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## Remittances and credit in developed and developing countries:

### A dynamic panel analysis

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#### **Graphical abstract**

In this paper, we revisit the macroeconomic literature in two ways.

First, contrary to the majority of existing papers, we distinguish between short-run and long-run impacts of remittances on credit.

Second, the literature implicitly assumes that remittances influence credit provided to households. However, macroeconomic papers cannot distinguish between household credit and firm credit due to the lack of data.

This article investigates the impact of remittances on credit in 30 developing (low and middle income) countries and 27 developed (high-income) countries during the period of 2000-2014.

We employ a Pooled Mean Group (PMG) estimator that allows us to distinguish between short-run and long-run effects.

Our findings are summarized as follows: (i) remittances have a positive impact on credit in the long run but no impact in the short run; (ii) remittances have a stronger effect on household credit than on firm credit in developing countries; and, (iii) remittances stimulate credit provision through firm credit in developed countries.

#### **Abstract**

This article investigates the impact of remittances on credit in 30 developing (low and middle income) countries and 27 developed (high-income) countries during the period of 2000-2014.

This paper differs from existing literature in two ways. First, we distinguish the impact of remittances on credit in both the short run and the long run. Second, we investigate whether remittances influence credit provided to households and credit provided to firms differently, thanks to a new dataset. Our results indicate that (i) remittances have a positive impact on credit in the long run but no impact in the short run; (ii) remittances have a stronger effect on household credit than on firm credit in developing countries; and, (iii) remittances stimulate credit provision through firm credit in developed countries.

**JEL Codes:** E51; F24; G21; O11; O16

**Keywords:** Remittances; Financial development; Household credit; Firm credit; PMG estimator

## 1. Introduction

Remittances have become a significant source of external financing, especially in developing countries. In 2017, international migrants from developing countries were expected to have sent \$450 billion in remittances, according to World Bank's estimates.<sup>1</sup> Remittances have become the second largest source of external finance for developing countries after foreign direct investment (FDI) but they represent more than double the amount of official development aid and of portfolio flows. Remittances are not only an important source of financing for developing world but are also a stable one (World Bank, 2016). If remittances are an important source of financing for developing countries, high-income countries are among the most important recipients in absolute terms.

Consequently, a recent but burgeoning literature has scrutinized the consequences of remittances on economic development, growth and poverty. Recently, a body of research has investigated the impact of remittances on financial sector development. The question is important because (i) financial development has been shown to foster growth and reduce poverty (Ang, 2008; Beck et al., 2007; Valickova et al., 2015); but (ii) the net influence of remittances on financial sector development, especially credit, is ambiguous.

From a theoretical perspective, the impact of remittances on credit is largely unknown (Aggarwal et al., 2011). One view claims that remittances function as a substitute for credit by alleviating liquidity constraints. An opposite view states that remittances may stimulate credit provision for both recipients and non-recipients. On the demand-side, recipients can be less reluctant to ask for a loan due to improvements in financial literacy or newer perceptions of banks (less mistrust). On the supply side, bankers may have more incentives to offer loans to recipients due to additional stable revenues and a reduction in information asymmetry. Credit provision could also increase for non-recipients because

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<sup>1</sup> Latest update is available at: <http://www.worldbank.org/en/topic/labormarkets/brief/migration-and-remittances>

remittances increase funds available for loans (thanks to an increase in savings) and because banks tend to offer new products or create new branches to attract recipients that benefit all population.

Empirical literature, employing both micro and macro-analysis, does not solve this ambiguity. Micro-evidence, mainly focused on Latin American countries, has investigated whether recipients use more financial services than non-recipients do (Ambrosius and Cuecuecha, 2016; Anzoategui et al., 2014; Brown et al., 2013). These papers document that recipients of remittances are more likely to have a formal bank account. However, remittances have no effect on the demand for and use of credit from banks. A number of macro-empirical studies have complemented the micro-evidence. An advantage of macroeconomic papers is they consider the spillover effects of remittances for non-recipients and the general equilibrium effects. Unfortunately, these studies do not offer a clearer picture than those based on micro-evidence. While some macroeconomic articles give support for a positive relationship between remittances and credit (Aggarwal et al., 2011; Fromentin, 2017, 2018), others are less optimistic and document an absence of impact (Coulibaly, 2015) or a negative effect (Brown et al., 2013; Guiliano and Ruiz-Arranz, 2009). These studies differ in the sample considered (only developing countries or developed and developing countries), period considered, and methodology adopted, which makes comparison complex.

In this paper, we revisit the macroeconomic literature in two ways. First, contrary to the majority of existing papers, we distinguish between short-run and long-run impacts of remittances on credit.<sup>2</sup> In theory, remittances are more expected to spur credit in the long run. Indeed, remittances would stimulate credit by mechanisms that take time to occur (constitution of a collateral, acquisition of financial knowledge, etc.). We therefore expect that if a relationship exists between remittances and credit, it will materialize more in the long run than in the short run.

Second, the literature implicitly assumes that remittances influence credit provided to households. Existing macroeconomic papers cannot distinguish between household credit and firm credit due to the lack of data. This may raise a concern insofar as loans are often oriented in priority towards firms to the detriment of households, especially in developing countries (Beck et al., 2012; Léon, 2018a). Even if remittances spur household credit, empirical analysis could be unable to observe this impact due to the limited share of household credit in many (developing) countries. In this paper, we disentangle the impacts of remittances on firm credit and household credit, thanks to a new database.

In this article, we assess the short-run and long-run impacts of remittances on total credit, household credit and firm credit. To do so, we employ a new dataset on credit structure, the Credit Structure Database (Léon, 2018b). After restricting our sample to countries with complete data on credit, remittances and control variables, we obtain a balanced sample of 30 developing countries and 27 high-income countries for the period 2000-2014. We employ a Pooled Mean Group (PMG) estimator that allows us to disentangle between short-run and long-run effects. Our findings are summarized as follows: (i) remittances have a positive impact on credit in the long run but no effect in the short run; (ii) the net impact of remittances is positive for total credit, household credit and firm credit; (iii) the effect

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<sup>2</sup> Recent papers (e.g., Fromentin, 2017) have also distinguished between short-term and long-term impact of remittances on financial development.

of remittances is stronger for household credit in developing countries; and, (iv) in developed countries, remittances influence firm credit but not household credit. In a nutshell, these findings indicate remittances positively affect credit in both developed and developing countries in the long run but in different ways (through household credit in developing countries and firm credit in developed countries).

Our contribution is twofold. First, this article adds to the burgeoning literature on the link between remittances and credit in two ways. First, we distinguish between the impact on credit provided to households and credit provided to firms. We document that remittances impact both types of loans but differently in developed countries and developing countries. In addition, this paper disentangles short-run effect and long-run impact of remittances on (total, firm and household) credit. Our results indicate the importance of this distinction when assessing the net impact of migrants' money transfers on credit because remittances only affect credit in the long run.

Second, we also contribute to a small literature on credit structure (household credit vs. firm credit) in developing countries. Recent papers have underlined that too much finance may be detrimental for long-term growth (Arcand et al., 2015; Rousseau and Watchel, 2012). A possible explanation has roots in credit structure. Credit expansion often occur through more credit to households, which is less productive than firm credit with implications on real activity (Beck et al., 2014; Sassi and Gasmi, 2014, Léon, 2016) or on financial stability (Büyükkarabacak and Valev, 2010). However, few papers have scrutinized the drivers and evolutions of household credit and firm credit, especially in the developing world (Beck et al., 2012; Beck and Brown, 2015; Léon, 2018a). In this paper, we point out that remittances affect both types of credit but have a disproportionate impact on household credit in developing countries.

The rest of this paper is organized as follows. Section 2 reviews the existing arguments and presents three testable hypotheses. Section 3 discusses the empirical model and the Pooled Mean Group (PMG henceforth) estimator. Section 4 presents the data and Section 5 displays the results. The final section concludes.

## **2. Testable hypotheses**

We start by presenting channels by which remittances influence credit that help us to develop our testable hypotheses in the second step.

### *2.1. Two views of the impact of remittances on credit*

The literature on remittances and formal credit has put forward two opposite views (Aggarwal et al., 2011).

The first view states that remittances function as a substitute for credit when households face liquidity constraints in either the short or long run. Remittances provide an alternative way to finance investment in human capital (Calero et al., 2009) and physical capital (Brown, 1994; Woodruff and

Zenteno, 2007) for households that are excluded from formal banking systems. Remittances can also act as an insurance against shocks because the migrant's income earned abroad is not hit by local shocks (Ambrosius and Cuecuecha, 2013). In absence of remittances, individuals hit by a shock should insure through debt from informal or formal lenders. In other words, remittances can reduce credit demands and have a dampening effect on credit markets. Several empirical papers give support to this view (e.g., Brown et al., 2013; Guiliano and Ruiz-Arranz, 2009).

An opposing view argues that remittances are a catalyst for credit for both recipients and non-recipients of remittances.

First, remittances allow individuals to create a first contact with formal lenders that would alleviate supply-side and demand-side obstacles to credit availability.<sup>3</sup> On the supply-side, the use of deposit accounts reduces the informational wedge between opaque borrowers (recipients) and formal lenders. Financial institutions may include remittances in the evaluation of creditworthiness of clients. Remittances often stabilize the flow of resources because they are countercyclical and therefore reduce the risk of defaults (Gubert, 2002; Yang and Choi, 2007). In addition, the constitution of a small capital stored in bank account, thanks to remittances, allows recipients to pledge a small collateral. As a result, banks become less reluctant to grant a loan to individuals that receive remittances. On the demand-side, receipt of remittances exposes households increasingly to the formal financial sector about which they become more familiar. Recipients without a previous relationship with a bank discover how a bank function in day-to-day operations. They change their perceptions about banks (e.g., lack of trust, banks are only for rich, etc.) with possible implications on borrowers' willingness to apply for a loan.<sup>4</sup> In addition, frequent interactions with formal banks allow recipients to improve their level of financial literacy (knowledge about financial instruments and financial techniques). In addition, when transferring remittances, migrants also transmit financial knowledge. The lack of financial literacy is recognized as a potential important barrier to the use of financial services (Cole et al., 2011; Lusardi and Mitchell, 2014).

An increase in remittances may affect credit access for non-recipients too. First, by increasing savings in formal banks, remittances could stimulate credit to both recipients and non-recipients. Remittances provide a stable and interest-insensitive source of funds to banks (Barajas et al., 2018). As a result, more funds at lower costs stimulate credit through a demand channel (lower interest rates) and/or a supply channel (less incentive to reject credit applications) for all potential borrowers (recipients and non-recipients) at the macro level. Second, remittances may also spur the supply of formal financial services, affecting financial development in the long-run. Demirgüç-Kunt et al. (2011) document that remittances are strongly associated with denser bank branch networks in Mexico. Soft information and therefore proximity is crucial for credit access (Agarwal et al., 2010), especially for opaque borrowers, and this could increase the provision of credit. In addition, banks may have some incentives to develop new products and services, to attract recipients in their pool of clients, that benefit all population. Third,

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<sup>3</sup> Even if remittances are often transferred through informal tools, they are expected to have a positive impact on the amount of bank deposits made by recipients. The lumpiness of remittances, due to the fixed costs of sending remittances, creates a demand for savings options.

<sup>4</sup> For instance, Pierce and Snyder (2018) document how the lack of trust in banking impedes the use of financial services.

recipients may share their experience with banking sector to other households (spillover effect). For instance, relatives of recipients might benefit from changes in perceptions about formal financial sector and financial knowledge through discussions and interactions with recipients.

## *2.2. Hypotheses tested*

With some exceptions (e.g., Fromentin, 2017), empirical investigations on the relationship between remittances and credit focus mainly on short-term analysis and ignore long-term impact. In this work, we distinguish the impact of remittances on credit in the short run and the long run. In the short run remittances may affect savings but could have a limited or no impact on credit, as documented by microeconomic evidence (Ambrosius and Cuecuecha, 2016; Anzoategui et al., 2014; Brown et al., 2013). However, remittances could impact credit provision for both recipients and non-recipients in the long run.

For recipients, remittances help alleviate demand-side and supply-side obstacles to credit access but this will take time to materialize. Recipients of remittances should accumulated enough capital to constitute a collateral and become credit-worthiness. Constitution of a capital often requires several months. In addition, banks need time to obtain information on how clients manage (deposit and withdraw) and spend their money before deciding to grant a loan. In addition, acquisition of financial knowledge allowed by frequent contact with banks for recipients takes time. Likewise, building confidence and trust is a long-run process that does not occur after the first interaction with a bank. As a consequence, even if remittances may increase the use of formal savings account in the short run for recipients, it could stimulate credit to them but in a longer horizon.

Remittances have also a potential positive impact on non-recipient, as explained above. Remittances allow banks to obtain funds at lower costs and use these additional funds to grant loans to firms and households. However, in line with monetary policy, banks should be ascertain that shocks observed (surge of remittances) are permanent. For instance, if recipients withdraw their money just after deposits, it could be dangerous for a bank to use new funds to offer new loans. As a result, banks take time to see whether a surge of remittances is temporary or permanent, before granting new loans. Meanwhile, supply-side responses by banks (denser networks of branches, product innovation) materialize after several periods for the same reason. Investing in these innovations requires a cost-benefit analysis and becomes profitable only if remittances flow is permanent. Finally, possible spillover effects take time.

We therefore made the following hypothesis:

**Hypothesis 1: The impact of remittances on credit is stronger in the long run than in the short run.**

Our paper also adds the literature by disentangling the impact of remittances on credit to enterprises and on credit to households. Theoretical arguments in the literature focus mainly on the impact of remittances for households' access to financial services in developing countries. Recipients of

remittances are individuals or households and help them to remove barriers to credit access. We therefore expect that household credit is more sensitive to changes in remittances than firm credit.

Nonetheless, remittances might also influence firm credit by two main channels. First, among recipients, some of them have launched businesses and use additional revenues to develop their activity. Second, remittances may stimulate firm credit through an increase in loanable funds available. Banks obtained more funds and use them to finance firms with a need for credit.

We therefore made the following hypothesis:

**Hypothesis 2: The impact of remittances on credit is stronger for household credit than for firm credit.**

Finally, our investigation considers both high-income countries and developing countries. However, remittances have different implications for developing and developed countries. The conceptual framework develops above is mainly inspired by the context of developing countries. Nevertheless, remittances could also influence credit provision in developed countries. In high-income countries, the impact of remittances on credit provision certainly occurs mainly through an increase in loanable funds, while other channels exposed above have a more limited impact.<sup>5</sup> Remittances allow banks to get access to funds at lower costs. A surge in remittances is therefore similar to an expansionary monetary policy. The impact could be particularly important because banks play a central role in the provision of external funds for firms and households. There is no reason to believe that remittances influence more household credit than firm credit. Formal lenders employ additional funds to finance households and firms without distinction. This fact has two main implications. First, the impact of remittances could be particularly important in developed countries because banks play a central role in the provision of credit to households and (small and medium) enterprises. Second, there is no reason to believe that remittances matter more for household credit than firm credit.

We therefore made the following hypothesis:

**Hypothesis 3: The effect of remittances on firm credit is accentuated in developed countries, while its impact on household credit is mitigated.**

Until now, we have argued that remittances have a positive effect on credit. However, as explained by the complementary view, the net impact of remittances is potentially negative for total credit, household credit and firm credit. Households may prefer to finance internally their human and physical investments (e.g., education or shelters) rather than relying on (expansive) external funds. Consequently, remittances substitute to bank finance by increasing internal funds. As for household

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<sup>5</sup> Remittances spur credit provision by acting on: (i) recipients; (ii) non-recipients. However, in developed countries, many households and firms have access to financial services and rely on bank credit to finance their investments. While recipients benefit from a new source of income to constitute a collateral and build creditworthiness, this may concern less individuals than in developing countries (where a large share of population is excluded from financial sector and levels of financial literacy are very low). In addition, the supply-side expansion induced by the surge of remittances is less likely in developed countries owing to dense bank branch networks.



credit, the net impact of remittances on firm credit can be positive or negative. On the positive side, firms can take advantages of a surge of remittances as explained above (firms may benefit from an increase of loanable funds available or from an improvement of creditworthiness of firm owners that receive remittances). However, an increase in remittances by favoring households' access to credit may depress the supply of funds to firms and/or increase their costs. This substitution effect between households and enterprises could induce a positive effect on household credit but a negative effect on firm credit. We are therefore agnostic about the net impact of remittances on both household credit, firm credit and, by consequence, on total credit.

### 3. Methodology and empirical model

To examine the relationship between remittances and credit, we estimate the equilibrium relationship between  $y$  and  $x$  in a panel data context with this model:

$$y_{it} = \theta_{0i} + \theta'_i x_{it} + \epsilon_{it} \quad (1)$$

where  $y_{it}$  is credit (household credit and firm credit) in period  $t$  for country  $i$ , and  $x_{it}$  is a  $(k \times 1)$  vector of explanatory and control variables, including a measure of remittances (remittances and GDP in the first stage (model 1); remittances, GDP, inflation and foreign direct investment in the second stage (model 2) and  $\epsilon_{it}$  is the error term.

We use an autoregressive distributed lag ARDL specification. This specification allows for dynamics in the way that credit adjusts to changes in remittances and other control variables. It 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. In complement, it is possible to capture potential adjustment dynamics of remittances on credit, in the short-term (see Fromentin, 2018 for more details).

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:

$$y_{it} = \sum_{j=1}^p \lambda_{ij} y_{i,t-j} + \sum_{j=0}^q \delta'_{ij} x_{i,t-j} + \mu_i + \epsilon_{it} \quad (2)$$

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  $\mu_i$  denotes country specific fixed effect.

By reparameterization, with respect to the long-run coefficients  $\theta$  and the adjustment coefficients  $\phi_i$ , the error-correction form is given by:

$$\Delta y_{it} = \phi_i [y_{i,t-1} - \theta'_i x_{it}] + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta^{*'}_{ij} \Delta x_{i,t-j} + \mu_i + \epsilon_{it} \quad (3)$$

where  $\phi_i = -(1 - \sum_{j=1}^p \lambda_{ij})$ ;  $\lambda^*_{ij} = -\sum_{m=j+1}^p \lambda_{im}$ ,  $j = 1, 2, \dots, p-1$ ;  $\delta^{*'}_{ij} = -\sum_{m=j+1}^q \delta_{im}$ ,  $j = 1, 2, \dots, q-2$ ;  $\theta_i = -(\frac{\beta_i}{\phi_i})$

$\theta_i$  defines the long-run or equilibrium relationship between  $y_{it}$  and  $x_{it}$ . In contrast,  $\lambda_{ij}^*$  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  $\phi_i$  measures the speed of adjustment of financial development towards its long-run equilibrium following a change in remittances and control variables.  $\phi_i < 0$  ensures that such a long-run relationship exists. That is, finding a significantly negative  $\phi_i$  constitutes evidence of a long-run equilibrium relationship. As a result, a significant and negative value of  $\phi_i$  is treated as evidence of co-integration between  $y_{it}$  and  $x_{it}$ .

Concerning the estimation, there are a few existing procedures for estimating the above model (mean group (MG), dynamic fixed-effect (DFE) or pooled mean-group (PMG) approach). However, the maximum likelihood-based PMG estimator (Pesaran et al., 1999) is a more efficient estimator (if the long-run homogeneity restrictions are valid). PMG approach restricts the long-run parameters to be identical over the cross section, but allows the short-run coefficients and error variances to differ freely across groups. 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. It is necessary to emphasize that in this paper, we decide to analyze the average short-run effect by considering the mean of the corresponding coefficients across countries by panel, like Loayza and Ranciere (2006) and Fromentin (2017).

We implement several tests before presenting the results. Even if the ARDL specification dispenses with unit root pretesting of the variables, we check the stationarity of variables using the LLC (Levin et al., 2002), B (Breitung, 2000) and IPS (Im et al., 2003) approaches (see table 1). Then, we test the possible existence of a cointegrated relationship with panel cointegration tests: Pedroni's well-known test (1999, 2004), the residual-based cointegration test developed by Kao (1999) and Westerlund test (2007). The last test takes into account cross-sectional dependence by taking a bootstrap approach (for more details, see Persyn and Westerlund (2008) or Damette and Fromentin (2013)). Therefore, we employ cross-section dependence tests to investigate contemporaneous correlation across countries. We employ the following cross-section dependence tests: the Breusch-Pagan (1980) LM, the Pesaran (2004) scaled LM and Pesaran (2007) CD tests.

#### 4. Data

We use annual data for developing countries defined as low and middle income countries (using the typology of the World Bank) and developed (high-income) countries. All in all, we have balanced panel datasets: 57 countries from 2000 to 2014 (855 observations) including 30 developing countries (450 observations) and 27 developed countries (405 observations)<sup>6</sup>. The data of the variables are obtained from the World Bank World Development Indicators (WDI) and the Credit Structure Database (Léon, 2018b).

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<sup>6</sup> See the Appendix for the list of all countries.

*Remi* refers to the ratio of remittances to GDP (expressed in log). 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 nonresident households. Personal transfers thus include all current transfers between resident and nonresident 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 nonresident entities.

Data on total credit, household credit and firm credit are retrieved from a new database: the Credit Structure Database (Léon, 2018b). The CSD provides data on credit by types of borrowers for 143 countries over the period 1995-2014.

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. 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), act as a proxy for uncertainty, and risk (see Giuliano and Ruiz-Arranz 2009). We include also FDI. In parallel to the traditional sources of development financing in the form of foreign aid, foreign direct investment (FDI), and private transfers, remittances serve as a life line for development projects (Nsiah and Fayissa, 2013). The governments may consider fostering technological innovation with a view of increasing formal flows and financial deepening. Moreover, FDI serves as an alternative measure of openness (Gupta et al., 2009).

To select countries included in this study, we first consider all countries for which we have data on total, firm and household credit from the CSD as well as data on remittances and control variables. The descriptive statistics and pairwise correlations for all log variables are shown in the Appendix.

## **5. Estimation results and discussion**

### *5.1. 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 first-differences for all the countries (in Table 1). The series could be considered as integrated of order one.

Table 2 reports the results of cross-section dependence tests and shows that the null hypothesis of cross-sectional independence is strongly rejected at conventional significance levels. Credit, remittances and GDP variables seem to exhibit some dynamics common to all countries.

Our next step of testing the possible existence of a co-integrated relationship between the series allows us to assume a potential long-term relationship between them. When we take into account cross-sectional dependencies with Westerlund tests (or not with the Pedroni and Kao tests), the tests reject the null hypothesis of no cointegration. Finally, we can presume the existence of a long-run equilibrium relationship between credit, remittances and GDP (see Table 3).

The existence of a co-integration vector is consistent with the negative sign of the adjustment term. The results support this condition. 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 error-correction coefficients  $\phi_i$  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 credit.

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. The PMG estimator is validated, with identical long-run parameters across countries.

## 5.2. Results of PMG estimations

Recall that data on total credit, household credit and firm credit are retrieved from a new database: the Credit Structure Database (Léon, 2018b). We can then appreciate the impact of remittances on total credit, obscuring the possible variations of the components (Household credit and Firm credit).

Tables 4 to 6 display the results on the estimation of long- and short-run parameters. 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 short-run (SR) coefficients are not restricted to being the same across countries. We do not obtain a single pooled estimate for each coefficient. However, as a reminder, we decided to analyze the average short-run effect by considering the mean of the corresponding coefficients across countries by panel<sup>7</sup>.

Table 4 includes all countries, both developing countries and developed countries. The long-run coefficients (column ECT) of remittances (except for the estimation with firm credit), GDP and FDI are positive and statistically significant in PMG estimations. Greater remittances and economic development improve credit (*Household credit* and *Total credit*). In view of the remittances coefficients, it appears that the transfer of funds has a greater impact on household credit, in line with Hypothesis 2. The effect of GDP is slightly greater on household credit than it is on firm credit in the long run. The credit is negatively correlated with inflation, in line with existing works (e.g., Aggarwal et

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<sup>7</sup> Detailed output from PMG estimations can be obtained by contacting the authors.

al., 2011). The effect of FDI is logically important on firm credit. In the short term, the coefficient "Remittances" is significant (only at 10%) and negative for the estimation with firm credit. Otherwise, we do not observe other short-term effects.

We then propose a comparison between developing countries (Table 5) and developed countries (Table 6). This will shed light on possible differences between "developed" and "developing" countries in the effect of remittances on credit. Indeed, remittances contribute to financial development in countries that have already achieved a certain stage of financial development. Alternatively, it could be that remittances positively affect financial development only if received in small amounts (as is the case for developed countries). Moreover, remittances are expected to play a greater role on household credit in developing countries, as explained in Section 2 (Hypothesis 3).

Concerning the results of the tables 5 and 6, we corroborate the hypotheses set out in section 2. We find globally the same effects for the variables GDP, inflation and FDI. Concerning the variable "Remittances", findings from Tables 5 and 6 tend to corroborate the Hypothesis 3. Indeed, the effect is significant and positive on household credit in developing countries; unlike developed countries, the impact is significant and positive on firm credit. The short-run coefficients are insignificant in all of the models. In both cases, remittances positively stimulate credit provision only in the long-term, in line with Hypothesis 1.

This result can be explained by a higher level of economic development, and the massive investment by firms in the countries concerned, which use credit through loans from credit institutions. 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. Moreover, it would seem that the effect of remittances on credit (with a differentiation between household credit and firm credit) is different for developing and developed countries, because of the intrinsic characteristics of the financial sector and differentiated behavior in terms of consumption and savings.

### *5.3. Robustness checks*

As robustness tests or sensitivity tests, we propose additional estimate with savings as dependent variables. This test allows us to gauge whether our findings are in line with previous works. Gross savings are calculated as gross national income less total consumption, plus net transfers (source: WDI). Linking remittances with additional financial services has important benefits by providing households with additional tools of risk management and asset accumulation (Ambrosuis et al., 2016).

In connection with the studies cited above, and a more recent study (Quartey et al., 2018), receiving remittances significantly affects household's propensity to save. Remittances may function as a "catalyst" for financial development at long-term (but not at short-term).

## **6. Conclusion**

In this paper, we assess the short-run and long-run impact of remittances on total credit, household credit and firm credit. To do so, we employ a new dataset on credit structure, the Credit Structure Database (Léon, 2018b). After restricting our sample to countries with complete data on credit, we obtain a balanced sample of 30 developing countries and 27 developed countries over the period of 2000-2014. We employ a Pooled Mean Group (PMG) estimator that allows us to distinguish between short-run and long-run effects. In a nutshell, our findings indicate that remittances stimulate credit but in the long run and through an increase of household credit in developing countries. In developed countries, remittances also spur credit but benefit for firms.

This paper suffers from two major limitations. First, we are unable to disentangle extensive margin and intensive margin. An increase of total, household, and firm credit can be due to better access for unserved clients (extensive margin) or to larger loans for already financed borrowers (intensive margin). The implications are potentially different in both situations. Future research should investigate whether remittances stimulate credit through an increase of extensive margin or of intensive margin, by relying on microeconomic data. Another limitation is that the sample considered is relatively short (fifteen years), including the post 2008 period. By using time-series data on specific countries, future works should confirm or challenge our conclusion.

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## **Appendix**

### **List of countries (57)**

#### ***Developing countries (30)***

Armenia, Belarus, Belize, Benin, Bosnia and Herzegovina, Botswana, Burkina Faso, Côte d'Ivoire, Croatia, Dominica, Fiji, Grenada, Guinea Bissau, Hungary, Kazakhstan, Kenya, Kyrgyzstan, Macedonia, Mali, Mexico, Nicaragua, Pakistan, Philippines, Senegal, Solomon Islands, St Lucia, St Vincent, Thailand, Togo and Turkey.

#### ***Developed countries (27)***

Antigua and Barbuda, Australia, Austria, Barbados, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Iceland, Israel, Japan, Netherlands, Oman, Poland, Portugal, Slovenia, Spain, St Kitts and Nevis, Sweden, Switzerland, Trinidad, United Kingdom, United States of America.

**Table 1**

Panel Units Test

Variable		LLC	B	IPS
Household credit	Level	-5.51***	3.86	--0.26
	1 <sup>st</sup> Dif.	-14.82***	-7.93***	-10.05***
Firm credit	Level	-2.54*	3.77	1.04
	1 <sup>st</sup> Dif.	-10.57***	-3.21***	-5.90***
Remi	Level	-15.41***	2.81	-5.67***
	1 <sup>st</sup> Dif.	-21.44***	-5.75***	-13.32***
GDP	Level	-<3.10***	2.88	1.48
	1 <sup>st</sup> Dif.	-16.30***	-8.32***	-8.06***
Inflation	Level	-13.15***	-7.56***	-10.58***
	1 <sup>st</sup> Dif.	-25.61***	-9.25***	-19.47***
FDI	Level	-13.51***	-5.91***	-7.43***
	1 <sup>st</sup> Dif.	-25.44***	-11.61***	-18.37***

**Table 2**

Test for cross-section dependence.

	Breusch-Pagan LM	Pesaran LM	Pesaran CD
Household credit / Remi / GDP	9088.87***	131.61***	44.04***
Firm credit / Remi / GDP	6696.56***	89.27***	22.94***

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

**Table 3**

Panel cointegration tests

Statistics	Household credit	Firm credit
$G_{\tau}$	-4.120 (0.00)	-11.236 (0.00)
$G_{\alpha}$	-1.368 (1.00)	-0.877 (1.00)
$P_{\tau}$	-11.251 (0.94)	-10.778 (0.98)
$P_{\alpha}$	-3.015 (1.00)	-3.584 (0.99)
v-Statistic Panel	0.05 (0.30)	-1.20 (0.88)
rho-Statistic Panel	3.53 (0.99)	3.84 (0.99)
PP-Statistic Panel	-2.83 (0.01)	-0.63 (0.26)
ADF-Statistic Panel	-8.55 (0.00)	-3.27 (0.00)
rho-Statistic Group	6.77 (1.00)	6.71 (1.00)
PP-Statistic Group	-3.03 (0.01)	--1.19 (0.11)
ADF-Statistic Group	-7.43 (0.00)	-6.08 (0.00)
Kao	-3.64 (0.00)	-6.28 (0.00)

Note: p-values are in parentheses.

**Table 4**

Estimates of the panel error-correction model with the PMG method for all countries

VARIABLES	Household credit		Firm credit		Total Credit	
	ECT	SR	ECT	SR	ECT	SR
ECT		-0.0559*** (0.0115)		-0.0225*** (0.00642)		-0.0683*** (0.0177)
$\Delta$ Rem		-0.0665 (0.0644)		-0.0801* (0.0485)		-0.0454 (0.0450)
$\Delta$ GDP		0.141 (0.237)		0.144 (0.202)		0.0399 (0.179)
$\Delta$ Inflation		0.00102 (0.00139)		-0.000616 (0.000794)		-0.000518 (0.000753)
$\Delta$ FDI		0.00392 (0.00240)		-0.00144 (0.00162)		0.000271 (0.00176)
Rem	0.165*** (0.0181)		0.0660 (0.0484)		0.147*** (0.0110)	
GDP	0.426*** (0.00327)		0.294*** (0.0171)		0.464*** (0.00347)	
Inflation	-0.0438*** (0.00192)		-0.0692*** (0.0108)		-0.0251*** (0.00235)	
FDI	0.0110*** (0.00182)		0.157*** (0.0224)		0.0411*** (0.00466)	
Observations	798	798	798	798	798	798

Notes: \*\*\*, \*\*, and \* denote a significance of 1%, 5%, and 10%, respectively. Standard errors are in parentheses.

**Table 5**

Estimates of the panel error-correction model with the PMG method for developing countries

VARIABLES	Household credit		Firm credit		Total Credit	
	ECT	SR	ECT	SR	ECT	SR
ECT		-0.0766*** (0.0183)		-0.0885** (0.0415)		-0.112*** (0.0194)
$\Delta$ Rem		-0.0254 (0.108)		-0.0922 (0.138)		-0.0606 (0.0958)
$\Delta$ GDP		0.370 (0.368)		0.650 (0.396)		0.150 (0.234)
$\Delta$ Inflation		0.00229 (0.00225)		-0.00117 (0.00075)		5.75e-06 (0.00105)
$\Delta$ FDI		0.00625 (0.00449)		0.00134 (0.00627)		0.00226 (0.00279)
Rem	0.0684** (0.0330)		0.0498 (0.0531)		0.00316 (0.0287)	
GDP	0.370*** (0.00782)		0.346*** (0.00317)		0.475*** (0.00993)	
Inflation	-0.0354*** (0.00235)		-0.00849*** (0.00183)		-0.0263*** (0.00241)	
FDI	0.0343*** (0.00432)		-0.0112*** (0.00361)		0.0147*** (0.00310)	
Observations	420	420	420	420	420	420

Notes: \*\*\*, \*\*, and \* denote a significance of 1%, 5%, and 10%, respectively. Standard errors are in parentheses.

**Table 6**

Estimates of the panel error-correction model with the PMG method for developed countries

VARIABLES	Household credit		Firm credit		Total Credit	
	ECT	SR	ECT	SR	ECT	SR
ECT		-0.0680*** (0.0112)		-0.0753*** (0.0263)		-0.0589** (0.0295)
$\Delta$ Rem		-0.0372 (0.0534)		-0.0963 (0.0662)		-0.0783 (0.0477)
$\Delta$ GDP		-0.116 (0.220)		0.230 (0.252)		0.0515 (0.240)
$\Delta$ Inflation		-0.00223** (0.000885)		-0.00155 (0.00129)		-0.000833 (0.000920)
$\Delta$ FDI		9.05e-05 (0.000627)		-0.00117 (0.001000)		-0.00217 (0.00166)
Rem	-0.0301 (0.0422)		0.181*** (0.0199)		0.140*** (0.0142)	
GDP	0.428*** (0.00706)		0.331*** (0.00407)		0.463*** (0.00437)	
Inflation	-0.00815 (0.00618)		-0.00399 (0.00313)		-0.0220*** (0.00463)	
FDI	-0.000447 (0.00261)		0.0208*** (0.00222)		0.0429*** (0.00523)	
Observations	378	378	378	378	378	378

Notes: \*\*\*, \*\*, and \* denote a significance of 1%, 5%, and 10%, respectively. Standard errors are in parentheses.



**Table 7**

Estimates of the panel error-correction model with the PMG method for developing and developed countries

VARIABLES	Savings	
	ECT	SR
ECT		-0.181*** (0.0330)
$\Delta$ Rem		2.003 (2.709)
$\Delta$ GDP		57.27*** (13.88)
$\Delta$ Inflation		0.0665 (0.0424)
$\Delta$ FDI		-0.159 (0.161)
Rem	0.670** (0.311)	
GDP	4.828*** (0.0737)	
Inflation	0.136*** (0.0276)	
FDI	0.0971 (0.0625)	
Observations	665	665

Notes: \*\*\*, \*\*, and \* denote a significance of 1%, 5%, and 10%, respectively. Standard errors are in parentheses.

## Additional Tables

**Table A1: Descriptive statistics and Correlation Analysis**

*Panel A: Descriptive statistics*

	CREDIT_H	CREDIT_F	REM	GDP	INFLATION	FDI
Mean	1.098588	1.400878	3.030232	6.20E+11	4.609364	5.457385
Median	1.302331	1.437116	1.264690	3.70E+10	2.751710	3.360790
Maximum	2.043794	2.122281	31.05640	1.70E+13	185.2910	87.44260
Minimum	-1.301030	-0.494850	0.015824	3.30E+08	-27.63270	-15.98920
Std. Dev.	0.676949	0.350504	4.522369	1.99E+12	9.886143	7.329222

*Panel B: Correlation*

Probability	CREDIT_H	CREDIT_F	REM	GDP	INFLATION	FDI	
CREDIT_H	1.000000						
	-----						
CREDIT_E	0.732530	1.000000					
	0.0000	-----					
REM	-0.306479	-0.273121	1.000000				
	0.0000	0.0000	-----				
GDP	0.157161	0.099922	-0.184030	1.000000			
	0.0000	0.0034	0.0000	-----			
INFLATION_DEFLATOR	-0.209069	-0.195199	0.029264	-0.085669	1.000000		
	0.0000	0.0000	0.3928	0.0122	-----		
FDI	0.269379	0.181258	-0.000392	-0.114072	-0.054426	1.000000	
	0.0000	0.0000	0.9909	0.0008	0.1118	-----	