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The long-run and short-run impacts of remittances on financial development in developing countries

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Abstract:

This paper analyzes the dynamic impact of remittances on financial development for emerging and developing countries over the period 1974–2014 employing a Pooled Mean Group (PMG) approach. With three panels differentiated by level of income, our results show that a positive long-run relationship between remittances and financial development coexists with a significant (and slightly positive) short-run relationship, except for low-income countries. Consequently, there is strong evidence supporting the view that remittances promote financial development in developing countries in the long term, but the effect may be different in the short term. We offer some financial and economic explanations for these findings.

1. Introduction

According to World Bank estimates (Migration and Development Brief, 2016), remittances to developing countries grew marginally in 2015, as weak oil prices and other factors strained the earnings of international migrants and their ability to send money home to their families. Furthermore, home income contractions do not appear to induce existing migrants to send more remittances (rejection of the pure altruism hypothesis) (Lim and Morshed, 2015). Remittances to developing countries amounted to $430 billion in 2014 and to $431.6 billion in 2015. 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). However, for many remittance-receiving developing economies, remittance flows exceed foreign direct investment, portfolio flows from financial markets, and official development assistance. Officially recorded remittances are generally underestimated (Reinke, 2007). In some countries, migrants have tended to rely heavily on informal transfer channels rather than bank transfers, due to a lack of financial sector development in the remittance-receiving communities combined with lower transaction costs and greater efficiency of informal transfer methods such as transfers by hand (Brown et al., 2013).

Some studies analyze the link between remittances and financial sector development. This relationship is important because intermediating remittances through the banking sector may magnify the developmental impact of remittance flows. In such cases, remittances may potentially contribute to raising the country's long-run growth through higher rates of capital accumulation (Mundaca, 2009). Globally, studies on financial development conclude that remittances affect the growth of the formal financial channel by standardizing the local banking sector up to the international standard following global practices. Burgess and Pande (2005) show that by allowing households to accumulate savings and obtain loans for productive long-term investments, the banking sector in particular can have a very significant impact on the level of poverty and growth. However, the positive effects of remittances on financial development are not accepted in all studies.

The selected literature review below presents a range of studies. 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, namely that remittances help to promote financial development. Demirgüç-Kunt et al. (2011) find evidence that remittances increase banking breadth and depth in Mexico by increasing the number of branches and accounts per capita and deposits. Estimating a homogenous panel data model on annual data from 94 developing economies, Cooray (2012) finds that remittances increase the size of the financial sector in countries with lower government ownership of banks, while they improve financial sector efficiency in countries with higher government ownership of banks.

Calderon et al. (2008), indicate that remittances can reduce credit demands and "have a dampening effect on the credit markets." 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 country where the funds originate, remittances do not increase domestic credit to the private sector. Using the panel Granger causality test proposed by Kónya (2006) (to account for both cross-sectional dependence and heterogeneity), 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 in only four countries (Niger, Senegal, Sierra Leone and Sudan) and financial development positively impacts remittances only in Gambia. Despite the different methods and the relatively large number of studies, there is still no consensus about the general effects of remittances on financial development.

Furthermore, to our knowledge, few studies attempt to consider a differential effect in the relationship between remittances and financial development in the short term and long term (Uddin and Sjö, 2013; Masuduzzaman, 2014; Karikari et al., 2016). The long-run impact may be of a different magnitude and sign from the short-run impact. Indeed, taking a short-term approach, it is possible that remittances may have been used previously for consumption purposes. Subsequently, in the long term, remittances could be devoted to the purpose of financial investment or savings that really enroll in the financial institution. Remittances or transfers can help ease the immediate budget constraints of recipients, and then provide an opportunity for small savers to gain access to the formal financial sector. In the long run, remittances received can enable unbanked recipients to acquire certain financial products and services that will in turn improve financial sector development. It is

interesting to study whether the recipients of these remittances are able to channel (or not) these monies for financial inclusion, via deposits and availability of credit, which may result from deferred (or direct) consumption of received remittances (Karikari et al., 2016).

This paper contributes to the existing literature on remittances and financial development by examining this relationship in developing countries from both long- and short-run perspectives. Consequently, the contribution of this study is threefold. First, it contributes to the debate by modeling the remittances–financial development relationship as intrinsically dynamic, explicitly distinguishing between the short and the long run. We use a methodology that, to our knowledge, has never been used before for this subject. We employ the Pooled Mean Group (PMG) estimator to control for panel heterogeneity and to distinguish between long-run and short-run effects. We evaluate the long-run equilibrium relationship among the variables of interest, whether such variables are stationary or not (in line with an autoregressive distributed lag approach). We believe that the relationship between remittances and financial development may be different in the short and long terms, especially given countries' level of development. Second, logically, we investigate whether the relationship varies with the stage of economic development. The paper uses panel data differentiated by level of income rather than by geographic criteria. The study provides a unified comparative analysis of the relative impact of remittances and other control variables on the financial development of low-income, lower-middle-income and upper-middle-income countries. A country's level of development can influence the relationship between the two main variables of the analysis. Accordingly, we investigate whether the remittances–financial development relationship varies with the stage of economic development. Third, we try to offer some financial and economic explanations for our findings related to the preliminary studies, and to several explanations, such as financial access, overhead costs, consumption and investment, formal banking and investment systems, governance weaknesses, etc. We try to shed some light on the short-term and long-term differentiated effects, particularly for low-income countries.

Using three panel data (low income (17 countries), lower middle income (43 countries) and upper middle income (42 countries)) for the 1974-2014 period, we find evidence of a strong positive link between remittances and financial development in the long and short terms, except for the low-income countries, with PMG estimations.

The rest of this paper is organized as follows. Section 2 discusses the empirical model and the PMG estimator. Section 3 presents the data and section 4 comments and analyzes the results. Section 5 presents our conclusions.

2. Methodology and empirical model

To examine the long- and short-run effects of remittances on financial development, we estimate the equilibrium relationship between *y* and *x* in a panel data context with this model:

$$y_{it} = \theta_{0i} + \theta_i' x_{it} + \epsilon_{it} \tag{1}$$

where y_{it} is financial development in period t for country i, and x_{it} is a (k x 1) vector of explanatory and control variables including a measure of remittances (remittances and GDP in the first stage (model 1); remittances, GDP, inflation and exports in the second stage (model 2)) and ϵ_{it} is the error term.

As a complement to the long-run coefficients θ, it is interesting to capture potential financial development adjustment dynamics. To this end, we use an autoregressive distributed lag ARDL specification. This allows for rich dynamics in the way that financial development adjusts to changes in remittances and other control variables. This model takes the co-integration form of the simple ARDL model and adapts it for a panel setting by allowing the intercepts, short-run coefficients and co-integrating terms to differ across cross-sections. The ARDL model is an autoregressive model of order p in the dependent variable and an autoregressive model of order q in the explanatory variables. In an ARDL model, the dependent and independent variables enter the right-hand side with lags:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} \, y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij}' \, x_{i,t-j} + \mu_i + \epsilon_{it} \tag{2}$$

where $i = 1,2,\dots,N$ is country index, $t = 1,2,\dots,T$ is a time index, j is the number of time lags, and μ_i denotes country specific fixed effects.

By re-parameterization, with respect to the long-run coefficients θ and the adjustment coefficients $\square_i$, the error-correction form[1] is given by:

$$\Delta y_{it} = \square_i\left[y_{i,t-1} - \theta_i^{'} x_{it}\right] + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*'} \Delta x_{i,t-j} + \mu_i + \epsilon_{it} \quad (3)$$

θ_i defines the long-run or equilibrium relationship between y_{it} and x_{it}. In contrast, λ_{ij}^* and $\delta_{ij}^{*'}$ are the short-run coefficients relating financial development to its past values and other determinants x_{it}. Finally, the error-correction coefficient $\square_i$ measures the speed of adjustment of financial development toward its long-run equilibrium following a change in remittances and control variables. $\square_i < 0$ ensures that such a long-run relationship exists. That is, finding a significantly negative $\square_i$ constitutes evidence of a long-run equilibrium relationship. As a result, a significant and negative value of $\square_i$ is treated as evidence of co-integration between y_{it} and x_{it}.

Concerning the estimation, it is possible to apply several dynamic panel methods related to the Eq. (3). There are a few existing procedures for estimating the above model: the mean group (MG) estimator (Pesaran and Smith, 1995), the pooled mean-group (PMG) estimator (Pesaran et al., 1999) and the dynamic fixed effect estimator. The difference is the degree of homogeneity applied to the coefficients. The mean group estimator permits both the long-run and the short-run slope parameters to vary over countries; the pooled mean group estimator permits only the short-run slope parameters to vary between countries; and the dynamic fixed effect estimator permits neither the long-run nor the short-run slope parameters to vary over countries. We can test the validity of a homogeneity restriction using a standard Hausman-type statistic. If the long-run homogeneity restrictions are valid, MG estimates will be inefficient. Then, the maximum likelihood-based PMG approach will yield a more efficient estimator. This estimator allows the short-run coefficients and error variances to differ freely across groups and the long-run coefficients are constrained to be the same. Therefore, the long-run adjustment seems to be given by conditions expected to be homogeneous across countries, while the short-run adjustment depends on country characteristics. Therefore, our analysis focuses on the estimates obtained with favorable PMG outcomes.

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[1] Where ; ; ;

We should note that the underlying ARDL specification dispenses with unit root pre-testing of the variables. Provided that there is a unique vector defining the long-run relationship among variables involved, PMG estimates of an ARDL regression yield consistent estimates of that vector, no matter whether the variables involved are I(1) or I(0) (for more details: Pesaran et al., 2001; Kim et al., 2010; Huang et al., 2015). The ARDL approach demonstrates that long-run relationships can exist between both stationary and non-stationary variables. Both the PMG and MG techniques permit non-stationary series. However, we check the stationarity of variables using the LLC (Levin et al., 2002), B (Breitung, 2000), IPS (Im et al., 2003), ADF-F and PP-F (Maddala and Wu, 1999) approaches because, if the panel dataset is stationary, then standard panel regressions can produce efficient estimates.

Furthermore, because we suspect that the data are cross-sectionally correlated, we employ cross-section dependence tests to show if the variables exhibit some common dynamics among the countries. To ascertain if the data are cross-sectionally correlated we apply the following cross-section dependence tests: the Breusch-Pagan (1980) LM, the Pesaran (2004) scaled LM and Pesaran (2007) CD tests.

With regard to co-integration, if $\square_i$ is significant and negative, it is possible to consider that variables are co-integrated. The existence of a co-integration vector is consistent with the negative sign of the adjustment term (EC). However, as a complement, if the series of most variables is non-stationary, we test the possible existence of a cointegrated relationship with three panel cointegration tests. Because we suspect that our variables are correlated cross-sectionally, we conduct a second-generation cointegration test that is based on structural rather than residual dynamics and, therefore, do not impose any common-factor restrictions. To examine the possible existence of one or more cointegrated relationships among the series considered, we perform a Westerlund test (2007). Two tests are designed to ascertain the alternative hypothesis that the panel is cointegrated as a whole ("*Group*": G_τ and G_α), while the other two test the alternative that at least one unit is cointegrated ("*Panel*": P_τ and P_α). The test developed by Westerlund (2007) takes into account cross-sectional dependence by taking a bootstrap approach (for more details, see Persyn and Westerlund (2008) or Damette and Fromentin (2013)). As a complement, we implement Pedroni's well-known test (1999, 2004) and the residual-based co-integration test developed by Kao (1999) to ascertain the null hypothesis of no cointegration among all variables, for *M2* and *Credit* like dependent variables. Pedroni's test allows for unbalanced

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panels and heterogeneity in the slope coefficients. The main advantage of the Pedroni method, unlike Kao's (1999), is that it takes into account the heterogeneity under the alternative hypothesis by assuming parameters that can differ across countries.

3. Data

We use annual data for three panels taking the typology of the World Bank dataset: low income (17 countries), lower middle income (43 countries) and upper middle income (42 countries)[2]. The idea is to investigate whether the relationship between remittances and financial development varies with the level of income and the stage of economic development. Rather than choose a geographical division, we believe that the level of countries in the database is an income criterion relevant to differentiation for analyzing the link between financial development and remittances.

All in all, we have three unbalanced panel datasets: 17 countries from 1974 to 2014 (Panel 1 with 505 observations) for low income, 43 countries from 1974 to 2014 (Panel 2 with 1306 observations) for lower middle income and 42 countries from 1974 to 2014 (Panel 3 with 1253 observations) for upper middle income[3]. The data of the variables are obtained from the World Bank World Development Indicators (WDI).

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 (*Credit*) refers to financial resources provided to the private sector by other depository corporations (deposit-taking corporations other than 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*) equal currency plus demand and interest-bearing liabilities of banks and non-bank financial intermediaries divided by GDP. This is considered the broadest measure of financial intermediation and includes three types of financial institution: the central bank, deposit money banks, and other financial institutions.

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[2] For the current 2016 fiscal year, low-income economies are defined as those with a GNI per capita, calculated using the World Bank Atlas method, of $1,045 or less in 2014; middle-income economies are those with a GNI per capita of more than $1,045 but less than $12,736. Lower-middle-income and upper-middle-income economies are separated at a GNI per capita of $4,125.
[3] See Appendix A for the list of all countries. Table 4 presents the list of countries.

Rem refers to the ratio of remittances to GDP. Personal remittances comprise personal transfers and employee compensation. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from non-resident households. Personal transfers thus include all current transfers between resident and non-resident individuals. Employee compensation refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by non-resident entities.

To strengthen our empirical results, we include control variables in the relationship between financial development and remittances, based upon the previous literature. We use the log of GDP per capita to evaluate the level of economic development and to estimate the quality of legal institutions in the country. GDP per capita has been shown to have a positive impact on financial development and on certain indicators of political stability and corruption. Economic development enables financial system development.

We also control for inflation, measured as the annual percentage change in the GDP deflator. Inflation can discourage financial intermediation (see Aggarwal et al. 2011) and also act as a proxy for uncertainty and risk (see Giuliano and Ruiz-Arranz 2009). We include some variables to control for the degree of current account openness, i.e. exports of goods and services. We use only 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. Our choice of variables is guided by the literature on remittances and financial development (Aggarwal et al. (2011) and Cooray (2012) for examples).

The descriptive statistics and pairwise correlations for all log variables are shown in Tables A1 to A3 in Appendix A. The different measures of financial development are highly correlated with the other variables, notably remittances (except for Panel 3 with *Credit*). Note that the correlation matrix only shows an association between any two pairs of variables; it does not establish causal relationship.

4. Estimation results and discussions

4.1. Panel unit root, cross-section dependence and cointegration tests

The panel unit root tests performed both on level and on first-differences indicate the stationary of the variables: in level for variables "M2", "Remi", "Inflation" and "Export" and in first-differences for variables "Credit" and "GDP" (Table A5). The series could be considered as integrated of order one.

Table 1 reports the results from cross-section dependence tests and shows that the null hypothesis of cross-sectional independence is strongly rejected at conventional significance levels[4]. FD, remittances and GDP variables seem to exhibit some dynamics common to all countries.

Our next step of testing the possible existence of a cointegrated relationship between the series allows us to assume a potential long-term relationship between them. When we take into account cross-sectional dependencies (or not with the Pedroni and Kao tests), the tests reject the H0 of no cointegration. Finally, we can presume the existence of a long-run equilibrium relationship between FD, remittances and GDP (see Table 2).

Consequently, before discussing our PMG findings, we examine whether a long-run relationship (or dynamic stability) exists among financial development, remittances and other variables. This requires a negative coefficient on the error-correction term (ECT) of between 0 and -2 (Loayza and Ranciere, 2006; Huang et al., 2015). The results support this condition. The error-correction coefficients $\square_i$ in all specifications are negative and within the unit circle. The long-run equilibrium relationship implies interpretable long-run estimates. It validates the long-term mean reversion of financial development. The existence of a cointegration vector is consistent with the negative sign of the adjustment term.

In addition, we examine whether the slope parameters vary among countries by performing a Joint Hausman test, which compares the mean group (MG) and pooled mean group (PMG) estimators. In specifications, we cannot reject the slope homogeneity restriction at conventional significance levels (always above 0.2). The PMG estimator is validated, with identical long-run parameters across countries. In addition, we impute the

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[4] Note that the temporal dimension has been slightly reduced in order to obtain balanced panel data, and to apply the cross-section dependence tests.

values of the relative Akaike Information Criterion (AIC)[5] for models with ARDL(1,1,1) and ARDL(1,1,1,1,1).

4.2. Results of PMG estimations

Tables 3 and 4 display the results on the estimation of long- and short-run parameters. We focus on the results of using the PMG estimator because of the elements mentioned above (i.e. consistency, efficiency and long-run homogeneity restriction)[6]. The PMG estimator allows us to evaluate a short-run causality, testing the significance of the coefficients related to the lagged difference, and a long-run causality related to the ECT coefficient. The PMG estimator approximates common long-run coefficients and different short-run coefficients, below the reported average short-run parameters. With the PMG estimator, the short-run dynamic specification differs from country to country. The short-run coefficients are not restricted to being the same across countries. We do not obtain a single pooled estimate for each coefficient. However, we decide to analyze the average short-run effect by considering the mean of the corresponding coefficients across countries by panel[7]. In addition, we test the robustness of the model (on the full sample) excluding dynamically unstable observations. We check if the average short-run coefficient is sensitive to the exclusion of countries (in our case: China, Morocco, Paraguay and Turkey) whose present error-correction coefficients statistically fall outside the dynamic stable range (Loayza and Ranciere, 2006). The signs and statistical significance of coefficients (long-run and short-run) remain unchanged. However, we are aware that averaging eliminates information that may be used to estimate a more flexible model that would allow some parameter heterogeneity across countries.

In the first model (with remittances and GDP), the long-run coefficients of remittances and GDP are positive and statistically significant in PMG estimations where results are

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[5] We tried different orders for *p* and *q* selected using Schwarz Bayesian Criterion (SBC) and Hannan and Quinn (HQ). We found both qualitatively and quantitatively similar results.
[6] Our key finding is robust to alternative estimators, such as mean group (MG) and dynamic fixed effect (DFE) estimations. Results can be requested from the author.
[7] Detailed output from PMG estimations can be obtained by contacting the author.

relatively close. Greater remittances and economic development improve financial development (*M2* and *Credit*). Note that this long-run relationship is coherent with a simple correlation (in Appendix A). The effect of remittances is slightly greater on Deposit and Money than it is on Credit (except for "upper middle income"), which conforms to the results of Gupta et al. (2009), Aggarwal et al. (2011) and Chowdhury (2011).

In the second model (with remittances, GDP, inflation and exports), in the long run, the results tend to reinforce our previous findings. These results confirm that financial development is positively associated with the level of economic development and trade openness (except for Panel 3), but negatively correlated with inflation (like Aggarwal et al. (2011) for example).

Globally, in the long run, remittances seem to promote financial development in low-income countries, lower-middle-income countries, upper-middle-income countries[8], and in the full sample (with model 1). Therefore, it seems that the relationship between remittances and financial development is relatively similar from one region to another, with the level of income as a criterion for differentiation. However, we might assume that the long-term impact of remittances on financial development decreases when the level of the countries studied is higher. As the income of a country increases over time, it is expected to implement an improved institutional set-up that facilitates financial sector development. Economic development facilitates financial development. This in line with previous literature, which shows that economies possessing higher institutional and legal quality promote the development of the financial sector. Otherwise, inflation may distort economic agents' decision-making regarding nominal magnitudes, discourage financial intermediation, and promote saving in real assets. Inflation can discourage financial intermediation and increase risk thereby reducing remittance flows and financial sector development. Greater openness, as measured by the volume of exports to GDP, contributes to financial sector development. This is reasonable considering that increased openness could encourage increased transfers to remittance-receiving countries and also increase the use of the formal sector for money transmission purposes (Cooray, 2012). Huang and Temple (2005) also provide evidence in support of a positive relationship between trade and financial development, especially for lower-income countries.

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[8] We obtain substantially the same result when Exchange is integrated into model 2 (in Annex A, Table A6).

The short-run estimated coefficients of remittances are not totally consistent with the long-run estimate.

In the first model, for low-income countries (Panel 1) and full samples, remittances have insignificant effects on financial development in the short run. For lower-middle-income countries and upper-middle-income countries, we find the coexistence of positive long-run effects and positive short-run effects of remittances on financial development. For example, in the short-run, column (4) indicates that a 1% increase in remittances leads to a 0.04% (for panel 2) and a 0.02% (for panel 3) increase in bank deposits. The short-term effect of GDP is more mixed. One might expect growth to be "sustainable" enough to really impact financial development.

In the second model, the short-run coefficients of remittances are significant with M2 in all of the models, and significant with credit only for panel 3. It should be noted that the coefficient is negative for low-income countries (for M2). It is then possible for households to resort to remittances for consumption and investment, completely abandoning the financial sector in the short term. It takes time for remittances, with an accumulation of sums received, to have a positive impact on financial development. Furthermore, globally, GDP exerts a significant negative effect on financial development. In emerging and developing countries, the relationship between GDP and financial development appears to become positive only in the long run when growth is sustainable. When the coefficients on the ratio of exports to GDP are statistically significant (column 1), we might expect greater openness to contribute to an increase in the size of the financial sector in the short run.

4.3. Discussions

Comparing the long- and short-run estimates, the relationship between remittances and financial development depends on whether the movements of such remittances are temporary or permanent. It seems that the impact is permanent, positive and temporary for lower-middle-income countries and upper-middle-income countries. Besides, the magnitude of the short-run estimated coefficient is lower than the long-run one, and the link between remittances and financial development is sensitive to the financial development indicator. Compared to M2, which captures the degree of monetization in the system, the provision of credit by the banking sector to the private sector is also an indicator of the degree of activity of financial intermediaries. It seems that remittances

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augment the flow of money in circulation far more than loanable funds or purchases of financial products. Indeed, remittances received may serve as a platform to acquire financial assistance in the form of loans.

It seems that remittances lead to an increase in domestic credit to the private sector by banks, and liquid liabilities in the financial system. This is reasonable considering that remittances serve as an important means of providing financial access. In many low- and middle-income economies, the banking system subsidizes loans to give the public access to funds (Detragiache et al., 2005). Remittances provide a means through which recipients can open accounts thereby improving the liquidity of the banking system and the availability of credit to the public. It is possible that remittance inflows permit banks to further subsidize loans and that they thereby have the potential to reduce overhead costs (Cooray, 2012). Depending on the level of development, recipient countries are probably subject to different transmission costs and remittance uses.

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; moreover, processing remittance flows provides banks with information on the income of recipient households (Demirgüc-Kunt et al., 2011). Long-term savings may be motivated by the intention to purchase high-cost goods (housing and durable goods, for example). Wealthier households spend a smaller portion of their income on goods purchased repeatedly, and a higher portion of their income on good purchased less frequently. Purchases of durable goods and housing may also increase a household's demand for credit (Demirgüc-Kunt et al., 2011).

Migrant remittances help ease the immediate budget constraints of recipients, and provide an opportunity for small savers to gain access to the formal financial sector. Remittances received can enable unbanked recipients to acquire certain financial products, which in turn improve financial sector development in the short run (Karikari, 2016). The role of the financial system is to transform liquid, short-term savings into relatively illiquid, long-term investments, thus promoting capital accumulation (World Bank, 2005).

In our case, remittances have insignificant effects (or negative effects) on financial development in the short run for low-income countries. Several factors could explain this. It is possible that remitted funds are not primarily used for financial investment purposes or savings, but are sent specifically for consumption purposes, which will not remain in the

financial institution for a long time, even if retained. It may be that the effect is not immediate and takes some time to materialize fully, because remittances can be either mostly used for investment or to supplement current consumption. So, remittances can have a significant positive long-run impact in the countries where they are largely used for investments, and an insignificant and slightly positive impact in areas where they are used principally to supplement consumption. In the short run, it is possible that remittances were used previously for consumption purposes. Then, in the long run, remittances could be devoted to financial investment or savings that really involve? financial institutions. According to Aggarwal et al. (2011), remittances usually involve substantial amounts, and recipients may require financial products that allow them to save some of these funds for later consumption and earn some interest from them, which boosts the financial sector. Excess funds after consumption and use of other investments could be saved, introducing unbanked recipients to formal banking and investment systems (Gupta et al. 2009), particularly in countries with a certain level of development. Moreover, it is possible that remittances tend to strengthen long-run financial development, while increasing the frequency of crises, which are a short-run phenomenon, due to the instability of the financial sector in some countries.

Moreover, as Martinez et al. (2015) point out, it is possible that products and services available from financial institutions are not aimed at making credit available. In their study of venture funding with remittances, they show that remittances did not specifically improve financial depth, such as bank loan availability. Receipts of remittances may not serve as a guarantee for individual recipients to acquire a bank loan, particularly in emerging and developing countries.

In addition, with regard to panel data differentiation by level of income, the intuition that lower effects in relatively lower-income countries are due to the fact that these countries tend to have weaker institutions and be more vulnerable to greater volatility and economic shocks is partially confirmed by the short-term coefficients. Nevertheless, differences in countries' income and governance could influence the results. Due to governance weaknesses, the investment climate is relatively poor, therefore, banks are reluctant to lend and prefer to hold excess liquidity (Coulibaly, 2015). In this case, a rise in remittances might not translate into improved financial development.

Finally, the characteristics of banks may potentially interfere with the relationship between remittances and financial development. Countries with a lower presence of state

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banks offer higher interest rates on deposits, attracting larger volumes of deposits. This in turn enables these banks to increase liquid assets and lend to the private sector. Private banks could also provide customers with a wider range of financial services and instruments than state banks (Cooray, 2012).

5. Conclusion

A sizable amount of literature examines the impact of remittances on financial development. However, to our knowledge, no studies have been conducted employing the PMG methodology in a dynamic framework with a short-run and long-run analysis and a differentiation by stage of economic development. PMG methodology allows us to estimate a more flexible model (with some parameter heterogeneity across countries) and explore the possibly conflicting effects of remittances on financial development at different time horizons.

This issue is very important because financial development and remittances have been shown to foster growth and reduce poverty (Beck et al., 2007; Hassan et al., 2011; Akobeng, 2016). 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.

Employing three types of panel data, differentiated by level of income and using World Bank typology, our results suggest that the increasing flow of remittances is positively and significantly expanding and deepening the financial sector in long run. In the short run, the study finds in general that remittances have a positive impact on financial development (except for low-income countries). These results for the long run aim to support 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'). Remittances seem to promote financial development in developing countries, which confirms the results of Gupta et al. (2009), Aggarwal et al. (2011), Chowdhury (2011), Demirgüc-Kunt (2011), Arezki and Brückner (2012), and only partially those of Coulibaly (2015). However, for "poor" countries, it is possible that remitted funds are not primarily targeted at financial investment or savings, but are sent specifically for consumption purposes

From a policy perspective, it is important for policymakers to formulate and implement policies to encourage migrant workers to remit through the formal financial system. Efforts should be undertaken to improve the efficiency of the formal channels of remittance inflows so that they can be increased continuously, thus participating in the development of the financial sector. Note that at the Addis Ababa conference Action Agenda recognized the role of remittances in supporting families in developing countries and emphasized that financial sector development is necessary to boost migrants' transfers through lower costs and better service availability (Sobiech, 2015). The role of public authorities could be to shape the financial environment to leverage these flows by promoting financial sector development. Policy makers in governments and other international institutions that formulate policies concerning countries' financial infrastructure could modify such policies to include recipients of remittances, especially in the short term, for example by allowing cash withdrawals.

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Table 1

Test for cross-section dependence

		Breusch-Pagan LM	Pesaran LM	Pesaran CD
M2 / Remi / GDP	Low income	711.6646***	33.87402***	12.27012***
	Lower middle income	3510.535***	80.13570***	13.97805***
	Upper middle income	3818.084***	78.91792***	32.59225***
Credit / Remi / GDP	Low income	833.7829***	41.27853***	13.20622***
	Lower middle income	3847.276***	89.62231***	7.491240***
	Upper middle income	4665.039***	100.9186***	15.47840***

Notes: ***, **, and * denote a significance of 1%, 5%, and 10%, respectively.

Table 2

Panel cointegration tests

Statistics	M2	Credit
G_τ	-2.376 (0.00)	-2.442 (0.00)
G_α	-8.275 (0.90)	-7.203 (0.99)
P_τ	-17.307 (0.25)	-41.719 (0.00)
P_α	-6.945 (0.03)	-15.991 (0.00)
v-Statistic Panel	4.267607 (0.00)	1.056691 (0.29)
rho-Statistic Panel	-4.043920 (0.00)	1.791336 (0.33)
PP-Statistic Panel	-6.550903 (0.00)	-0.112667 (0.01)
ADF-Statistic Panel	-6.885569 (0.00)	-0.984492 (0.00)
rho-Statistic Group	-0.833694 (0.20)	2.819609 (0.99)
PP-Statistic Group	-8.304348 (0.00)	-1.925402 (0.02)
ADF-Statistic Group	-8.901482 (0.00)	-4.877976 (0.00)
Kao	-6.901869 (0.00)	-3.911678 (0.00)

Note: p-values are in parentheses.

Table 3
Estimates of Panel Error-Correction Model with PMG method

	Low income		Lower middle income		Upper middle income		Full sample	
	M2	Credit	M2	Credit	M2	Credit	M2	Credit
Remi	0.192***	0.062***	0.107***	0.027*	0.046**	0.059*	0.108***	0.022*
GDP	1.551***	1.765***	0.565***	1.908***	0.675***	1.301***	0.706***	0.894***
ECT	-0.222***	-0.283***	-0.208***	-0.214***	-0.257***	-0.181***	-0.315***	-0.166***
ΔRemi	-0.001	-0.028	0.041***	0.013	0.022**	0.021*	-0.002	0.007
ΔGDP	-0.661**	0.421	-0.165	-0.601*	-0.371***	0.404**	-0.436	0.193
Constant	-0.591***	-0.981***	-0.040***	-0.908***	-0.171**	-0.554***	-0.146***	-0.231***
Proba. Hausman	0.86	0.95	0.51	0.77	0.46	0.54	0.53	0.64

Notes: ***, **, and * denote a significance of 1%, 5%, and 10%, respectively.

Table 4
Estimates of Panel Error-Correction Model with PMG method (model 2).

	Low income		Lower middle income		Upper middle income	
	M2	Credit	M2	Credit	M2	Credit
Remi	0.109***	0.111**	0.079***	0.060*	0.032*	0.045*
GDP	1.014***	2.367***	-0.114	0.609***	0.620***	1.293***
Inflation	-0.003***	-0.007***	-0.335***	-0.300***	-0.120***	-0.329***
Exports	0.165	-0.336	0.438***	0.180*	0.091	-0.039
ECT	-0.276***	-0.142***	-0.116***	-0.143***	-0.267***	-0.187***
ΔRemi	-0.030**	-0.021	0.016***	0.004	0.021**	0.027**
ΔGDP	-0.793***	-0.575***	-0.291***	-0.358***	-0.430***	0.490***
ΔInflation	-0.001	-0.001	0.004	0.015**	0.010*	0.015*
ΔExports	0.083*	0.063	-0.020	-0.047	-0.027	0.005
Constant	-0.386***	-0.628***	0.187***	-0.059	-0.144*	-0.513***

Notes: ***, **, and * denote a significance of 1%, 5%, and 10%, respectively. Hausman test is always above 0.2.

Appendix A

Table A1
Descriptive statistics and Correlation Analysis: low-income countries.

	M2	CREDIT	REMI	GDP	INFLATION	EXPORT	FDI
Mean	1.339527	1.057085	0.087285	2.553677	10.74116	1.269808	2.297429
Median	1.325350	1.101168	0.245691	2.554030	6.725506	1.266229	0.911157
Maximum	1.937775	1.796765	1.465151	2.874801	165.6766	1.836281	41.80964
Minimum	0.803616	-0.095677	-2.867333	2.135625	-12.30419	0.690417	-28.62426
Std. Dev.	0.193360	0.302426	0.795824	0.121512	16.68930	0.219945	4.512821

Correlation Probability	M2	CREDIT	REMI	GDP	INFLATION	EXPORT
M2	1.000000					

CREDIT	0.639060	1.000000				
	0.0000	-----				
REMI	0.405458	0.367491	1.000000			
	0.0000	0.0000	-----			
GDP	0.476464	0.357833	0.136274	1.000000		
	0.0000	0.0000	0.0031	-----		
INFLATION	-0.098763	-0.244014	-0.343941	-0.075703	1.000000	
	0.0323	0.0000	0.0000	0.1012	-----	
EXPORT	0.270755	0.119245	0.033671	0.423859	-0.078191	1.000000
	0.0000	0.0097	0.4665	0.0000	0.0904	-----

Table A2
Descriptive statistics and Correlation Analysis: lower-middle-income countries.

	M2	CREDIT	REMI	GDP	INFLATION	EXPORT	FDI
Mean	1.659975	1.552215	0.068730	3.535210	0.844659	1.536505	1.593456
Median	1.663068	1.563180	0.212816	3.549982	0.816117	1.551349	0.129919
Maximum	2.409810	2.221425	1.562210	3.947666	3.873998	2.083899	542.0339
Minimum	0.933006	0.066715	-2.956265	2.606174	-1.523849	0.828026	-56.25786
Std. Dev.	0.256479	0.331139	0.770963	0.219081	0.566843	0.228990	20.10877

Correlation Probability	M2	CREDIT	REMI	GDP	INFLATION	EXPORT
M2	1.000000					

CREDIT	0.691204	1.000000				
	0.0000	-----				
REMI	0.390561	0.238090	1.000000			
	0.0000	0.0000	-----			
GDP	0.342272	0.446339	0.159819	1.000000		
	0.0000	0.0000	0.0000	-----		
INFLATION	-0.250461	-0.327387	-0.155962	-0.317913	1.000000	
	0.0000	0.0000	0.0000	0.0000	-----	
EXPORT	0.148488	0.240442	0.068482	0.422747	-0.192144	1.000000
	0.0000	0.0000	0.0209	0.0000	0.0000	-----

Table A3

Descriptive statistics and Correlation Analysis: upper-middle-income countries.

	M2	CREDIT	REMI	GDP	INFLATION	EXPORT	FDI
Mean	1.551924	1.334261	0.373644	2.990616	0.836720	1.469853	0.121702
Median	1.546576	1.369909	0.520953	2.984496	0.883885	1.468050	0.046788
Maximum	2.060139	2.059652	1.936711	3.511512	4.070025	2.011238	5.405231
Minimum	0.851827	-0.016399	-3.362080	2.401556	-1.452295	0.708137	-24.94459
Std. Dev.	0.223729	0.291037	0.759274	0.228138	0.446091	0.223000	1.188869

Correlation Probability	M2	CREDIT	REMI	GDP	INFLATION	EXPORT
M2	1.000000					

CREDIT	0.748431	1.000000				
	0.0000	-----				
REMI	0.156132	-0.000109	1.000000			
	0.0000	0.9971	-----			
GDP	0.118698	0.187898	-0.190591	1.000000		
	0.0001	0.0000	0.0000	-----		
INFLATION	-0.393136	-0.332330	-0.246102	-0.087079	1.000000	
	0.0000	0.0000	0.0000	0.0035	-----	
EXPORT	0.262366	0.202847	0.096561	0.096874	-0.368846	1.000000
	0.0000	0.0000	0.0012	0.0011	0.0000	-----

Table A4

List of countries used in the study.

Panel 1		Panel 2		Panel 3	
Value	Cumulative %	Value	Cumulative %	Value	Cumulative %
Benin	8.12	Albania	1.65	Armenia	1.53
Burkina Faso	16.24	Algeria	5.19	Bangladesh	4.50
Cambodia	20.59	Azerbaijan	6.77	Bolivia	7.48
Ethiopia	26.14	Belarus	8.42	Cabo Verde	10.15
Guinea	30.30	Belize	10.86	Cameroon	12.90
Guinea-Bissau	35.25	Bosnia and Herzegovina	12.20	Congo, Rep.	15.19
Haiti	38.61	Botswana	15.34	Cote d'Ivoire	18.24
Madagascar	46.73	Brazil	18.49	Djibouti	20.08
Mali	54.65	Bulgaria	19.98	Egypt, Arab Rep.	22.98
Mozambique	59.60	China	22.58	El Salvador	25.95
Nepal	63.96	Colombia	26.12	Georgia	27.33
Niger	72.08	Costa Rica	29.11	Ghana	30.08
Rwanda	78.02	Dominica	32.10	Guatemala	32.98
Sierra Leone	84.95	Dominican Republic	35.64	Guyana	34.73
Tanzania	88.91	Ecuador	37.92	Honduras	37.86
Togo	96.83	Fiji	40.76	India	40.92
Uganda	100.00	Gabon	42.96	Indonesia	43.36
		Grenada	45.24	Kenya	46.79

Iran, Islamic Rep.	46.73	Kyrgyz Republic	48.32
Jamaica	49.80	Lao PDR	50.00
Jordan	53.19	Lesotho	53.05
Kazakhstan	54.76	Mauritania	54.35
Lebanon	55.78	Moldova	55.88
Macedonia, FYR	57.28	Morocco	58.93
Malaysia	59.48	Nigeria	61.83
Maldives	62.00	Pakistan	64.81
Mauritius	63.65	Papua New Guinea	67.79
Mexico	66.40	Philippines	70.69
Mongolia	67.74	Samoa	73.21
Panama	70.73	Sao Tome and Principe	74.27
Paraguay	73.88	Senegal	77.40
Peru	75.85	Solomon Islands	78.63
Romania	77.50	Sri Lanka	81.68
Serbia	78.13	Sudan	84.58
South Africa	81.67	Swaziland	87.71
St. Lucia	84.19	Syrian Arab Republic	90.08
St. Vincent	86.47	Tajikistan	91.07
Suriname	89.46	Ukraine	92.52
Thailand	92.60	Vanuatu	95.04
Tonga	93.71	Vietnam	95.95
Tunisia	96.77	West Bank and Gaza	97.25
Turkey	100.00	Yemen, Rep.	99.08
		Zambia	100.00

Table A5

Panel Units Test

Variable		LLC	B	IPS	ADF-F	PP-F
M2	Level	-4.22476***	-0.70129	-5.30010***	318.116***	283.806***
	1st Dif.	-36.2301***	-22.8988***	-39.1244***	1539.53***	2442.72***
Credit	Level	1.12282	-0.06844	-2.34175***	246.543***	193.102
	1st Dif.	-31.2235***	-20.8063***	-30.0608***	1122.98***	1789.36***
Remi	Level	-7.74050***	-1.72489**	-6.48817***	359.100***	329.191***
	1st Dif.	-46.2737***	-18.7998***	-42.1746***	1578.46***	3849.81***
GDP	Level	-1.61833*	5.23886	1.70308	188.930	167.983
	1st Dif.	-31.3067***	-19.7924***	-31.0650***	1325.15***	1465.87***
Inflation	Level	-14.4947***	-8.91322***	-14.9315***	657.830***	725.700***
	1st Dif.	-35.3470***	-23.2377***	-37.3432***	1787.89***	8536.22***
Export	Level	-2.90580***	-1.91503**	-5.17802***	314.476***	246.253***
	1st Dif.	-37.2101***	-20.6833***	-34.7943***	1416.46***	2345.47***

Table A6
Estimates of Panel Error-Correction Model with PMG method (model 2 with exchange).

	Low income		Lower middle income		Upper middle income	
	M2	Credit	M2	Credit	M2	Credit
Remi	0.149***	0.124*	0.097***	0.080**	0.033*	0.035*

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GDP	0.995***	2.351***	-0.047	0.652***	0.555***	1.077***
Inflation	-0.004***	-0.006**	-0.279***	-0.296***	-0.075**	-0.224***
Exports	0.269**	-0.335	0.458***	0.223*	0.078	-0.044
Exchange	-0.072*	-0.0351	-0.055***	-0.054*	-0.135**	-0.525***
ECT	-0.286***	-0.142***	-0.120***	-0.144***	-0.234***	-0.150***
ΔRemi	-0.039***	-0.021*	0.015***	0.002	0.023**	0.028**
ΔGDP	-0.813***	-0.562***	-0.304***	-0.342***	-0.673***	0.086
ΔInflation	-0.001	-0.001*	0.003	0.014**	0.006	0.010*
ΔExports	0.048	0.071	-0.002	-0.042	0.025	0.075
ΔExchange	0.181***	-0.053	-0.051***	-0.013	-0.178***	-0.431***
Constant	-0.372***	-0.610***	0.169***	-0.079	-0.023	-0.190

Notes: ***, **, and * denote a significance of 1%, 5%, and 10%, respectively. The Hausman test is always above 0.2. Exchange corresponds to the official exchange rate which is either the exchange rate determined by national authorities or the rate determined in the legally sanctioned exchange market. Exchange is calculated as an annual average based on monthly averages (Source: WDI).