

Financial Development Thresholds and the Remittances-Growth Nexus

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Abstract

This study provides new evidence on the relationships between remittances and economic growth using Panel Threshold Regression (PTR) model proposed by Hansen (1999) that authorized multiple thresholds. The sample consists of 76 developing countries from 1975-2013. The empirical results indicate that there is a threshold effect of financial development in the remittances-growth relationship. In particular, remittances promote economic growth in recipient countries whose financial sector functions relatively well; beyond the threshold level further development of finance tends to adversely affect the remittance-growth nexus. Our results remain robust when we control for potential endogeneity bias using GMM approach. The findings reveal that more finance is not necessarily good for economic growth in the recipient countries. They highlight that an “optimal” level of financial development is more crucial in the remittance-growth nexus.

Keywords: Remittances; Economic growth; Financial development; Non-linearity; PTR; GMM

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1. Introduction

Remittances by migrant workers to their countries of origin have rapidly increased in recent years from U.S. \$ 3.3 billion in 1975 to \$ 431.6 billion in 2015 (World Bank, 2016) in addition to unknown amounts transferred through unofficial channels.¹ They are now, the second largest source of external financial flows to developing countries after foreign direct investment and represent almost double the official aid to developing countries (Bettin and Zazzaro, 2012). Despite the increasing importance of remittances in recent years, the relationship between remittances and economic growth has not been adequately studied. Remittances may have both welfare and growth effects. They alleviate poverty, improve human capital, affect labour supply, reduce inequality and smooth internal shocks (Adams and Page, 2005 for example). Although this debate is still open, it is generally accepted that the impact of remittances on economic growth is less conclusive.

Existing theoretical literature does not give a clear answer as to whether remittances enhance economic growth. From a theoretical viewpoint, Chami et al. (2008) and Barajas et al. (2009) identified three main channels through which remittances can affect economic growth. The first one is the accumulation of physical capital. When domestic households face financial restrictions that constrain their investment activities, remittances can contribute to capital accumulation by relieving household's financial constraints. Furthermore, remittances may have a positive impact on growth via the facilitation of human capital formation. Indeed, remittances contribute to the accumulation of physical and human capital by promoting their financing when the financial sector is underdeveloped. Moreover, by relaxing financial constraints, migrant transfers might lead to lower demand for credit and thereby have a dampening effect on financial development. Remittances can therefore be considered as substitutes to the financial sector, and their impact on growth would be even more significant when the financial sector is underdeveloped. Even though, the majority of remitted funds are devoted to consumption and residential investment, significant productivity spillovers may result from the recipients' improved nutrition and shelter, assuming that they participate in the labor market. Indeed, the literature offers several examples in which a significant fraction of remittances are spent on education, assuming that those who receive the education do not in turn emigrate.

The second channel highlights the impact of remittances on growth through their effects on the recipient economy's financial system. By increasing the recipient country's demand for money, remittances are likely to expand the supply of funds to the banking system. This in turn may lead to enhanced financial development through a reduction in the external premium and thus to higher economic growth through one of the two channels: economies of scale or a political economy effect. This complementary relationship between financial development and remittances is highlighted by Aggarwal et al. (2011). According to these authors, the greater financial developed system might lead to larger measured remittances, since financial development stimulates migrant transfers through official channel. In the same vein, Demirgüç-Kunt et al. (2011) find that remittances are strongly associated with greater banking breadth and depth, increasing the number of branches and accounts per capita and the amount of deposits to GDP in Mexico. Gupta et al. (2008) also investigate the effect of remittances on

¹ It well known that official statistics minimize the level of remittances, as they focus mainly on the banking channel. Unofficial transfers send via non-bank institutions (e.g. money transfer operators) and informal channels (e.g. family and friends) are more than 50% of the official remittances to Sub-Saharan Africa (World Bank, 2011) and range from 50 to 250% of official statistics on remittances according Freund and Spatafora (2008).

financial development in sub-Saharan African countries, using a panel of 44 countries from 1975 to 2004 and suggest that remittances promote financial development. Remittances can also reduce financial exclusion problems, since the recipients can open bank accounts and access to other financial services. For instance, Ambrosius et al. (2014) suggest that microfinance institutions have a potential to foster financial access via remittances in the Dominican Republic, El Salvador and Mexico, since recipient countries can benefit a range of financial services offered by the microfinance institutions. The regularity of such transfers may partially address the collateral problem and facilitate the recipients' access to bank financing.

The third channel is the labor force growth. Indeed, because remittances take place under asymmetric information and uncertainty, there exists a significant moral hazard problem between the migrants and the recipient households. The recipients may consider the remitted funds as a substitute for labor income and increase their leisure activities. They can decrease their labor force participation, limit their job searches, reduce labor effort, or invest in riskier projects, among other actions (Amuedo-Dorantes and Pozo, 2006). Acosta et al. (2009) show in a two-sector dynamic stochastic general equilibrium model that an increase in remittances flows leads to a decline in labor supply and an increase in consumption demand that is biased towards non-tradables. In the same vein, Finkelstein-Shapiro and Mandelman (2016) and Annen et al. (2016) also suggest that migrants' transfers reduce labor demand and then can have negative effects on investment and output.

From an empirical viewpoint, a large amount of literature has examined the relationship between remittances and economic growth using cross-section, times series, panel data. For example, Chami et al. (2005) use a variety of fixed effects models and find a negative and significant relationship between international remittances and economic growth for different groups of countries over various sets of years. On the basis of this finding, Chami et al. (2005) conclude that remittances do not serve as capital for economic development, but rather as a type of compensation for countries with poor economic conditions. Pradhan et al. (2008) assess the impact of remittances on economic growth using data for 39 developing countries during the period 1980-2004. Using fixed effects models, they show support for the view that remittances have a positive impact on economic growth.

However, cross-sectional methodology has many drawbacks. Quah (1993) formally shows the lack of balanced paths across country – which violates the hypothesis of averaging and pooling of cross country data. Evan (1995) also points out the heterogeneity of slope coefficients across countries as a main limit of a cross-section analysis. Furthermore, the methodology used by Chami et al. (2005) and Pradhan et al. (2008) does not fully account for endogeneity. Correcting for endogeneity of remittances remains the primary challenge for researchers on the effects of remittances on growth. Failure to correct for reverse causality and other sources of endogeneity in remittances flows may lead to misleading conclusions regarding the causal relationship from remittances to economic growth.

To address the endogeneity issue, Jongwanich (2007) applied the GMM method to estimate the relationship between workers' remittances, economic growth and poverty in developing Asia and the Pacific countries. The empirical evidence suggests that remittances only have a marginal impact on growth operating through domestic investment and capital development. Barajas et al. (2009) used fixed effects and Instrumental Variable models to evaluate the impact of remittances on economic growth for 84 emerging countries. They introduce a novel instrument that represents a significant improvement both over internal lag-

driven instruments and other previous attempts at obtaining an external instrument. Their results show that remittances have no effect on economic growth. The implication of their findings is that other policies can be used to increase the long run growth rate instead of depending on increasing the receipts of remittances alone. In the same vein, Fenny et al. (2014) found no statistically significant link between remittances and economic growth from a large sample of 136 developing countries over the period 1971-2010. However, subsequent results by the authors suggest that there is positive association between remittances and growth in the Small Island Developing States (SIDS). Nshia and Fayissa (2013) use the Panel Fully Modified OLS (PFMOLS) approach to analyze the effect of remittances on economic growth. Using a data set covering 64 countries for the period 1985 to 2007, they find that remittances promote economic growth.

One limitation of the previous studies is that they do not take into account the potential non-linearity of this relationship. It has been advanced that the relationship between remittances and economic growth, far from being linear, may be influenced by financial development levels. In other words, the marginal effect of economic growth may be stronger in some countries than others. Indeed, investigating the non-linearity between remittances, financial development and growth, Giuliano and Ruiz-Arranz (2009) put forward the existence of thresholds above and below which the growth effects of remittances differ. More precisely, they use systems Generalized Methods of Moments (GMM), to control for endogeneity and find that remittances have a positive impact on economic growth in countries that have a lower level of financial sector development. This suggests that there is a threshold that countries have to pass through, which eventually renders the effects of remittances minimal. The existence of such a non-linear pattern has been confirmed by other authors, such as Bettin and Zazzaro (2012), Nyamongo et al. (2012), Hassan et al. (2012) and Cooray (2008). Contrary to Giuliano and Ruiz-Arranz (2009) who have provided evidence of substitutability between remittances and financial development in fostering growth, Bettin and Zazzaro (2012) suggest that remittances promote growth only in countries whose financial system works well, from a sample of 66 developing countries from 1975 to 2005. They use quality-based indicator of financial development and conclude to the existence of complementarity hypothesis. In the same vein, Nyamongo et al. (2012) used panel estimation to investigate the relationship between remittances and economic growth for 36 African countries over 1980-2009. They also addressed the non-linearity of this relationship and find that remittances appear to be working as a complement to financial development. Hassan et al. (2012) examine the relationship between remittances and economic growth in Bangladesh over the period 1974-2006. Using instrumental variables and a standard cross-section growth model, the authors find that the growth effect of remittances is negative at the first but becomes positive at a later stage-a strong evidence of a non-linear relationship. Furthermore, remittances positively affect growth in Bangladesh when complementarity between remittances and financial development is included into analysis. This complementarity effect between remittances and financial development with respect to economic growth is also found by Cooray (2012) over the period 1970-2008 from a sample of 6 South Asian countries.

The current study is closely related to this strand of literature. It aims at contributing to the literature in three respects. First, we provide new evidence that sheds light on the role that financial development plays in mediating the influence of remittances on economic growth. More specifically, following Giuliano and Ruiz-Arranz (2009) and Bettin and Zazzaro (2012), we test the existence of financial development threshold effects in the remittances-growth relationship and try to justify the conflicting results obtain by the previous authors. It may be that a certain level of financial development has to be attained before remittances can have

any impact on growth. This conjecture requires a more flexible modeling strategy that can accommodate different kinds of remittances-growth-financial development interactions. To this end, we use panel threshold regression (PTR) model proposed by Hansen (1999) that authorized multiple thresholds. Previous empirical literature identifies exogenous breaks or endogenous break thresholds using rolling Chow test. This test imposes a discontinuity in the relationship between remittances and economic growth. This is not the case of our PTR model which captures, on a continuous basis, the effect of remittances on economic growth. Alternatively, for robustness checks, we also rely on the dynamic generalized methods of moments (GMM) that account for endogeneity under each regime.

Second, we used a dataset sufficiently large to enable robust conclusions to be draw; specifically, the sample used in this study consisted of annual data from 76 developing countries from 1975 through 2013.

Finally, four financial development indicators were employed in the analysis - private sector credit, liquid liabilities, money and quasi-money and commercial banking assets – to capture various aspects of banking sector development.

The rest of the paper is organized as follows: Section 2 presents our methodology through the presentation of PTR specification. The data are described in Section 3. Section 4 presents empirical results. Finally, Section 5 provides some concluding remarks.

2. Multiple thresholds specification

The conventional linear panel specification of the relationship between remittances and economic growth is as follows:

$$y_{it} = \lambda_i + \beta_0 rem_{it} + \delta_0' X_{it} + \varepsilon_{it}, \quad (1)$$

for $i = 1, \dots, N$ and $t = 1, \dots, T$, where N and T denote the cross-sectional and time dimensions of the panel, respectively. The dependent variable y_{it} is a scalar and denotes the growth rate of GDP per capita, Rem_{it} the ratio of remittances to GDP, X_{it} is a k -dimensional vector of control variables usually considered in the growth literature, λ_i represents individual fixed effects, and ε_{it} is the error term. We are interested in testing whether the marginal effect of remittances on growth is statistically significant. However, this specification has the drawback in assuming that the relationship between remittances and growth is constant over the time and for all countries. Moreover, it does not account for the non-linearity that can depend on over macroeconomic determinants such as financial development. The recent literature has shown that financial development level can affect the remittances-growth relationship, suggesting complementary or substitution effects between financial depth and remittances (Giuliano and Ruiz-Arranz, 2009; Rao and Hassan, 2011). In order to account for the potential non-linearity in remittances-growth relationship, we relax the previous assumptions and use a non-dynamic Panel Threshold Regression (PTR) model of Hansen (1999) that can be considered as an extension of the linear specification.

Let us consider the simplest case of PTR with two extreme regimes and a single threshold:

$$y_{it} = \begin{cases} \lambda_i + \beta_1 rem_{it} + \delta_1' X_{it} + \varepsilon_{1it}, & \text{if } findev_{it} \leq \gamma_1 \\ \lambda_i + \beta_2 rem_{it} + \delta_2' X_{it} + \varepsilon_{2it}, & \text{if } findev_{it} > \gamma_1 \end{cases} \quad (2)$$

where γ_1 a threshold parameter, $findev$ is the corresponding financial development variable and X_{it} the vector control variable like in Eq. (1). The observations are divided into two

regimes depending on whether the threshold variable $findev$ is smaller or larger than the threshold parameter γ_1 . The regimes are distinguished by different regression slopes, β_1 and β_2 , for the low regime and the high regime, respectively.

The first step of our estimation method is to test the null hypothesis of linearity $H_0: \beta_1 = \beta_2$ against the threshold model in Eq. (3). Under the null hypothesis the threshold γ_1 is not identified, so classical tests have non-standard distribution. For each possible value of γ_1 , a LM statistic is calculated and subsequently inferences is based on the supremum of the LM across all possible γ_1 . The likelihood ratio test of H_0 is based on: $F_1 = (S_0 - S_1(\hat{\gamma}_1)) / \hat{\sigma}_1^2$, where S_0 is the sum of the squared residuals of the linear model, $S_1(\hat{\gamma}_1)$ the sum of the squared residuals of the one-threshold model, and $\hat{\sigma}_1^2 = S_1(\hat{\gamma}_1) / N(T-1)$. Unfortunately, the asymptotic distribution of the LM statistic is non-standard and appears to depend in general upon moments of the sample. Since the critical value cannot be tabulated, Hansen (1996) suggested a bootstrap to simulate the asymptotic distribution of the likelihood ratio test. If the single threshold hypothesis is accepted, the next step is to estimate the following double thresholds model:

$$y_{it} = \begin{cases} \lambda_{1i} + \beta_1 rem_{it} + \delta_1' X_{it} + \varepsilon_{1it}, & \text{if } findev_{it} \leq \gamma_1 \\ \lambda_{2i} + \beta_2 rem_{it} + \delta_2' X_{it} + \varepsilon_{2it}, & \text{if } \gamma_1 < findev_{it} \leq \gamma_2 \\ \lambda_{3i} + \beta_3 rem_{it} + \delta_3' X_{it} + \varepsilon_{3it}, & \text{if } findev_{it} > \gamma_2 \end{cases} \quad (3)$$

where $\gamma_1 < \gamma_2$. The likelihood ratio test of one versus two thresholds can be based on the statistic: $F_2 = (S_1(\hat{\gamma}_1) - S_2(\hat{\gamma}_2)) / \hat{\sigma}_2^2$. The minimizing sum of squared error from the second stage threshold estimate is $S_2(\hat{\gamma}_2)$ with variance estimate $\hat{\sigma}_2^2 = S_2(\hat{\gamma}_2) / N(T-1)$. When the second threshold effect is proved, the same procedure can be applied to general model in order to determine the number of thresholds required to capture the whole non-linearity. The new null hypothesis consists of testing a specification with r regimes versus a specification with $r+1$ regimes. The procedure stops when the null hypothesis is not rejected.

3. Data and variables

The present study covers the period from 1975 to 2013 and focuses on a sample of 76 developing countries,² according to the data availability. Our data are taken from World Development Indicators (WDI, 2015). The WDI data represent current transfers by migrant workers and wages and salaries earned by nonresident workers. The data are reported by countries in their balance of payments. There is a widespread consensus in the literature that the quality of data on remittances is extremely poor. It is well known that official statistics minimize the level of remittance, as they focus mainly on the banking channel. Unofficial transfers send via non-bank institutions and informal channels are more than 50% of the

² Albania, Algeria, Antigua and Barbuda, Argentina, Bangladesh, Barbados, Belize, Benin, Bolivia, Botswana, Brazil, Burkina Faso, Cabo Verde, Cameroon, Central African Republic, Chad, China, Colombia, Comoros, Congo. Rep., Costa Rica, Cote d'Ivoire, Cyprus, Dominica, Dominican Republic, Ecuador, Egypt. Arab Rep., El Salvador, Ethiopia, Fiji, Gabon, Ghana, Guatemala, Guinea, Guinea-Bissau, India, Indonesia, Jamaica, Jordan, Kenya, Lesotho, Madagascar, Malaysia, Mali, Mauritania, Mexico, Morocco, Mozambique, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Sri Lanka, St. Kitts and Nevis, Sudan, Suriname, Swaziland, Syrian Arab Republic, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Venezuela RB, and Zimbabwe.

official remittances to Sub-Saharan Africa (World Bank, 2011) and range from 50 to 250% of official statistics on remittances according to Freund and Spatafora (2008). Therefore, efforts to measure remittance suffer from important limitations as official estimates understate actual flows. This is however a common problem for all paper on remittances (Giuliano and Ruiz-Arranz, 2009). The list of descriptions of the variables used is presented in Table 1.

Table 1: Description of the variables

Variables	Description
Gdp	Gross domestic product (GDP) per capita is measured in constant 2011 U.S. dollars.
Gdpgr (y_{it})	Annual percentage growth rate of GDP per capita based on constant 2011 U.S. dollars.
Rem	Remittances comprise personal transfers and compensation of employees (as % of GDP).
M2/GDP	Money and quasi money (as % of GDP).
Private	Domestic credit to private sector (as % of GDP).
Credit	Domestic credit provided by the financial sector (as % of GDP).
Bank	Domestic credit to private sector by banks (as % of GDP).
Gov	Government expenditures are government final consumption expenditure (as % of GDP).
Invest	Investment is measured by gross fixed capital formation includes (as % of GDP).
Trade	Sum of exports and imports of goods and services as percentage of GDP.
School	Human capital is measured by the gross secondary enrollment ratio.
Inflation	Inflation is measured by the annual growth of consumer price index.

Our endogenous variable is GDP growth per capita (constant 2011 US\$) and the main exogenous variable is received personal remittances as percentage of GDP. The threshold variable is financial depth that is appraised by four traditional quantity-based indicators and we use the conventional control variables for growth equation (see Table 1). For the PTR regressions, we use annual data, while 5-year interval averages are used for our GMM system estimator, in order to avoid the influence of idiosyncratic economic dynamics at business cycle frequency, as well as to control for cyclical output movements. Moreover, the use of annual data in GMM-system estimations would lead to over-identification of the model, given the large number of instruments. Lagged instruments by 5- year periods provide theoretical conditions for the exogeneity of the instruments. Finally the estimates on annual and 5- year overlapped data can be considered as a robustness test of our results. Table 2 provides summary statistics on the used variables.

Table 2: Descriptive statistics

Variables	Mean	Std. Dev.	Min.	Max.
Gdp	2753.123	3230.421	160.989	16917.12
Gdpgr	1.710	1.633	-1.206	8.326
Rem	3.827	7.588	0.027	61.227
M2/GDP	41.936	25.156	12.442	138.646
Private	30.609	25.094	4.596	147.439
Credit	44.009	29.333	10.087	160.539
Bank	28.573	23.107	4.465	137.131
Gov	14.848	5.132	4.767	31.450
Invest	21.709	6.032	10.700	43.180
Trade	71.538	33.893	20.275	158.641
Inflation	12.836	10.893	2.874	48.754
School	48.665	23.917	7.384	94.757

4. Empirical results

Our empirical findings will be described in three steps: the first one is the tests of nonlinearity and the thresholds estimates. Secondly, we present the panel threshold estimations and thirdly the robustness checking using system GMM methodology.

4.1. Testing for nonlinearity

Table 3 presents results of nonlinearity tests and the estimated threshold estimates for each of the financial development variables and their corresponding 95% confidence interval. To identify the number of thresholds, we estimated Eq. (3) by least squares, allowing sequentially for zero, one, two, and three thresholds.

Table 3: Tests for non-linearity and threshold estimates

	M2/GDP	Private	Credit	Bank
Test for single threshold				
First threshold (γ_1)	19.141	16.880	20.484	16.876
Confidence interval	[18.832-19.319]	[14.054-17.139]	[18.748-22.406]	[13.994-17.150]
F1	53.057	75.198	56.749	82.784
P-value	[0.000]	[0.000]	[0.000]	[0.000]
Test for double thresholds				
Second threshold (γ_2)	85.271	47.449	59.245	47.449
Confidence interval	[66.907-92.449]	[46.555-50.721]	[48.445-78.599]	[41.214-60.059]
F2	45.300	48.955	39.569	43.180
P-value	[0.006]	[0.004]	[0.019]	[0.009]
Test for triple thresholds				
F3	23.970	21.269	19.548	27.423
P-value	[0.589]	[0.631]	[0.891]	[0.425]

We find that the test for a single and double thresholds are highly significant at 1% and 5% significant levels, whereas the test for a third threshold is not statistically significant at conventional level. We conclude that there is strong evidence that there are two thresholds in the remittances-growth relationship, with respect to financial development. Following the financial development variable, the first threshold ranged between 18.87 and 20.48%, whereas the second threshold is comprised between 47.45 and 85.27%. Then, for the remainder of the analysis we work with this double threshold model, which corresponds to a model with three regimes, each including suitable number of observations to have reliable results.

4.2. Nonlinear estimation

Tables 4a and 4b report the panel threshold results of the impact of remittances on growth according to financial development level. Let us consider a general comment relating to the control variables. All the explanatory variables have the expected sign. Indeed, the lagged GDP per capita coefficient is negative, meaning that the conditional convergence hypothesis is evidenced following the neoclassical theory (see Barro and Sala-i-Martin, 2004). The investment, the trade openness, the financial development and the human capital variables are positively associated to economic growth, whereas government expenditures and inflation appear to be negatively and highly significantly associated with economic growth. These results are valid under the different regimes and are overall in line with theoretical predictions and are consistent with the extensive literature on economic growth.

Table 4a: Results of panel threshold estimations

Estimated Threshold	M2/GDP			Private		
	≤ 19.141	]19.141-85.271]	> 85.271	≤ 16.880	]16.880-47.449[	>47.449
Lgdp	-1.480 ^{***} (0.413)	-1.508 ^{**} (0.532)	-1.114 [*] (0.587)	-1.343 ^{***} (0.341)	-1.108 ^{**} (0.487)	-1.130 ^{**} (0.591)
Rem	0.075 (0.126)	0.537 ^{***} (0.098)	-0.072 (0.339)	0.187 [*] (0.106)	0.540 ^{***} (0.109)	0.290 (0.207)
Findev	0.389 (0.357)	1.152 ^{***} (0.449)	1.598 ^{**} (0.604)	0.472 (0.350)	0.961 [*] (0.500)	1.181 [*] (0.596)
Gov	-3.435 ^{***} (0.688)	-2.243 ^{***} (0.402)	1.446 (3.518)	-2.549 ^{***} (0.453)	-2.006 ^{***} (0.466)	-2.920 ^{***} (1.101)
Invest	1.137 ^{**} (0.518)	3.219 ^{***} (0.381)	3.200 ^{***} (0.903)	1.270 ^{***} (0.404)	3.941 ^{***} (0.432)	5.198 ^{***} (0.760)
Trade	2.876 ^{***} (0.672)	1.362 ^{***} (0.417)	2.243 ^{**} (1.005)	2.279 ^{***} (0.463)	0.979 ^{**} (0.475)	-0.251 (0.817)
School	1.436 ^{***} (0.390)	0.419 (0.330)	1.088 [*] (0.522)	1.710 ^{***} (0.330)	0.439 (0.366)	0.680 (0.905)
Inflation	-0.022 ^{***} (0.009)	-0.040 ^{***} (0.006)	0.011 (0.029)	-0.031 ^{***} (0.006)	-0.044 ^{***} (0.008)	-0.033 (0.022)
R2	0.117	0.137	0.232	0.087	0.135	0.185
Countries	37	76	18	56	67	30
Obs.	460	2,180	248	1,030	1,353	505

Table 4b: Results of threshold estimations

Estimated Threshold	Credit			Bank		
	≤ 20.484	]20.484-59.245]	>59.245	≤ 16.876	]16.876-47.449]	>47.449
Lgdp	-1.166 ^{**} (0.491)	-1.094 [*] (0.603)	-1.606 ^{**} (0.791)	-1.161 [*] (0.579)	-1.240 [*] (0.684)	-1.814 ^{**} (0.805)
Rem	0.139 (0.129)	0.480 ^{***} (0.097)	0.234 (0.191)	0.190 (0.103)	0.598 ^{***} (0.111)	0.426 (1.420)
Findev	0.230 (0.318)	1.442 ^{***} (0.436)	1.661 ^{***} (0.687)	0.465 (0.320)	1.103 ^{**} (0.501)	2.045 ^{**} (0.930)
Gov	-2.295 ^{***} (0.541)	-2.261 ^{***} (0.464)	-1.273 (3.272)	-2.418 ^{***} (0.444)	-2.408 ^{***} (0.472)	-2.121 [*] (1.202)
Invest	1.033 ^{**} (0.510)	3.025 ^{***} (0.391)	4.254 ^{***} (0.622)	1.371 ^{***} (0.394)	4.105 ^{***} (0.437)	4.997 ^{***} (0.831)
Trade	1.985 ^{***} (0.624)	1.416 ^{***} (0.416)	1.467 ^{**} (0.654)	2.011 ^{***} (0.458)	1.175 ^{***} (0.479)	1.548 [*] (0.937)
School	1.241 ^{***} (0.348)	1.112 ^{**} (0.479)	0.800 (0.901)	1.580 ^{***} (0.320)	1.337 [*] (0.711)	1.010 (1.010)
Inflation	-0.025 ^{***} (0.009)	-0.036 ^{***} (0.006)	-0.027 ^{**} (0.013)	-0.030 ^{***} (0.006)	-0.045 ^{***} (0.009)	-0.032 ^{***} (0.013)
R2	0.096	0.152	0.179	0.088	0.134	0.177
Countries	44	73	40	58	67	27
Obs.	734	1,511	643	1,096	1,338	454

Turn now to the relationship between remittances and growth according to financial development level. The results highlight a differentiated relationship between remittances and

growth based on the level of financial development, which incorporates the sophistication of the banking system to funnel migrants' transfers.

First, for lower level of financial development (about 20%), financial development does not affect growth and the relationship between remittances and growth is not significant. Our results contrast to recent research by Giuliano and Ruiz-Arranz (2009) who find that the impact of remittances is positive for countries with low financial development. In our case, for financial development level less than 20%, the financial sector cannot play a major role in the transfer of migrant's resources. Indeed, when financial sector is poorly developed, migrants' transfers channelled through the banking system are low and hardly allocated to the productive sector, therefore do not enhance economic growth. Moreover, when financial system is undeveloped, remittances occur through informal channels and are less measurable, and then, the impact on economic growth is uncertain. The degree of measurement error for the remittances through official channels is associated with the financial development level which seems likely since more remittances will go through nonbank channels when banking channels are unavailable. Then, another explanation for the insignificant coefficients associated to remittances for the countries with low level of financial development is linked to the measurement error for remittances in these countries. We conclude that there is neither substitution effect, nor complementary effect between remittances and growth in financially underdeveloped countries.

Secondly, for the financial development level between 20% and 50%, the relationship between remittances and growth is positive, all other things being equal, an increase of 1% in the remittances enhances the economic growth about 0.5%. In particular, consistent with the complementarity hypothesis, remittances appear to promote economic growth in countries where the size of the financial sector is at middle stage. This means that only a small group of countries can have benefit effects from remittances. Our results are close of those provided by Bettin and Zazzaro (2012) who found that remittances have positive effect on economic growth only if the domestic banking system is sufficiently sound. The positive relationship between remittances and economic growth confirms the theoretical findings and highlights the importance of migrants' transfers through financial development. Nonetheless, this positive effect can also occur through human capital, and consumption and investment channels. This positive effect can happen if financial sector has suitable size in order to funnel remittances to productive uses. For instance, given the middle level of financial development in developing countries, remittances are alternative financing sources for the realization of investment projects, increasing and smoothing consumption of the beneficiary households. At the same time, remittances improve human capital stock by allowing the enrolment of children in recipient households and the access to health care of the beneficiaries. These effects of remittances on the countries' structural aggregates finally spur economic growth.

Finally, for higher levels of financial development (more than 50%), the impact of remittances on growth is not significant. At the same time, financial development has a high and significant impact, suggesting that financial sector plays a key role in the economy financing over remittances (Beck et al., 2000). Then, in financially developed countries, productive investments are financed by the banking sector and not by migrants' transfers. This result is in the line with the funding of Rao and Hassan (2011).

4.3. Robustness checks

In light of the main empirical results, a simple robustness consists of performing System Generalized Method of Moments regressions (SGMM) which address endogeneity problem. On the one hand, we consider the global sample, on the other hand, we split the sample according to the level of financial development identified from the previous threshold tests and compare the impact of remittances across sub-sample.

As far as the global sample is concerned, we find that the estimation results are qualitatively unchanged. The regressions satisfy the specification tests (AR1, AR2, Hansen and Sargan tests). There is no evidence of a second serial correlation, but there is strong evidence of a first serial correlation. Moreover, the regressions pass the Hansen and Sargan tests and confirm the validity of the instruments. Indeed, table 5a shows that the impact of remittances on growth is positive and significant in all cases. With regard to financial development, as mentioned above, we use four traditional quantity-based indicators. We find that financial development is positively correlated with economic growth in all cases. Overall, it seems to be complementary between remittances and financial development in boosting economic growth. Our results are in line with Bettin and Zazzaro (2012) but contrast to studies by Giuliano and Ruiz-Arranz (2009), Calderon et al. (2008) and Barajas et al. (2009).

Table 5a: Dynamic panel data estimation with System GMM for global sample

	(1)	(2)	(3)	(4)
Estimated Threshold				
L.lgdp	-0.637 (0.470)	-0.217 (0.539)	-0.358 (0.488)	-0.209 (0.536)
Rem	0.389** (0.202)	0.438** (0.213)	0.491** (0.221)	0.399** (0.201)
M2/GDP	0.469** (0.225)			
Private		0.521** (0.255)		
Credit			0.520** (0.216)	
Bank				0.470** (0.215)
Gov	-1.620** (0.770)	-1.718** (0.826)	-1.660** (0.807)	-1.799** (0.829)
Invest	4.347*** (0.880)	4.874*** (1.055)	4.642*** (0.977)	4.803*** (1.099)
Trade	1.022** (0.450)	1.199** (0.508)	0.872** (0.385)	1.273** (0.528)
School	0.457 (0.787)	0.332 (0.707)	0.571 (0.731)	0.344 (0.720)
Inflation	-0.035*** (0.010)	-0.034*** (0.011)	-0.030*** (0.010)	-0.035*** (0.010)
Constant	-9.054** (4.192)	-11.13** (4.948)	-8.924* (4.617)	-11.29** (5.139)
AR2 (<i>p-value</i>)	0.505	0.562	0.541	0.556
Sargan test (<i>p-value</i>)	0.000	0.000	0.000	0.000
Hansen test (<i>p-value</i>)	0.164	0.123	0.120	0.156
Number of countries	76	76	76	76

Notes: Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Moving on sub-samples according to the level of financial development, we find that remittances do not seem to have an impact in countries with less developed financial system (tables 5b and 5c). However, when the size of the financial development is at middle stage, we find strong evidence of a positive and significant coefficient of remittances flows on economic growth. These results confirm our findings from PTR specification. Therefore, accounting for endogeneity, remittances seem to have positive and significant impact only in countries with middle financial development. Developed financial sector enhances economic growth, while the remittances' effects become insignificant. Taken together, our work provides evidence of complementarity between remittances and financial development in fostering economic growth. The impact of remittances is not homogeneous across the countries and depends on the levels of financial development in the recipient countries.

Table 5b: Dynamic panel data estimation with System GMM

Estimated Threshold	M2/GDP			Private		
	≤ 19.141	]19.141, 85.271]	>85.271	≤ 16.880	]16.880, 47.449[	>47.449
L.lgdp	-1.562 (0.947)	-1.153** (0.547)	-1.362** (0.623)	-0.403 (0.770)	-0.388 (0.974)	-3.214*** (1.094)
Rem	0.192 (0.270)	0.410** (0.201)	-0.207 (0.161)	0.344 (0.299)	0.388** (0.185)	0.370 (0.317)
M2_GDP	0.171 (0.137)	0.649** (0.230)	0.810** (0.328)			
Private				0.892 (0.561)	0.757** (0.206)	1.087 (1.214)
Gov	-1.838** (0.535)	-2.440*** (0.808)	-2.232 (1.369)	-1.287** (0.601)	-3.199*** (0.932)	-0.485 (0.554)
Invest	1.549* (0.868)	4.821*** (1.005)	5.429*** (0.856)	0.828 (0.972)	6.367*** (0.938)	5.107** (1.945)
Trade	1.433** (0.642)	1.177** (0.475)	1.442** (0.682)	2.478** (1.188)	1.482** (0.694)	1.383*** (0.503)
School	1.702 (1.072)	0.0150 (0.672)	0.855** (0.335)	0.185 (1.050)	1.823 (1.411)	4.662** (2.178)
Inflation	-0.038 (0.025)	-0.035** (0.014)	-0.019* (0.009)	-0.049** (0.020)	-0.026** (0.013)	-0.044** (0.022)
Constant	4.310 (4.817)	-13.830** (5.815)	2.499 (13.80)	-4.653 (4.399)	-7.131 (4.533)	0.257 (1.043)
AR2 (<i>p-value</i>)	0.694	0.520	0.194	0.168	0.296	0.768
Sargan test (<i>p-value</i>)	0.028	0.000	0.028	0.040	0.000	0.000
Hansen test (<i>p-value</i>)	1.000	0.183	1.000	0.968	0.425	1.000
Number of countries	23	72	15	49	60	27

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

What determines a country's capacity to profit from migrants' remittances? A natural candidate to make remittances effective for growth is the level of financial development in receiving countries. In this regard, investigating the non-linearity between remittances, financial development and growth, Giuliano and Ruiz-Arranz (2009), Bettin and Zazaro (2012) among others put forward the existence of a threshold above and below which the growth effects of remittances differ. While the former has provided evidence of substitutability between remittances and financial development in fostering growth, the latter finds the existence of complementarity between both variables.

In this paper, we test the existence of financial development threshold effects in the remittances-growth relationship and try to justify the conflicting results obtained by the previous authors. Using a sample of 76 developing countries for the period 1975-2013 and Panel Threshold Regression (PTR) model proposed by Hansen (1999), we find that the impact of remittances on growth varies across levels of financial development in the recipient countries. For lower (less than 20%) and higher (more than 50%) level of financial development, the impact of remittances on growth is practically nil. For the financial development level between 20% and 50%, the relationship between remittances and growth is positive, all other things being equal, an increase of 1% in the remittances enhances the economic growth about 0.5%. Remittances promote economic growth only in countries whose banks function relatively well. Our results are closely related to Bettin and Zazzaro (2012) who show the existence of complementarity between remittances and financial development in promoting economic growth. We control for the endogeneity of remittances and financial development using a SGMM approach. The results qualitatively remain unchanged.

This article suggests that some countries enjoy much greater growth from remittances than others. The main policy recommendation is that public authorities in recipient economies might implement policies that take into account the reality of each recipient economy given our findings. Naïve recommendations in favor of important remittances in all situations must be taken with caution. Furthermore, the empirical findings suggest that more finance is definitively not always better. Therefore, knowing the optimal level of financial development is more crucial in the recipient country.

Table 5c: Dynamic panel data estimation with System GMM

	(1)	(2)	(3)	(4)	(5)	(6)
	Credit			Bank		
Estimated Threshold	≤ 20.484	]20.484, 59.245]	>59.245	≤ 16.876	]16.876, 47.449]	>47.449
L.lgdp	-0.838 (1.171)	-0.441 (1.049)	-1.317 (1.005)	-0.234 (0.748)	-0.148 (0.913)	-1.690 (1.351)
Rem	0.432 (0.277)	0.315** (0.144)	-0.287 (0.453)	0.222 (0.252)	0.592** (0.255)	0.367 (0.305)
Credit	0.431 (0.542)	1.239** (0.534)	1.668** (0.610)			
Bank				0.366 (0.633)	1.355** (0.547)	2.150** (0.825)
Gov	-0.600 (1.398)	-3.407*** (1.022)	-1.221 (1.234)	-0.765 (1.154)	-2.841*** (0.913)	-4.176 (3.454)
Invest	1.117 (0.919)	4.242*** (1.077)	7.386*** (1.330)	0.364 (1.037)	6.302*** (1.025)	4.643*** (1.529)
Trade	2.175** (1.089)	1.340** (0.676)	1.211** (0.554)	1.989** (0.887)	1.252** (0.542)	1.534 (0.616)
School	0.904 (1.003)	1.173 (1.081)	2.227 (2.058)	0.0874 (1.028)	1.449 (1.535)	2.789 (2.994)
Inflation	-0.698 (0.153)	-0.531*** (0.142)	-0.401* (0.225)	-0.654** (0.271)	-0.130 (0.177)	-0.121 (0.092)
Constant	-2.603 (1.469)	-4.037 (3.761)	-1.409* (0.514)	-4.505 (4.746)	-1.110** (5.361)	1.680 (1.750)
AR2 (<i>p</i> -value)	0.529	0.570	0.705	0.304	0.432	0.898
Sargan test (<i>p</i> value)	0.292	0.000	0.036	0.050	0.000	0.003
Hansen test (<i>p</i> -value)	1.000	0.516	1.000	0.892	0.520	1.000
Number of countries	34	63	32	50	62	24

Notes: Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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