use a parsimonious specification of models (1) and (2), which only includes the log of per capita GDP as a regressor (like Brown et al. (2013) for example) in addition to remittances or to financial development and the time and country fixed effects. In a dynamic logic and to account the endogeneity of variables, the explanatory variables are expressed in lag of order 1.

¹ The results are very similar for a lag of order 2 and when we integrate other variables like inflation and exports.

Table 3

Simple model: Macro Panel Estimates in OLS with fixed effects

| Variables (in log) | Remittances | | Bank/GDP | M2/GDP |
|----------------------|-------------|-----------|----------|----------|
| Lag 1 M2/GDP | 0.583*** | | | |
| Lag 1 Bank/GDP | | 0.397*** | | |
| Lag 1 Remittances | | | 0.021** | 0.028*** |
| Lag 1 GDP per capita | -0.919*** | -0.965*** | 0.166*** | 0.046* |
| Constant | 8.424*** | 9.242*** | -0.187 | 1.156*** |
| Country dummies | Yes | Yes | Yes | Yes |
| Time dummies | Yes | Yes | Yes | Yes |
| Observations | 983 | 983 | 982 | 982 |
| R-Squared | 0.81 | 0.81 | 0.74 | 0.78 |

Notes: *, **and ***indicate significance at the 10%, 5% and 1% levels, respectively.

Table 4

Simple model: Macro Panel Estimates in GMM with remittances in dependent variable

| Variables (in log) | Remittances | Remittances |
|---------------------------|-------------|-------------|
| Lag of M2/GDP | 0.514*** | |
| Lag of Bank/GDP | | 0.266* |
| Lag Remittances | 0.753*** | 0.799*** |
| Lag GDP per capita | -0.232* | -0.077 |
| Country dummies | Yes | Yes |
| Time dummies | Yes | Yes |
| Observations | 944 | 943 |
| AR(1) test | 0.01 | 0.02 |
| AR(2) test | 0.83 | 0.79 |
| P-value Hansen test > 10% | Yes | Yes |

Notes: *, **and ***indicate significance at the 10%, 5% and 1% levels, respectively. The dynamic panel GMM estimations were performed using Stata software (xtabond 2). Diagnostic tests used are Hansen test of over-identifying restrictions and Arellano-Bond LM test for autocorrelation of residuals AR(1) and AR(2). Two lags of all endogenous variables are used as instruments for all non strictly exogenous variables.

Table 5

Simple model: Macro Panel Estimates in GMM with financial development in dependent variable

| Variables | Bank/GDP | M2/GDP |
|---------------------------|----------|----------|
| Lag of M2/GDP | | 0.779*** |
| Lag of Bank/GDP | 0.799*** | |
| Log Remittances | 0.007* | 0.016*** |
| Log GDP per capita | 0.121*** | 0.119*** |
| Country dummies | Yes | Yes |
| Time dummies | Yes | Yes |
| Observations | 943 | 943 |
| AR(1) test | 0.00 | 0.00 |
| AR(2) test | 0.20 | 0.357 |
| P-value Hansen test > 10% | Yes | Yes |

Notes: *, **and ***indicate significance at the 10%, 5% and 1% levels, respectively. The dynamic panel GMM estimations were performed using Stata software (xtabond 2). Diagnostic tests used are Hansen test of over-identifying restrictions and Arellano-Bond LM test for autocorrelation of residuals AR(1) and AR(2). Two lags of all endogenous variables are used as instruments for all non strictly exogenous variables.

In columns 1 and 2 of tables 3 and 4, the estimated coefficient of financial development is positive (for both indicators) and largely significant (like previous results). This suggests that a higher financial sector development is associated with any relevant increase in inflow of remittances. We cannot retain the hypothesis that the lack of financial institutions and information about financial products may dissuade a large portion of remittances flow ending up to the banking system. The developed financial sector can facilitate the higher inflow of remittances. This can be done by introducing and offering numerous banking facilities and investment and saving products and by making the facilities much more accessible to the remittances recipient families (Chowdhury, 2011).

Moreover, the presence of financial institutions may cause higher remittance flows because banking development allows people to finance migration, and hence increases migration flows and remittances, and because the financial development is associated with lower costs of sending remittances, and hence a greater propensity to do so (Demirgüç-Kunt et al., 2011). It is also noted that economic development seems hampered remittances (although only one coefficient is significant in Table 4).

Then, in table 3 (columns 3 and 4) and in the table 5, the estimated coefficient of remittances is positive and significant. Remittances are positively related to the measures

of financial development. It seems that recipient's countries need financial products that allow for the safe storage of these funds. The coefficient of per capita GDP is also positive and significant, consistently with the idea that economic development facilitates financial development.

A first obvious concern with the parsimonious specification estimated in tables 3 and 5 is that it does not account for various other macroeconomic factors that the previous literature has employed to explain financial development. Therefore, we expand the set of regressors of the equation (1) to include the following: the value added of the industry (to evaluate the level of economic development²), the rate of inflation, the trade openness (with exports of goods and services), the foreign direct investment flows and aid flows. To finish, we integrate gross savings in some estimations.

Table 6

Macro Panel Estimates in OLS

| Variables | Bank/GDP | | M2/GDP | |
|-----------------|-------------|------------|------------|------------|
| Constant | -200.241*** | -202.52*** | -266.93*** | -261.99*** |
| Remittances | 0.252 | 0.278 | 0.616** | 0.587** |
| GDP per capita | 54.89*** | 54.966*** | 76.062*** | 76.217*** |
| Industry | 0.167 | 0.224 | -0.410 | -0.548 |
| Inflation | -0.0008 | -0.0009 | -0.0015* | -0.0013* |
| Exports | -0.230* | -0.169 | -0.059 | -0.117 |
| FDI | 0.078 | 0.165 | -0.252* | -0.349* |
| Aid | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| Gross saving | | -0.202 | | 0.218 |
| Country dummies | Yes | Yes | Yes | Yes |
| Time dummies | Yes | Yes | Yes | Yes |
| Observations | 934 | 934 | 934 | 934 |
| R-Squared | 0.21 | 0.22 | 0.28 | 0.29 |

Notes: *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 7

²Note that the results are relatively similar when we retain the log of GDP in constant dollars like control for country side.

Macro Panel Estimates in GMM

| Variables | Bank/GDP | | M2/GDP | |
|---------------------------|------------|-----------|-----------|-----------|
| Lag 1 Bank/GDP | 0.709*** | 0.783*** | | |
| Lag 2 Bank/GDP | -0.048 | -0.075 | | |
| Lag 1 M2/GDP | | | 0.716*** | 0.756*** |
| Lag 2 M2/GDP | | | -0.101** | -0.099*** |
| Remittances | 0.281** | 0.166* | 0.386* | 0.327* |
| GDP per capita | 15.955** | 17.56*** | 26.81** | 19.225* |
| Industry | -0.124 | -0.157 | -0.179* | -0.075 |
| Inflation | -0.0025*** | -0.0026** | -0.0009** | -0.0009* |
| Exports | -0.142** | -0.104* | -0.163** | -0.055* |
| FDI | 0.233*** | 0.132* | -0.133 | -0.092 |
| Aid | 0.0001 | 0.0001 | -0.0001 | -0.0001 |
| Gross saving | -0.199*** | | 0.162* | |
| Observations | 724 | 742 | 729 | 747 |
| AR(1) test | 0.00 | 0.01 | 0.01 | 0.02 |
| AR(2) test | 0.77 | 0.92 | 0.60 | 0.52 |
| P-value Hansen test > 10% | Yes | Yes | Yes | Yes |

Notes: *, **and ***indicate significance at the 10%, 5% and 1% levels, respectively. The dynamic panel GMM estimations were performed using Stata software (xtabond 2). Diagnostic tests used are Hansen test of over-identifying restrictions and Arellano-Bond LM test for autocorrelation of residuals AR(1) and AR(2). Two lags of all endogenous variables are used as instruments for all non strictly exogenous variables.

Across all estimations in table 6 (in OLS with lag of one period) and in table 7 (in GMM), the inclusions of some other repressors do not change the previous results. We focus our discussion on the GMM specification but it is worth noting that both are very similar.

Remittances seem to promote financial development in LAC countries. The effect of remittances is much larger on Deposit and Money than Credit, which conforms the results by Gupta et al. (2009), Aggarwal et al. (2011) and Chowdhury (2011). The results also confirm that financial development is positively associated with the level of economic development (particularly for GDP per capita), but negatively correlated with inflation and trade openness. As the income of country increases over time, it is expected to have better institutional set up, which facilitates the financial sector development. Financial sector development requires paying fixed costs that become less important the larger the size of the economy and the richer the country (Djankov et al. (2007)). Studies have shown that inflation distorts economic agents' decision-making regarding nominal magnitudes, discouraging financial intermediation, and promoting saving in real assets. The percentage

of FDI inflows to GDP is positively associated with financial development in GMM models. The openness in capital market negatively and significantly raises the financial sector expansion. The goods market openness has mixed effects on financial development (like Brown et al. (2013) and Chowdhury (2011)). Current and capital account openness has been found to have a positive effect on financial development (for the dependent variable $Bank/GDP$). Aid flows do not appear to be correlated with financial development. In some estimation with gross savings, this variable seems to be positively correlated with the liquid liabilities of the financial system.

Note also autocorrelation tests and the Hansen test of overidentifying restrictions are performed to assess the validity of the instruments which are employed. In all the different specifications used, the Hansen test and the second order correlation tests indicate that we cannot reject the validity of the moment conditions assumed for the estimation.

Overall, consistent with previous literature, these results suggest that the positive association between remittances and financial development is robust, for both OLS and GMM, for each of our measures.

Estimations in OLS and GMM on subsamples

We have chosen to study a region with a very similar cultural background, instead of choosing a larger group of countries with more diversified economies. However, the possible impact of remittances may vary across countries. To complete the analysis, we want to take into account the heterogeneity of our panel demonstrated by the standard deviation of our variables, including remittances, but also by the results of the Granger Homogeneous Non Causality tests.

In addition to the methods used to deal with heterogeneity, we split the sample into two more homogeneous subsamples of countries and re-run GMM estimates on each subsample. The criterion for splitting the sample is the level of remittances, and more precisely the median of this variable. Within the group of 32 economies that constitute the full sample, there are 15 that receive below to median of remittances (relative to GDP) and 17 that receive above to median. This will shed light on possible differences between 'below median' (mainly developed countries) and 'above median' of the remittances

(mainly developing countries) to analyze the impact on financial development. We should find a larger impact of remittances in the subsample of countries where the level of remittances is more important. Results by subsamples are reported in Table 8. Note that splitting the sample according to the level of remittances and comparing the impact of remittances across sub-samples is also a good robustness test.

Table 8

Macro Panel Estimates in GMM (below and above the median level of financial depth)

| Variables | Bank/GDP | | M2/GDP | |
|---------------------------|--------------|--------------|--------------|--------------|
| | Above median | Below median | Above median | Below median |
| Lag 1 Bank/GDP | 0.808*** | 0.815*** | | |
| Lag 2 Bank/GDP | -0.047 | -0.073 | | |
| Lag 1 M2/GDP | | | 0.766*** | 0.925*** |
| Lag 2 M2/GDP | | | 0.113*** | -0.114*** |
| Remittances | 0.116* | 0.0009 | 0.146* | 0.479 |
| GDP per capita | 10.894*** | 11.582* | 4.603* | 10.203* |
| Industry | -0.192 | -0.161 | -0.100 | -0.116 |
| Inflation | -0.371*** | -0.002** | -0.127*** | -0.001** |
| Exports | -0.074** | -0.069 | -0.007 | 0.028 |
| FDI | 0.213** | 0.168* | -0.068 | 0.196*** |
| Aid | -0.0001 | 0.0001 | 0.0001 | 0.0001 |
| Observations | 396 | 351 | 396 | 351 |
| AR(1) test | 0.001 | 0.064 | 0.002 | 0.068 |
| AR(2) test | 0.273 | 0.945 | 0.319 | 0.492 |
| P-value Hansen test > 10% | Yes | Yes | Yes | Yes |

Notes: *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively. The dynamic panel GMM estimations were performed using Stata software (xtabond 2). Diagnostic tests used are Hansen test of over-identifying restrictions and Arellano-Bond LM test for autocorrelation of residuals AR(1) and AR(2). Two lags of all endogenous variables are used as instruments for all non strictly exogenous variables.

These results tend to reinforce our previous findings for the sample 'above median'. The impact of remittances on financial development is positive for the sample of countries with high level of the ratio of remittance to GDP (above the median level) and it is nil for countries with low level of remittances. One possible way to look at this result is to argue that remittances do not contribute to financial development in countries that have already reached a certain stage of economic and, presumably, financial development. Alternatively, it could be that remittances positively affect financial development only if received in high amounts (relative to GDP). Migrants generally remit in accordance with the financial

development or investment opportunities in the home countries. Remittances increase demands for banking services, since banks offer households a safe place to store this temporary excess cash. Banks acting as remittance paying agents are well-positioned to offer other services to unbanked households receiving remittances and processing remittance flows provides banks with information on the income of recipient households (Demirgüç-Kunt et al., 2011).

5. Conclusions

As the importance of remittances for developing countries has grown, a sizeable literature has grown examining the impact of remittances on various aspects of countries' development. An issue which has received little attention is the contribution of remittances to the financial sector development. This issue is important given the evidence that financial development matters for growth and poverty alleviation and financial inclusion has many beneficial effects for households.

This paper tries to fill the gap in the literature by using several methodologies for a little studied region. Using both causality tests and estimates (OLS and GMM) to analyze the relationship between remittances and financial development in LAC countries, some highlights can be drawn from this study. Firstly, we find a positive and significant bi-directional link between the variables with a parsimonious model. Secondly, in a more developed model, the inclusions of some other repressors do not change the previous results. Thirdly, when we split the sample into two subsamples of more homogeneous countries, we find that the effect is positive for the sample of countries with high ratio of remittances to GDP and nil for countries with low level. These results are robust to using different measures and estimation techniques, and accounting for endogeneity or heterogeneity biases, and they are conform to the existing literature using different specifications.

Finally, our results suggest that the increasing flow of remittances is positively and significantly expanding and deepening the financial sector. This article aims to retain the hypothesis that households receiving remittances from abroad are more likely to use formal financial services for their transactions and payments (the 'induced financial literacy hypothesis').

From a policy perspective, it is important for policymakers to formulate and implement policies to encourage the migrant workers to remit through formal financial system. The role of public authorities could be to shape the financial environment to leverage these flows by promoting development of the financial sector. LAC countries must implement investment policies which will help to attract more investment from their emigrants, particularly for countries where the level of remittances to GDP is low. There is clear scope for further research on these issues in the future, especially taking into account the heterogeneity of countries at levels of stage of economic development, the quality of institutions, corruption, weaknesses in governance, ... More evidence at both macroeconomic and microeconomic level is needed to better understand the relationship between remittances and financial development that varies across countries, regions, periods or methodologies.

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Appendix

Table 9

Descriptive statistics.

| | M2/GDP | Bank/GDP | Remittances/GDP | GDP per capita | Industry | Inflation | Exports to GDP | FDI | Aid | Gross savings |
|--------------|----------|----------|-----------------|----------------|----------|-----------|----------------|----------|-----------|---------------|
| Mean | 49.62852 | 38.14097 | 3.559173 | 533191.6 | 28.59454 | 51.98919 | 38.21382 | 22.99262 | 2.09E+08 | 17.20812 |
| Median | 44.76508 | 34.59008 | 2.054672 | 14964.44 | 28.43415 | 6.741430 | 34.46128 | 21.87955 | 1.07E+08 | 17.02099 |
| Maximum | 147.4949 | 133.0759 | 24.40220 | 9871264. | 66.21987 | 12338.66 | 127.5553 | 58.78809 | 1.68E+09 | 55.02644 |
| Minimum | 10.08290 | 6.559538 | 2.89E-05 | 898.3340 | 13.45291 | -26.29999 | 5.061973 | 4.351838 | -3.90E+08 | -12.55084 |
| Std. Dev. | 25.48909 | 19.80499 | 4.265979 | 1638557. | 8.959062 | 480.6736 | 20.82860 | 7.587206 | 2.69E+08 | 8.199269 |
| Skewness | 0.786394 | 0.992483 | 1.704388 | 3.474045 | 0.854581 | 21.52983 | 0.915736 | 1.306276 | 1.923508 | 0.193138 |
| Kurtosis | 3.025350 | 4.367121 | 5.832489 | 14.54451 | 4.009729 | 532.8657 | 3.814302 | 5.867890 | 6.993386 | 4.893334 |
| Jarque-Bera | 83.50785 | 196.0576 | 662.9429 | 6127.372 | 133.0017 | 9538148. | 135.5864 | 507.9450 | 1037.700 | 126.0200 |
| Probability | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| Sum | 40199.10 | 30894.19 | 2882.930 | 4.32E+08 | 23161.58 | 42111.25 | 30953.20 | 18624.02 | 1.69E+11 | 13938.58 |
| Sum Sq. Dev. | 525602.4 | 317320.3 | 14722.65 | 2.17E+15 | 64934.22 | 1.87E+08 | 350969.1 | 46570.65 | 5.86E+19 | 54387.46 |
| Observations | 810 | 810 | 810 | 810 | 810 | 810 | 810 | 810 | 810 | 810 |

Table 10

Correlation matrix.

| | M2/GDP | Bank/GDP | Remittances/GDP | GDP | Industry | Inflation | Exports to GDP | FDI | Aid | Gross savings |
|-----------------|--------|----------|-----------------|--------|----------|-----------|----------------|--------|-------|---------------|
| M2/GDP | 1 | | | | | | | | | |
| Bank/GDP | 0,80* | 1 | | | | | | | | |
| Remittances/GDP | 0,24* | 0,11* | 1 | | | | | | | |
| GDP | -0,15* | -0,07* | -0,16* | 1 | | | | | | |
| Industry | -0,47* | -0,45* | -0,28* | 0,18* | 1 | | | | | |
| Inflation | -0,08* | 0,00 | -0,08* | -0,03 | 0,10* | 1 | | | | |
| Exports to GDP | 0,45* | 0,39* | 0,15* | -0,19* | -0,32* | -0,10* | 1 | | | |
| FDI | 0,41* | 0,30* | 0,25* | -0,12* | -0,15* | -0,05 | 0,32* | 1 | | |
| Aid | -0,36* | -0,27* | 0,04 | 0,18* | 0,17* | 0,05 | -0,38* | -0,20* | 1 | |
| Gross savings | -0,08* | -0,07* | -0,07* | 0,02 | 0,40* | -0,02 | 0,25* | 0,30* | -0,06 | 1 |

The asterisk denotes significance in the correlation at the 5 percent.

Table 11

Countries and periods includes.

| Country | Years | Country | Years |
|---------------------|--------------|--------------------------------|--------------|
| Antigua and Barbuda | 1986-2013 | Guyana | 1992-2013 |
| Argentina | 1978-2013 | Haiti | 1998-2013 |
| Aruba | 1994-2013 | Honduras | 1974-2013 |
| Barbados | 1970-2010 | Jamaica | 1976-2013 |
| Belize | 1984-2013 | Mexico | 1979-2013 |
| Bolivia | 1976-2013 | Nicaragua | 1992-2013 |
| Brazil | 1975-2013 | Panama | 1977-2013 |
| Chile | 1983-2013 | Paraguay | 1975-2013 |
| Colombia | 1970-2013 | Peru | 1990-2013 |
| Costa Rica | 1977-2013 | St. Kitts and Nevis | 1980-2013 |
| Dominica | 1977-2013 | St. Lucia | 1983-2013 |
| Dominican Republic | 1970-2013 | St. Vincent and the Grenadines | 1986-2013 |
| Ecuador | 1986-2013 | Suriname | 1977-2013 |
| El Salvador | 1976-2013 | Trinidad and Tobago | 1975-2011 |
| Grenada | 1986-2013 | Uruguay | 2001-2013 |
| Guatemala | 1977-2013 | Venezuela, RB | 1985-2012 |

Table 12

Variables definitions

| Variable | Definition | Source |
|-----------------|---|-----------------------------|
| M2/GDP | Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government (expressed as a percentage of GDP) | International Monetary Fund |
| Bank/GDP | Financial resources provided to the private sector by financial corporations, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment (expressed as a percentage of GDP) | World Bank |
| Remittances/GDP | Personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from nonresident households. Personal transfers thus include all current transfers between resident and nonresident individuals (expressed as a percentage of GDP) | World Bank |
| GDP | GDP per capita in thousand of constant 2000 US\$ | World Bank |
| Industry | Industry comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs (expressed as a percentage of GDP) | World Bank |
| Inflation | Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly | International Monetary Fund |
| Exports to GDP | Exports of goods and services represent the value of all goods and other market services provided to the rest of the world (expressed as a percentage of GDP) | World Bank |
| FDI | Foreign direct investment flows (expressed as a percentage of GDP) | International Monetary Fund |
| Aid | Official development assistance and official aid (expressed as a percentage of GDP) | World Bank |
| Gross savings | Gross savings are calculated as gross national income less total consumption, plus net transfers (expressed as a percentage of GDP) | World Bank |