Remittances, finance and growth: does financial development foster remittances and their impact on economic growth?*

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Preliminary. This version: March 28, 2015

Abstract

In this paper, I measure the importance of remittances and financial development for developing countries. I estimate a financial sector development index and use it to determine the relevance of finance as a transmission channel for remittances to affect economic growth. The index brings together information from existing measures, reflecting size, depth and efficiency of the financial sector. It is created by means of an unobserved components model. I show that the more financial development in a country, the more negative becomes the impact of remittances on economic growth. For countries with weak financial markets there is a positive effect, but significant only at the very earliest stages of financial development. The effect becomes negative already around mean financial development. These results hold irrespective of the measure of financial development included, but are most profound in case of the created index. This means that estimates based on proxies might be slightly biased. I also show that countries with both low levels of remittances and financial development should first focus on developing the latter, while migrants' transfers become important for growth if they reach high levels.

JEL classification: F24, O11, O15 and O16

Keywords: remittances, economic growth, financial development, unobserved components model, dynamic panel data analysis.

*I thank Michael Binder, Philipp Harms, Mauro Rodrigues Jr. and the participants of the GSEFM Summer Institute for their helpful comments. Responsibility for all remaining errors rests with the author.

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1 Introduction

There is a vast literature on the importance of remittances for development and poverty alleviation, especially for small countries where the ratio of remittances to GDP is high, reaching more than 30% (e.g. Lesotho – with the average ratio over 50%, Moldova, Tajikistan, Tonga, Samoa[1]). Given these large numbers, sometimes even bigger than the value of foreign direct investment (FDI) or official development assistance (ODA), many researchers have examined the impact of these transfers on economic growth in receiving countries. Although no consensus has been reached so far, remittances are generally believed to enhance economic growth through indirect channels (mainly through investment and human capital formation). Yet, studies focusing on their direct impact on GDP per capita growth[2] suggest a negative or at best insignificant relationship (Chami, Fullenkamp, and Jahjah (2003); Gapen, Chami, Montiel, Barajas, and Fullenkamp (2009); Rao and Hassan (2011)).

Rao and Hassan (2012); Senbeta (2013) show that the direct effect of remittances on economic growth may be nil but these transfers still can affect GDP per capita through different channels: investment, financial development, output volatility, total factor productivity (TFP) and the real exchange rate. However on aggregate the effects can seem to cancel out. Senbeta (2013) argues additionally that the negligible remittance impact on TFP justifies the lack of significance of migrants' transfers on long-run economic growth. More recently, Clemens and McKenzie (2014) have shown that the rapid increase in remittances recorded after the year 2000 is due to changes in definition of the transfers rather than actual sudden higher values. In this context, they do not expect remittance measured based on Balance of Payments data to show significant growth-enhancing effects.

Only few studies have found positive causal links between remittances and growth (The World Bank (2006); Giuliano and Ruiz-Arranz (2009); Catrinescu, Leon-Ledesma, Piracha, and Quillin (2009); Ramirez and Sharma (2009); Ramirez (2013)[3]). Giuliano and Ruiz-Arranz (2009) show that remittances can significantly improve economic growth, if the financial sector development is taken into account (showing that financial sector can be a channel through which remittances affect growth). They also argue that migrants' transfers and the financial sector can be substitutes – their growth model includes an interaction term between the two variables and this term has negative sign, as expected by the authors. They interpret this result as follows. If the financial sector is well developed, credit constraints are removed and remittances received from relatives from abroad need not be used in a productive way. However in countries with poorly developed financial markets remittances can be an important source of financing growth-enhancing activities.

In the conclusions Giuliano and Ruiz-Arranz (2009) express their concern that the results might suffer from bias, related in particular to the omission of measures of institutional quality. Catrinescu

[1]Data sources are described in Section 2

[2]In these studies, estimation equations include measures of investment and human capital in order to partial out the indirect effects of remittances through these channels.

[3]The last two studies consider only selected Latin American and Carribean countries from 1990 to 2005/7. The methodology applied therein (fully-modified OLS) was criticized by Gapen et al. (2009) for limited small sample performance.

et al. (2009) estimate dynamic panel data models including workers' remittances, various measures of institutional quality[4] and interaction terms of the two and show that better quality of institutions strengthens the impact of remittances on economic growth. The direct effect of migrants' transfers however is not robust, and only significantly positive in some of the specifications.

The substitutability found by Giuliano and Ruiz-Arranz (2009) is confirmed by studies focused on Latin American and Caribbean countries by Ramirez and Sharma (2009); Ramirez (2013) and on a larger set of countries by Gapen et al. (2009). However Nyamongo, Misati, Kipyegon, and Ndirangu (2012); Zouheir and Sghaier (2014) provide evidence of the opposite relationship between remittances and financial development in African countries. In this region, the two variables seem to be complements with continuing financial deepening strengthening the positive impact of remittances on growth, rather than mitigating it. As remittances can be deposited in banks, they bring a larger share of the population in contact with the financial sector, expanding the availability of credit and savings products (International Monetary Fund (2005); Aggarwal, Demirgüç-Kunt, and Pería (2011)).

Moreover, countries with underdeveloped financial markets have larger transaction fees and migrants tend to use informal channels instead (e.g. hawala in parts of Asia and Africa). Freund and Spatafora (2005) estimate that official remittance data underrates their value by 35 to 75% which means that the true impact of such transfers on GDP might still be understated, and Freund and Spatafora (2008) show that lowering transaction costs by 1 percentage point would lead to remittance increasing by 14-23%. This view is supported e.g. by Ratha (2003): "*By strengthening financial-sector infrastructure and facilitating international travel, countries could increase remittance flows, thereby bringing more funds into formal channels.*" (p. 157).

Bettin and Zazzaro (2012) explain that the negative sign of the interaction term between remittances and financial development need not necessarily indicate that these two are substitutes and can be considered as alternative sources of financing productive investment for economic growth. They explain, following Rioja and Valev (2004) and Gapen et al. (2009), that this coefficient may capture a nonlinear effect of the size of financial sector on output growth. This is in line with an alternative interpretation of the interaction term between remittances and financial sector development, focused on the marginal effect of the latter rather that that of migrants' transfers. In this case, the negative sign of the interaction term coefficient can mean that growing remittances increase bank deposits and available credit but loans are not necessarily given in an efficient way. Therefore, this remittance-driven rise in the financial sector size does not contribute to economic growth.

For this reason, Bettin and Zazzaro (2012) construct a measure of financial development related to its (in)efficiency rather than its size and provide evidence for remittances financial sector's efficiency to act as complements for economic prosperity. The efficiency of the financial sector in a given country is measured as the weighted average of the ratio banks' operating expenses to their net interest revenues

[4]They use Corruption Perceptions Index from Transparency International and political risk indicators from the International Country Risk Guide.

and other income[5]. Higher outcomes are related to less efficient financial intermediation. Bettin and Zazzaro (2012) show that the combined effect of remittances on economic growth is lower the larger the size of the financial sector (substitutes) but it is higher the more efficient the financial sector is (complements).

There are several challenges associated with measuring the impact of remittances and financial sector development on economic growth. For many developing countries (according to World Bank's classification of countries) data on financial indicators (e.g. in the Financial Structure Dataset) are generally available only for short time periods or with gaps. There is also no consensus as for an adequate measure of financial development – Giuliano and Ruiz-Arranz (2009) used four different proxies: deposit to GDP ratio, loan to GDP ratio, credit to GDP ratio and M2 to GDP ratio to provide some insight about different aspects of financial sector development[6]. All of them refer only to the size of the financial sector, therefore Bettin and Zazzaro (2012) used their own measure of bank inefficiency, but due to data availability their sample is limited to the time period from 1991 to 2005 and inference about long-run trends is rather limited.

For these reasons it is desirable to create a measure of financial development which would capture more aspects of the financial sector, helping to evaluate the true impact of remittances on growth and the role of the financial intermediaries in this process. In this paper I tackle this problem by using an unobserved components model in which a financial development indicator is extracted from available information, stemming from existing measures describing the size, depth and efficiency of the financial sector, combining measures of size suggested by Giuliano and Ruiz-Arranz (2009) and measures of efficiency others than in Bettin and Zazzaro (2012) due to better data availability.

The proposed measure can provide information about the overall impact of financial sector development on the remittance-growth relationship. By combining elements of size and efficiency of the financial sector, it takes into account the fact that availability of credit in the economy is determined both by bank efficiency (bureaucracy related to the application and decision process) and to availability of financial resources. The proposed measure assigns lower values of financial development to countries who have high deposits or credit to GDP ratio but inefficient banks and non-banking institutions. Similarly in the opposite situation, the score of countries with very high efficiency but low size proxies is also adjusted downwards. The first case allows to control for loans which were given out not for the most productive use, and the second case accounts for the fact that even if procedures related with obtaining a loan are simple, applicants may not be able to receive financial support due to unavailability of financial resources.

The main purpose of this paper is therefore to verify whether size or efficiency matter more – does the "overall financial development" strengthen the effect of remittances on economic growth in transfer-receiving developing countries (positive coefficient on the remttance-finance interaction term) or is it

[5]The data covers 53,820 banks in 66 developing countries over the time period 1990-2005.

[6]In his study for Ghana, Adenutsi (2011) provides a broader list with potential measures of financial development, including additionally: stock price index or market capitalization index, level of nominal interest rates, real interest rate growth, bank credit to the private sector to private deposits ratio, spread between deposit and lending rate, etc.

a substitute to remittances, removing credit constraints, providing financial resources for productive activities and allowing transfer recipients to spend remittances in a different, non-growth enhancing way (negative impact of the remittance-finance interaction term on GDP per capita growth)?

Another issue pertaining to this research question is the potential endogeneity of financial development measures and remittances. This paper follows the standard procedure of using lagged values as internal instruments for these variables in a system GMM (SGMM) setup. The quasi-maximum likelihood for dynamic panel data with fixed effects (QML-FE), which is another method applied, is correct under weak exogeneity of these regressors. This is a stronger assumption but still reasonable, given that all regressors are lagged by one year with respect to the dependent variable. The advantage of QML-FE is that it is not necessary to use any instruments and weak instrument problems described by Roodman (2009); Bazzi and Clemens (2013). To remove most common sources of cross-sectional dependence, time dummies are included in all regressions.

The results of this paper show that the impact of remittances on economic growth indeed depends on the level of financial development. For countries with the least advanced financial sectors there is evidence for positive correlation between remittances and growth, but the effect turns negative with increasing financial development. For countries who already reached high levels of financial development, remittances become irrelevant and can even lead to small output losses. This means, that remittances and financial development can be seen as substitutes. Nonetheless, some initial financial development is an important prerequisite to induce economic development and to foster remittances. On the other hand, migrants' transfers are especially profitable for countries who already receive substantial remittances. The results do not change significantly when years 2007-2009 (world financial crisis) are excluded from the sample, although there is some evidence showing that the substitution between remittances and financial development has weakened during the crisis.

The structure of the paper is following: Section 2 gives a detailed description of the data used for the creation of the index and for estimation, Section 3 includes a brief overview of the methodology applied, both for the index formation and for growth regressions. In Section 4 I present the results concerning the financial development index and in Section 5 the results of the growth model for a large cross-section of countries over the time period 1970-2010. All regressions are repeated for four different measures of financial development, first the overall financial conditions index and then for some of the variables which were used for its formulation. I control for measures of investment, government expenditure and human capital. Section 5 includes also two counterfactual scenarios, firstly of the impact on economic growth if remittances or financial development remained constant at their initial level for each country, and secondly if they were growing faster then in reality – by 20% each 5 years. Section 6 provides evidence for some weak structural changes which appeared during the financial crisis so that the role of the financial sector as a substitute for remittances has weakened. Section 7 concludes.

2 Data issues

2.1 Remittance data

As mentioned above, the reliability of remittance data is limited. At global level, receipts of remittances exceed their payments and this discrepancy is growing over time, see International Monetary Fund (2009). This is a problem especially in least developed countries where differences in costs between sending monies through the banking sector as compared to informal channels are large (and, moreover, transfers in-kind or carrying cash across borders is very popular). Improving the quality of the data (e.g. by estimating informal flows from transaction fees or errors and omissions post in the BoP) is beyond the scope of this paper.

Yet, there are differences among the existing official data sources and they need to be considered. One general practice is to compile the value of remittances from the balance of payments data published by the IMF. This is a cumbersome task, as local authorities are at freedom to define how remittances are recorded (some countries do not report this information to the IMF at all, e.g. Canada). The World Bank publishes corrected data, compiled according to Dilip Ratha's definition (Ratha (2003)), though. This data is part of the Migration and Remittances Prospects and it includes also monthly remittance data for selected countries and bilateral migration flows on decennial basis. In this study I use annual remittance inflows data from this World Bank dataset.

It is crucial to emphasize what kinds of transfers are reflected in official statistics (given the definition of remittances in the Balance of Payments), since this translates into the direction of their impact on economic growth. Migrants transfer parts of their income back home for two main reasons: altruistic and selfish – the "portfolio motive" (see e.g. Schiopu and Siegfried (2006), Bouhga-Hagbe (2004)). The former is related to supporting family members who stayed in the home country, mainly in times of bad economic conditions (countercyclical behavior), while the latter is motivated by portfolio diversification reasons (procyclical). The first kind of transfers is usually part of remittances, although it depends on the amount sent – some countries set up thresholds below which transactions are not recorded. The second one should not be included in official remittance statistics (e.g. if the money is transferred to the migrant's own account – as bank deposits or investments – or if real estates are acquired at home) it should be booked in the financial account instead. However, this is ambiguous. If relatives in the home country can withdraw money from the migrant's account, these cash withdrawals can be viewed as remittances again. Therefore, in principle, remittances data should only reflect altruistic transfers, implying that migrants' transfers could possibly lower economic growth through real exchange rate appreciation and resource reallocation from tradable goods to non-tradable goods production – the Dutch disease, see Acosta, Lartey, and Mandelman (2009). However, as these monies can be spent on investment in education or in starting a business, it may also generate long-run growth. This paper tries to evaluate which motive dominates by quantifying growth effects of remittances.

Given that the official remittance data reflect different kinds of transfers, including both consump-

tion and investment expenditure, different models exist, explaining the direction of the impact of remittances on GDP. On one hand, Chami et al. (2003) claim that the consumption purpose dominates[7]. In their model, moral hazard problems occur and family members at home lower their labor supply leading to negative growth impacts of the transfers. On the other hand, Giuliano and Ruiz-Arranz (2009) provide a model where resources from migrants are spent on productive investment and growth impact is positive (also Freund and Spatafora (2008)). Some authors point out strong altruistic motives and negligible self-interest portfolio motives, see Bouhga-Hagbe (2004); Schiopu and Siegfried (2006), while others show an inverted-U relationship between remittances and GDP in the home economy and positive dependence on the domestic interest rate, see Adams (2009).

Until now, no possibility of disentangling the two types of transfer spending has been proposed for a broad range of countries[8]. There is evidence from gravity models suggesting that the two motives summed explain less than half of the transfer flows and more than 50% is generated by links between the sending and receiving countries (distance, common language, common history, etc.; see e.g. Lueth and Ruiz-Arranz (2006) or Balli, Guven, Gounder, and Ozer-Balli (2010)), which means that separating the altruistic motive from the portfolio motive would lead to a substantial underestimation of the total value of the transfers. For this reason it is also difficult to draw conclusions as for what should be the overall impact of remittances on economic growth. This is one drawback of large cross-country studies with aggregate remittance data. Nevertheless, I would expect a negative correlation at a shorter time horizon but positive effects in the longer term, as there is some evidence for such relationships in the literature.

2.2 Data on financial development and the composition of the index

Some of the important purposes of the financial sector can be summarized as follows[9]:

- "*The role of the financial system is to transform liquid, short-term savings into relatively illiquid, long-term investments, thus promoting capital accumulation.*" (The Wold Bank (2005), p.22)
- "*Financial markets have an important role in channeling investment capital to its highest value use.*" (Huang (2011))

There is no composite measure which would perfectly gauge the ability of the financial sector to transform savings into investments. However, such an indicator can be obtained by combining information from various existing measures. Data on financial development used in this paper come

[7]They motivate this claim by results of previous empirical studies and by their first-stage regression results showing that remittances are significantly correlated to GDP differentials but not to interest rate differentials between the home country and the U.S. (2SLS instrumenting remittances with the two aforementioned variables)

[8]For Sub-Saharan countries, Arezki and Brueckner (2012) use rainfall as an instrument for GDP to disentangle the altruistic motive and check whether it is a significant determinant of remittances. They also show that this motive plays an important role when financial development is low – remittances may help overcome domestic credit constraints and take advantage of unexploited investment opportunities.

[9]An important purpose of the financial sector is to provide opportunities for risk sharing. This aspect is not considered in this paper to simplify interpretations of the estimated coefficients.

mostly from the World Bank's "A Database on Financial Development and Structure" (updated in April 2013). This data set covers 203 jurisdictions over the time period 1960 - 2010. Some variables come from the World Bank's World Development Indicators (WDI) database. The following variables have been chosen to form the financial indicator (definitions from The Wold Bank (2005)):

1. **overall size of the financial system**:
    - financial system deposits to GDP ratio (%) - deposits in deposit money banks and other financial institutions as a share of GDP
    - liquid liabilities to GDP ratio (%) - defined as M3 to GDP ratio, used when deposits to GDP ratio not available (it is broader than M2 as it includes money deposits apart from cash, and therefore reflects better the ability of an economy to channel funds from savers to borrowers.) The advantage of this measure is broad availability, but it includes M2, therefore may be driven by factors other than financial depth and reflect more the ability of the system to merely provide transaction services, see Khan and Senhadji (2000).
2. **financial institution depth** (other than in 1): provision of credit to the economy
    - private credit by deposit money banks and other financial institutions to GDP ratio (%) - all loans offered by commercial banks and other financial institutions
    - domestic credit to the private sector to GDP ratio (%) - only domestic loans to the private sector (both measures from WDI)
3. **institutional efficiency** - ability of the financial sector to provide high-quality products and services at the lowest cost
    - interest rate spread - difference between the lending and the deposit interest rate (reflects the value of loan-loss provisions and the risk premium associated with loans to high-risk borrowers)
    - deposit interest rate (%)
    - overhead costs to total assets (%) - total costs of financial intermediation, including operating costs, taxes, loan-loss provisions, net profits, etc.

Such a measure is able to combine both, size and efficiency, aspects of the financial sector, therefore passing the critique raised by Gapen et al. (2009) and Bettin and Zazzaro (2012) that most studies only focus on measures of size of the financial sector, ignoring its efficiency. If this measure of overall financial development is used, concerns related to the interaction term between finance and remittances reflecting non-linear effects of the size of financial sector increasing with growing migrants' transfers are limited. As a measure of "overall financial conditions", this index also accounts for the fact that high bank efficiency may not be enough for a liquid financial sector, if availability of financial resources is limited (small size of the financial sector).

There is, however, one aspect that is not considered by the constructed index. This measure captures the availability of the financial sector to transform liquid deposits into illiquid investments, but it does not capture advantages in terms of risk sharing, allowing for consumption and output

smoothing. As these are difficult to measure, they are not included. This might be a shortcoming of all commonly used proxies of financial development, as remittances can serve to buffer economic fluctuations, therefore substituting the financial sector.

More detailed information about the construction of the index of "overall financial conditions" is provided in section 3.1.

2.3 Other determinants of economic growth

Main data sources include:

- Penn World Tables version 8.0 and National Accounts and PWT 7.1
- Barro-Lee dataset, version April 2013
- World Development Indicators
- Financial Structure Dataset, version April 2013 (includes Ratha's data on remittance inflows)

Other variables included in the estimations are standard in the growth literature and include measures of: investment, government expenditure, trade openness, population growth and human capital. Most data come from the World Development Indicators database of the World Bank: gross fixed capital formation to GDP ratio, government expenditure to GDP ratio and trade openness (exports+imports to GDP ratio). Data on population size and growth stems from the Penn World Tables version 7.1. Human capital is measured by the share of the population who completed secondary education (from the Barro-Lee database).

The baseline specification of the model does not include any measure of institutions, which can be a drawback for the estimation outcomes. Some authors (e.g. Mansoor and Quillin (2007)) see this as a potential source of bias in the results and argue that the exclusion of this variable may explain the differences in existing results as for the impact of remittances on growth. Catrinescu et al. (2009) and Bettin and Zazzaro (2012) show that the significance (but not the sign) of the direct effect of remittances on economic growth may be affected by the inclusion of measures of political institutions' quality, and the qualitative interpretation of the remittance-finance interaction term coefficient remains unchanged. Therefore the addition of a measure of institutional quality will be considered only as an robustness check due to low data availability and low time-series variation of such variables[10].

Some variables have been transformed into natural logarithms[11] (openness, remittances inflows and all financial development data, as well as real GDP per capita), others are expressed in percentages

[10]Many authors use the World Governance Indicators of Kaufmann, Kraay, and Mastruzzi (2008) as measures of institutional quality. However, the authors of this data base warn potential users that annual variation of the data is very low, with overlapping confidence intervals, therefore they are not appropriate to be analyzed on an annual basis, as was done by Bettin and Zazzaro (2012). Kaufmann et al. (2008) suggest to focus more on developments over decades rather than yearly ones.

[11]More precisely, all variables apart from openness where transformed according to a rule frequently applied to transformation of inflation - values below 1% are changed into $x - 1$ instead of $\log(x)$.

as shares in GDP. Following Mankiw, Romer, and Weil (1992), I add 5 percentage points to the population growth, to account for the capital depreciation rate and long-run GDP growth rate. Tab. 1 shows summary statistics of the transformed data (after taking logarithms and obtaining 5-year time averages) and appendix 8.2 provides information about pairwise correlation between the regressors.

2.4 Estimation sample

The estimation sample consists of developing countries based on the classification used by the IMF[12]. The maximum time period is 1970-2010, non-overlapping 5-year time averages for each country are used in the estimations. Given that remittances are more important for smaller countries, I did not exclude small (with average population below 1 million) and oil-producing countries from the sample, hence not following the study of Mankiw et al. (1992). This should not affect the results to a large extent, since I identified only 5 countries as small (Barbados, Belize, Gabon, Maldives and Swaziland) and 2 as oil-producing (Gabon and Iran) in the set of 54 developing countries. For former communist countries (Central and Eastern European countries, as well as former USSR republics) only data from 1990 onwards are considered. The list of countries and years for which data is available is provided in appendix 8.1.

3 Methodology

3.1 Dynamic factor model ("Single-Index" Model, Stock and Watson (1988)) - construction of the financial development index

The variables described in Section 2.2 have been grouped into the three categories in order to extract the overall, unobserved financial sector indicator (in what follows also referred to as overall financial development or overall financial conditions) from them. A country is only included in the sample if data from at least two out of the three categories to be available for at least 20 time periods (not necessarily consecutive). The model is formalized as follows:

$$\boldsymbol{y_{it}} = \boldsymbol{\alpha} + \boldsymbol{\beta\iota}\text{findev}_{it} + \boldsymbol{w_{it}} \quad (1)$$

$$\text{findev}_{it} = \gamma\text{findev}_{i,t-1} + v_{it} \quad (2)$$

with
$\mathbb{E}(\boldsymbol{w_{it}}) = \boldsymbol{0}\ \forall i, t$

[12] All developing countries are assigned to one of the following regions: Central and Eastern Europe, Commonwealth of Independent States, developing Asia, Latin America and the Caribbean, Middle East and North Africa and Sub-Saharan Africa)

$$\mathbb{E}(\boldsymbol{w_{it}}\boldsymbol{w_{is}}') = \begin{cases} \boldsymbol{\Sigma} \text{ if t=s} \\ \mathbf{0} \text{ otherwise} \end{cases}$$
$\mathbb{E}(v_{it}) = 0,\ \mathbb{E}(v_{it}^2) = 1\ \forall i, t$

where $\boldsymbol{y_{it}}$ is a $k \times 1$ vector consisting of measures of financial development from the three categories ($k = 3$ if all three measures are available for a country i at time t, otherwise $k \in \{0, 1, 2\}$); $findev_{it}$ is a scalar representing the unobserved financial sector development measure for country i at time period t and $\boldsymbol{w_{it}}$ is the idiosyncratic error. $\boldsymbol{\iota}$ is a vector of ones with the same dimension as the data in $\boldsymbol{y_{it}}$ (dimension k). t in this setup refers to a 1-year time period (in the latter growth regressions it will stand for 5-year time averages).

Equation (1) is referred to as the "measurement equation" (or observation equation), and equation (2) is the "state equation". In this case they are estimated jointly for all countries (parameters are not country-specific) by MLE and the Kalman Filter[13]. This specification is based on the assumption that existing measures of financial development are determined by the overall state of the financial development which is unobserved. This variable is estimated jointly with the vector of unknown parameters:

$\boldsymbol{\theta} = \{\boldsymbol{\alpha}, \boldsymbol{\beta}, \gamma, \text{vech}(\boldsymbol{\Sigma})\}$.

The methodology builds on the idea of Stock and Watson (1988) (for one country), Kaufmann et al. (2008) (extended to panel data) and Binder, Georgiadis, and Sharma (2009)[14]. In contrast to the previous literature, the data generating process of the unobserved component (the financial sector development index) is assumed to be autoregressive (with one relevant lag). In this way, I allow for persistence in the development of the index. It accounts for two special cases: a random walk and a process with no memory (identical and independent draws from a given distribution). The latter was the specification chosen in other studies. The Kalman Filter accommodates AR(1) processes (see e.g. Hamilton (1995)). In fact, the financial development index turns out to be close to following a random walk (see Section 4 for the results).

This specification of the model accounts for random effects (which are included in the composite error terms $\boldsymbol{w_{it}}$ and v_{it}). It does not allow for fixed effects in the state equation since information about the level of the unobserved financial conditions index would be lost after taking the first difference of this equation, and therefore it would preclude making international comparisons of the financial development index (which is necessary to ensure reliability of the obtained overall financial conditions values). Fixed effects in the measurement equation are possible to implement but it would lead to inconsistency between the two equations, if correlation between the unobserved effects and regressors was allowed in the measurement but not in the state equation.

[13]The Kalman filter is the best linear unbiased predictor of unobserved states even if the normality assumption on errors from equations (1) and (2) does not hold. If it holds, and the initial states are also normally distributed, the Kalman filter gives the best prediction among all possible functional forms, not only among the linear ones.

[14]Stock and Watson (1988) have used a single-index model to estimate the overall state of the American economy, Kaufmann et al. (2008) have estimated various dimensions of governance in 212 countries over 1996-2007, while Binder et al. (2009) used this kind of model to obtain a financial development index and a institutions development index for 60 countries in 1970-2006, but only a small subset of them are developing countries.

Another advantage of this methodology is the fact that it accounts for missing values. Countries for which not all observations for each time period are available can be included in the sample, since the estimation-maximization (EM) algorithm applied estimates the value of the unobserved component consistently even in the presence of missing values (Durbin and Koopman (2001)). More details on the estimation procedure are provided in the Appendix in Section 8.3.

3.2 Dynamic panel data models for growth regressions

Given the dynamic structure of the model and a "short T, large N" specification of the panel data, I use system GMM (Arellano and Bover (1995); Blundell and Bond (1997)). The advantage of this approach is that it allows for endogenous regressors and takes account of the endogeneity of the lagged dependent variable at the same time. Moreover, it models initial observations for the sake of including the first time period. Given that the equation is being estimated also in levels, apart from differences, the model can include time-invariant regressors. To include as many observations for unbalanced models as possible, forward orthogonalization can be used instead of first differences. There are disadvantages too, though. This method has been criticized for low robustness against the instrument choice, in particular in large models weak instruments may cause the estimates to be biased[15]. For these reasons I use the quasi maximum likelihood estimator for fixed effects dynamic panel data developed by Hsiao, Pesaran, and Tahmiscioglu (2002), as well. Both methods are suitable for short dynamic panels with a persistent left hand side variable. While in system GMM it is possible to use second and older lags as GMM-style instruments for potentially endogenous variables, QML-FE allows only for weakly (and strictly) exogenous regressors.

The estimation equation looks as follows:

$$y_{it} = \alpha + \gamma y_{i,t-1} + \delta_1 \text{Rem}_{it} + \delta_2 \text{FinDev}_{it} + \delta_3 \text{Rem}_{it}\text{FinDev}_{it} + \boldsymbol{\beta X_{it}} + \mu_i + \eta_t + \epsilon_{it} \tag{3}$$

where the left hand side variable is the 5-year average real GDP per capita, Rem_{it} denotes the share of remittance inflows to GDP of the transfer-receiving country, FinDev_{it} is a measure of financial development (estimations were repeated for four different measures, all variables expressed in natural logarithms) and the vector $\boldsymbol{X_{it}}$ includes all other regressions from Section 2.3. η_t refers to common unobserved shocks and is approximated by year dummy variables. In this way, potential cross-sectional correlation is limited. To ensure that no such dependence among countries prevails in the model I perform the SYR test (results available from the author on request), developed by Sarafidis, Yamagata, and Robertson (2009)[16].

Following standard procedures in the economic growth literature, lagged values of the dependent variable and of the regressors, which are assumed to be weakly exogenous, are used as "GMM style

[15] For a comprehensive critique of GMM estimators refer to Bazzi and Clemens (2013)

[16] A simple way to perform this test was proposed by De Hoyos and Sarafidis (2006) and consists of computing the difference in Sargan's statistics for overidentifying restrictions from two GMM regressions - one with the full set of instruments and one without instruments with respect to the lagged dependent variable. A large discrepancy between the two values indicates presence of cross-sectional correlation.

instruments". Only the first lag of each regressor is included, and I use the 'collapse" option in Stata to keep the overall number of instruments at a reasonable level (in case of the instruments for the lagged GDP per capita level, in the differenced equation the first and second lags are included). Exogenous variables (time dummies) serve as instruments for themselves ("IV style"). Estimation tables include Hansen's test statistics for overidentifying restrictions which can help evaluate the quality of the instruments.

Such a formulation of the model including an interaction term between remittances and financial development allows for a nonlinear impact of remittances on economic growth, depending on the level of financial development of the transfer-receiving country. This means that remittances might be particularly important only for a subgroup of countries, e.g. those with lowest levels of financial development which is the main hypothesis of this paper. For countries with more developed financial markets I expect the impact of remittances on economic growth to be reduced.

3.3 Generated regressor problem

The inclusion of the estimated overall financial conditions index in the regressions brings about advantages as well as challenges. The former have been already discussed and refer to measuring better the different aspects of financial sector in one indicator, as well as imputing information for countries with missing values. Problems, however, are related to the additional uncertainty added to the model if an estimated variable is included instead of its observed value.

The problem was first pointed out by Pagan (1984) and Murphy and Topel (2002). They propose different two-step maximum likelihood procedures in order to account for the bias in the standard errors of the coefficients. Alternatively bootstrap can be used to correct the standard errors, as was done by Ashraf and Galor (2013). In this paper I follow this approach due to its simplicity.

The procedure is as follows. First, countries are drawn with replacement from the set of all available countries (not only developing). For the chosen set of countries I run the Kalman filter to estimate the unobserved financial development indicator. The values of the indicator are stored, and the sample is then limited to include only developing countries. System GMM and QML-FE regressions are then run on this sample with possibly repeating countries. I store coefficient estimates from each regression. This procedure is repeated N times ($N = 1200$), however for the QML-FE the repetition of observations creates problems and leads to the log-likelihood function not being concave, therefore parameter values are only stored for ca. 90% of the runs. Standard errors which are displayed in the following tables are computed as standard deviations of the parameter estimates from the 1200 runs of the bootstrap procedure outlined in this section. This procedure closely follows the one of Ashraf and Galor (2013), who generate (1000 times) a variable measuring migratory distance from East Africa to destination country in order to predict ethnical diversity (ethnical diversity was only available for 21 countries) and use this diversity to explain population density in AD 1500 in 145 countries.

4 The financial development index - results

The index of financial development was estimated for 142 countries on annual basis over the time period from 1970 to 2010 (or other longest available). The resulting relationship between the underlying variables and the constructed index can be summarized by the following equations (standard errors in brackets):

$$\begin{pmatrix} Y_{it}^1 \\ Y_{it}^2 \\ Y_{it}^3 \end{pmatrix} = \begin{pmatrix} 3.42[0.06] \\ 3.32[0.07] \\ 1.73[0.07] \end{pmatrix} + \begin{pmatrix} 0.14[0.01] \\ 0.15[0.01] \\ -0.04[0.01] \end{pmatrix} \times \text{FinDev}_{it} \quad (4)$$

$$\text{FinDev}_{it} = 0.99[0.002] \times \text{FinDev}_{i,t-1} \quad (5)$$

All coefficients in equations (4) and (5) are statistically significant at 1% significance level. The first vector in equation (4) ($\boldsymbol{\alpha}$ in equation (1)) refers to the estimated means of the variables from each of the three categories used for extracting the overall financial conditions index, abstracting from the index values. The second vector ($\boldsymbol{\beta}$ in equation (1)) reflects the strength of the dependence of the observable measures on the unobserved overall financial conditions indicator. The coefficients can be interpreted as follows – the higher financial development in general, the higher financial deposits to GDP ratio and credit to GDP ratio ($\beta(1)$ and $\beta(2)$). A higher level of financial development leads to higher institutional efficiency, represented by decreasing interest rate spreads – hence the negative sign of $\beta(3)$.

Section 8.4 provides a ranking of financial development, based on the time mean of the estimated index for each country. As expected, advanced economies take the highest positions, with East Asian, European countries and the United States forming the top 10. The location of small countries can be surprising but it is due to large financial deposits to GDP ratios. The index corrects this information by including data from other measures, but is unable to remove this effect completely.

The leaders in the group of developing countries included in the estimations in this paper are Malaysia (17), St. Kitts and Nevis (19), Lebanon (21), South Africa (22) and Thailand (24). As for European countries (which belong to developing countries according to IMF), only four are included in the ranking: Hungary (55), Bulgaria (58), Poland (66) and Turkey (94). The leaders for developing Asia are Malaysia, Thailand, Vanuatu (26), China (28) and Fiji (63), while in Latin America and the Caribbean the best positions are taken by small states: St. Kitts and Nevis (19), St. Lucia (27), Antigua and Barbuda (31), Grenada (32) and Panama (36). As for larger and more important (in terms of economic power) countries from this region, Chile (49) is followed by Brazil (56), Venezuela (75), Uruguay (78) and Mexico (95). South Africa, Lebanon, Jordan (29), Tunisia (40) and Bahrain (42) obtained highest results among countries from the Middle East and Africa.

For the sake of brevity I do not provide information about the estimation results of the financial development index for each particular country. Such data, including graphs of historical evolution and

tables with mean values of the index and the underlying variables, is available on request.

5 Estimation results from growth regressions

In the tables and graphs in the remainder of this paper I present results of system GMM and quasi-maximum likelihood estimations. All estimations where performed in Stata and Mata. I use GMM for my work to be comparable to the previous studies and the QML-FE given its advantages in bias correction for processes close to unit roots. For both methods, I repeat each estimation four times: first for the generated index of financial conditions and then for three other measures, which were used for its construction. I have chosen financial system deposits to GDP ratio as it is, apart from M3 to GDP ratio, the broadest measure of the financial sector. As I am not only interested in domestic loan providers, I use private credit by banks and other financial institutions to GDP ratio to account for all sources of credit offered to the private sector by financial institutions. Finally, I use the interest rate spread to include a measure covering the cost efficiency aspect of financial development.

Fig. 1 shows the correlation between remittances share in GDP and GDP per capita growth (before excluding the impact of other factors) for different levels of financial development (left versus right hand side panels: low versus high financial development) and for four different measures of financial development. Fig. 1 (a) shows on the horizontal axis the overall financial conditions index, extracted by use of the methodology in 2.2.1. Panels (b) - (d) refer to other measures frequently used in the literature: financial system deposits to GDP ratio, private credit by banks and other financial institutions to GDP ratio and interest rate spread. The threshold level of financial development is determined arbitrary (for illustrative purposes) by its median for the whole estimation sample. For each country I have computed the mean of remittance inflows to GDP ratio and of GDP per capita growth separately for the time periods for which the country was in each of the two possible regimes[17]. These are presented in the subsequent plots.

The dashed line in Fig. 1 corresponds to the correlation between the two measures and its 95% confidence interval which would be obtained by bivariate OLS regressions. A horizontal dashed line indicates that remittances and GDP per capita growth are not correlated, while a positively (negatively) sloped line indicates that remittance inflows to GDP ratio growth is positively (negatively) correlated with GDP per capita growth. All four presented sample splits indicate that countries which have higher remittance inflows to GDP ratio tend to have a higher GDP per capita growth rate in the low financial development regime, while there is no evidence for this relationship to hold in the other regime. This suggests that when the transfer-receiving country reaches a certain level of financial development (here arbitrary fixed at the median for all developing countries), additional monies

[17]In this paper the threshold level of financial development has been fixed arbitrarily. It would be possible to determine its existence by a dynamic threshold model based on Hansen (1999) but the threshold is unlikely to be unique for all countries and constant over time. Regime switches would only be possible with radical policies, including sharp interest rate changes or changes in regulations of the financial markets (e.g. limiting the presence of foreign credit providers on the domestic market).

obtained from relatives abroad are not being spent on productive purposes anymore. This means that remittances help overcome liquidity constraints if these might be binding (which is likely in countries with low financial development), but once other sources of financing become available for productive activity (startups, investment in education) transfers from migrants are more likely to be used for consumption and do not contribute to economic growth. This result is robust to the choice of the measure of development.

A word of caution is necessary for understanding plots and tables referring to the interest rate spread. As its interpretation is opposite to the other measures, with lower difference between the lending and deposit rates reflecting higher levels of development, also the marginal effects of remittances on economic growth will have the opposite slope than for the other measures of financial development. For instance, in Fig. 1 (d) the positive relationship between remittance inflows to GDP ratio and GDP per capita growth for interest rate spreads above median reflects the same relationship as the strong relationship for the lower regime in panels (a)-(c) of the same figure. They all refer to the fact that countries with low financial development who have higher remittance to GDP ratios also have higher GDP per capita growth rates.

The results for the high financial development regime may be affected by China which has a much higher GDP per capita growth rate and much lower remittances to GDP ratio than other members of this group. There is another potential outlier – Lesotho, who has by far the largest value of migrants' transfers to GDP ratio in the whole sample. Yet, both countries were kept in the estimation sample as excluding them does not affect the main results.

The main estimation results are presented in Tab. 3, Tab. 4 and in Fig. 2. Each column of the tables includes the coefficients obtained from regressions using different measures of financial development. The first column refers to the index of overall financial development, constructed in the way described in Section 2.2.1, while in the other columns the usual measures of financial development were used. Both estimation methods, system GMM and QML-FE, indicate a positive impact of remittance inflows to GDP ratio on economic growth for countries with low financial development and a negative impact for more financially developed ones. The coefficient on remittances inflows share in GDP (δ_1) refers to its influence on GDP per capita growth for countries with financial development equal to 0 (which is possible given the logarithmic scale applied to measures of financial conditions). Yet, this value does not contain all the information about the relationship between remittances, growth and finance. To fully assess it, also δ_3, the coefficient on the interaction term between remittance inflows and measures of financial development, needs to be taken into account, since:

$$\frac{\partial y_{it}}{\partial \text{Rem}_{it}} = \delta_1 + \delta_3 \text{FinDev}_{it} \equiv \delta_{it} \tag{6}$$

$$\text{Var}(\delta_{it}) = \text{Var}(\delta_1) + \text{Var}(\delta_3)\text{FinDev}_{it}^2 + 2\text{FinDev}_{it} Cov(\delta_1, \delta_3) \tag{7}$$

Equation (6) captures the complete relationship between remittances and GDP per capita growth for

different levels of financial development. δ_{it} and its 90% confidence interval has been depicted in Fig. 2. The partial derivative of y_{it} with respect to remittance inflows to GDP ratio has been computed for all observed values of various measures of financial development and the standard error of δ_{it} was obtained from equation (7). The graphs reinforce the inference based on estimation tables. There is a positive effect of remittances on economic growth in countries with lowest financial development, but it quickly becomes insignificant with even very small improvements of financial conditions. The effect turns negative for moderate values of financial development and can become statistically significantly negative for the most financially developed countries. This indicates that remittances and financial development can be seen as substitutes on the way to achieve economic prosperity - once one of these inputs becomes large, the other one can be redundant or even harmful.

δ_{it} can be interpreted as follows: given the level of financial development, if the share of remittance inflows to GDP in country i at time t increases by 1%, real GDP per capita will change by δ_{it}%. Therefore, given the coefficient estimates for different levels of financial development presented in Tab. 2, a 10% increase in remittance inflows to GDP ratio for a country with an average financial development (irrespective of the measure used) would lead to a fall in real GDP per capita over the next 5 years of around 0.1%, but this result is not statistically significant. If, on the other hand, we considered a country with higher financial development, e.g. at the 75th percentile in the sample, a 10% increase in remittance share in GDP would lead to a decrease of real GDP per capita by 0.24% (when considering column (1), the index of overall financial development) and this result would be significant at the 5% level. These effects can in general be considered negligible, irrespective of the level of development of the financial sector.

The fact that results are not significant for the part of the sample with lower financial development can be due to the asymmetric distribution of financial development, with more countries at its higher end (see appendix 8.5). It might as well be that, if more observations were available for the lowest financially development countries, the impact of remittances of economic growth would be significantly positive (as indicated by the system GMM results). For now, there is only weak evidence for this positive relationship and stronger evidence for a negative link at the higher end of the sample.

The positive (even though not statistically significant) marginal effect of remittances on economic growth for countries with low financial development can be explained by binding liquidity constraints in these countries. As the financial sector is not well developed, the supply of loans for productive activities can be insufficient. Transfers from family members abroad can help overcome these constraints. On the other end of the financial development distribution there are countries with well functioning markets - on levels similar to industrialized countries (e.g. in Malaysia, South Africa). In these places, moral hazard problems can appear, as indicated by Chami et al. (2003). If remittances are spent on consumption and labor supply is lowered, there will be negative long-run effects on economic growth. This could be one explanation of the negative impact of remittances on GDP per capita for countries with highest financial development. Another reason could be that, given that these monies are registered as remittances, they are not invested in the financial market by the sender but sent to their

family, who spends them in a different way. This means that, again, they are not used in the most productive way in order to contribute to economic prosperity.

The negative impact of remittances on economic development for countries with highest levels of financial development in the sample could also be a purely statistical outcome due to the method applied. By including an interaction term in the linear regression model I impose a monotonic linear structure of dependence of the impact of remittance inflows on GDP per capita levels. In my model, δ_3 defines the negative slope of this relationship. This means, that if in fact the positive effects of remittance for growth are diminishing with increasing levels of financial development but nil (or only slightly negative, but independent of financial development) for higher levels of this measure (as suggested by Fig. 1), the model will wrongly assign strong negative values to δ_{it} in this region. As this study is targeted more at finding policy implications for countries with lower rather than higher values of financial development, I decided to keep the structure of the model unchanged.

5.1 How important are remittances and financial development for economic growth?

When looking at Fig. 2 one can see that only for very low levels of financial development remittances can have a positive impact on economic growth. In fact, there are very few observations in the sample for which the effect would be significantly positive. Therefore, the effect of remittances on growth can in general be considered nil or even slightly negative. To illustrate that, I provide some counterfactual scenarios. For all countries for which both remittance inflows to GDP ratio and financial development have grown over the time period 1970-2010 (or other maximum time period available), see Fig. 3, I have computed GDP per capita growth rate values for two counterfactual scenarios: one if there was no remittance change (ceteris paribus) and one if there was no financial development change over the same time period. I have compared these growth rates with the actual changes in GDP per capita between the first and the last time period available for each country - to capture the overall growth change triggered by growth of each of the two aforementioned factors. In other words, I have compared the overall change of GDP per capita which would be achieved given each of the two scenarios with the actual recorded change. A positive value indicates that the counterfactual scenario would lead to economic gains, while negative values suggest growth losses in comparison to the realized values. For the computation of the counterfactual growth rates I have used the coefficient estimates implied by QML-FE. Details on the computation of the growth gains/losses are provided in Section 8.6.

The results of this exercise are presented in Fig. 4. In panel (a) one can see that the overall growth of GDP per capita would be significantly higher for all countries (apart from Sudan) if there was no increase in the remittance inflows to GDP ratio and that growth loss is the largest for countries with highest initial financial development and lowest remittances. The left hand side graph in this panel confirms the negative relationship between remittances and financial development (the higher financial development, the lower the impact or remittances on GDP per capita), while the right hand side graph

indicates that the difference in growth rates could become insignificant for initial remittance to GDP ratios above 5% (exp(1.6)) and even turn negative for initial remittance to GDP ratios above ca. 45% (exp(3.8)). This means that only for countries with already high transfer inflows their impact on economic growth can be positive.

Panel (b) of Fig. 4 leads to similar conclusions as for the counterfactual scenarios with financial development being kept at its initial level. Again, the left hand side part indicates that remittances and financial development are substitutes, while the right hand side graph shows that for countries who have started with a sufficiently high level of credit supply, its further development resulted in growth gains. For both counterfactual scenarios, the loss in GDP per capita would be in the range of 0 to 5 percentage points which can be considered relatively low, given the average overall economic growth from 1970 to 2010 of 42% (and a maximum of 150%), but yet statistically significant.

Given that both remittances and financial development seem to be improving economic growth (measured in GDP per capita terms) only if they achieve sufficiently large values, I provide another counterfactual scenario. I let either the transfers inflows or the financial sector grow by 20% more in total as compared to their actual growth between 1970 and 2010 (1.2 times $x_T - x_1$). I compare the GDP per capita which would have been achieved if such growth rates were true with its actual level (see Fig. 5). Again, the plots only include countries in which the overall change in remittances and financial development between the first and the last period was positive. The assumption about 20% higher overall growth rate assures additionally that I only look at countries for which the counterfactual scenario would lead to even higher remittance inflows/financial development at the end of the sample.

Panel (a) of Fig. 5 shows the growth rate differential if remittance inflows to GDP grew by 20% more in total instead of their actual rate of increase. This scenario would lead to growth gains of up to ca. 17 percentage points in Jordan and roughly 10 percentage points in Morocco. The left hand side graph of this panel indicates that for lowest levels of financial development, overall remittance increases higher by 20% would not be growth enhancing. This suggests that some initial financial development is necessary to attract remittance inflows into the official records and at the very beginning it might pay off more if the financial sector is being developed instead of encouraging transfer inflows. It can be related to the costs of sending and receiving remittances which are high if the financial sector is poorly developed. Countries with moderate and high initial financial development would profit significantly from higher remittance inflows, especially if starting with high transfer inflows. Apart from high impact on Jordan and Morocco, higher remittances inflows would lead to growth gains of 0 to 5 percentage points.

The strongly positive correlation of the growth differential if remittance inflows to GDP ratio was growing by 20% in total with initial remittances to GDP ratio (see panel (a) of Fig. 5, right-hand side) indicates that transfers from migrants indeed become significantly advantageous for economic growth if they are at high levels already, contributing by up to 5-7 percentage points to improvements in GDP per capita (abstracting from the two outliers mentioned before, Morocco and Jordan for whom the gains are even higher). The output gains are hence comparable to the losses which would have been

avoided in the previous scenario, if remittances or financial development remained at its initial level.

Panel (b) of Fig. 5 shows the growth rate differential if overall financial conditions grew by 20% more in total. This would lead to growth gains in terms of GDP per capita between 0 and 10 percentage points. Countries with higher initial levels of financial development and remittance inflows would benefit the most.

Fig. 6 shows the difference between the growth gains from higher increase in financial development versus higher increase of remittance inflows. This graph shows, that countries who start with higher initial financial development can gain more from its further evolution, unless remittance inflows are high, as in Bangladesh, Morocco and Jordan. Countries who start with very low initial remittance to GDP ratio would also benefit more from focusing first on the development of the financial sector. Only countries with very high remittance to GDP ratios can benefit from further encouraging their growth.

These two scenarios confirm the fact that it is sufficient to focus on developing either the financial sector or increasing remittance inflows to GDP ratio, depending on the current level of both variables. Growth gains from remittances inflows can be higher than from financial sector development, but this requires patience though, since positive growth effects can only be observed when very high levels of migrants' transfers are achieved – with a sufficiently large rate of increase of this measure.

6 Robustness

6.1 Did the financial crisis affect the role of the financial sector as a transmission channel?

The financial crisis of 2007 - 2008 may have changed the role of the financial sector as a transmission channel or substitute for remittances. To see whether this is true for developing countries, which in general did not suffer substantially from the crisis, I have removed the years 2007-2009 from the estimation sample. This means that the last 5-year average was in fact formed from 2 observations: for the years 2005 and 2006. Estimation results for this truncated sample are presented in Fig. 7, Tab. 6 and Tab. 8, Tab. 9 (appendix 8.7).

The fastest way to compare the results is by checking the coefficient on the interaction term between remittances and financial development in Tab. 6. This parameter reflects the strength of dependence of marginal effects of remittances on economic growth on the level of financial development in the receiving country. There is weak evidence that before the financial crisis the impact of remittances on GDP per capita growth used to depend more on financial development and this relationship has weakened afterwards. The difference is not statistically significant though.

Average marginal effects of remittances on economic growth (total effects, Tab. 6, last two columns of each panel) also present an interesting pattern. They are larger (less negative in most cases) when considering the whole sample period which means that a stronger, sound financial sector used to have

more importance and was a substitute to remittances, while now this relationship has become weaker (when comparing Fig. 2 with Fig. 7 the line representing the impact of remittances on economic growth is steeper for the case of the truncated sample). The difference between marginal effects estimated for the whole sample and for the sample truncated before 2008 is also not statistically significant.

These results indicate that, on one hand, the financial crisis probably had a stronger impact on the industrial world than on developing countries and, on the other hand, that inclusion of this time period in the main estimation sample does not affect the results to a large extent. The confidence into and role of the financial sector (credit provision) were not perturbed substantially in the developing countries included in this study.

7 Concluding remarks

The remittances and economic growth relationship is a relatively new topic in the literature. It arose in the last two decades, as migrants' transfers reached the highest levels in history and governments of developing countries realized their importance. However, until now, there is no consensus in the literature concerning the impact of remittances on economic growth stemming from cross-country analysis (many studies exist for particular countries).

Recently, researchers have started studying the role of the financial sector as a channel for remittances to affect growth, or, on the contrary, as a substitute for remittances (as means of overcoming credit constraints). Since not many measures of financial development exist, especially for developing countries over a long time span, it is challenging to establish the direction of relationship between migrants' transfers and financial development.

In this paper I use an unobserved components model to construct an a priori unknown index of financial development from observable measures (which are commonly used as proxies for financial development). This overall financial conditions index reflects the size, depth and efficiency of the financial sector. It can be used for creating international comparisons of financial development or for studying the historical evolution of finance in a particular country. It can also be used to reconcile contradictory or ambiguous results of studies which used proxies instead of a composite index. In this paper I provide a ranking comparing average overall financial conditions for a large group of advanced and developing economies using a newly constructed measure. Also, this new index is used as a control variable in growth regressions measuring the impact of remittances on GDP per capita changes, with special focus on the financial sector as a possible catalyst or obstacle in this process.

My GMM and QML-FE estimations show that, independently of the measure of financial development used, there is some indication for possible substitution between remittances and financial development as factors enhancing economic growth measured by GDP per capita. There is significant evidence for remittances having negative growth effects in developing countries with relatively large financial markets, while for the least advanced ones there can be positive effects. Before the outbreak of the financial crisis, there was a stronger substitution between the two channels (remittances and

finance), but this relationship has weakened after 2006. On average the financial crisis of the developed world did not affect the less advanced economies significantly, though.

If a government were to choose whether to focus on encouraging more remittance inflows or more financial development, the decision would depend on the initial levels of both factors. For countries with very poor financial conditions it would be more profitable to first develop this sector. For other countries it would be more advantageous to foster money transfers from migrants. In this case, output gains would only occur for sufficiently large remittance to GDP ratios, therefore this solution could be mostly advisable for smaller countries with large diasporas. Therefore, policy implications depend on the particular country's situation.

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Tables

Table 1: Summary statistics of 5-year averaged data

Variable	**N**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Real GDP per capita (log)	312	7.2	0.95	5.19	9.24
Investment/GDP	312	22.04	8.31	5.24	66.31
Population growth	312	7.13	0.91	3.92	10.63
Complete Sec. Sch. Attained in Pop.	312	10.2	8.45	0.25	48.96
Government expenditure/GDP	312	14.1	5.61	4.71	39.55
Trade Openness (log)	312	4.15	0.63	2.36	5.64
Remittance inflows/GDP (log)	312	0.54	1.23	-1	4.45
Financial development index (log)	312	-0.99	4.45	-15.95	9.9
Financial systems deposits/GDP (log)	293	3.26	0.62	1.16	4.75
Liquid liabilities (M3)/GDP (log)	292	3.51	0.59	1.4	4.97
Private credit by fin. inst. to GDP ratio (log)	293	3.15	0.76	0.86	4.93
Domestic credit to the private sector/GDP (log)	312	3.25	0.7	0.77	4.99
Interest rate spread (log)	225	1.66	1.1	-6.26	5.83
Deoposit interest rate (log)	263	2.18	0.85	0.14	8.02
Overhead costs (log)	152	1.34	0.55	-0.89	2.64

Population growth includes also the depreciation and GDP growth rates (assumed to be 5% in total)

Table 2: The estimated effects of remittance inflows to GDP changes on GDP per capita growth for different measures of financial development (QML-FE results)

	effect given the following measure of financial development:			
	(1)	(2)	(3)	(4)
effect at:	overall fin.dev.	fin. sys. deposits/GDP	priv. cred. by banks and fin.inst./GDP	interest rate spread
mean	-0.012	-0.007	-0.012	-0.012
p-value	0.249	0.467	0.259	0.404
median	-0.012	-0.007	-0.012	-0.010
p-value	0.259	0.504	0.240	0.477
other percentiles:				
10th	0.009	0.007	0.007	-0.026
p-value	0.585	0.652	0.677	0.198
25th	-0.002	0.001	-0.003	-0.017
p-value	0.854	0.962	0.816	0.281
75th	-0.024	-0.016	-0.021	-0.004
p-value	0.045	0.155	0.082	0.766
95th	-0.039	-0.030	-0.035	0.009
p-value	0.027	0.096	0.060	0.569
average marginal effect	-0.012	-0.008	-0.012	-0.010
p-value	0.454	0.546	0.415	0.423

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The values in the table can be interpreted as follows: for the country with overall fin. dev. at the sample mean, if remittances share in GDP changes by 1% real GDP per capita will change by -0.012% over 5 years (significant at 25%)

Table 3: Main system GMM results

	(1) Overall fin.cond. b/se	(2) Financial systems deposits/GDP b/se	(3) Priv. credit/GDP b/se	(4) Interest rate spread b/se
L.Real GDP per capita (log)	0.731***	0.781***	0.808***	0.729***
	(0.145)	(0.163)	(0.165)	(0.138)
Investment/GDP	0.007	0.007	0.009*	0.008**
	(0.005)	(0.005)	(0.005)	(0.004)
Population growth	-0.138***	-0.175***	-0.116**	-0.147***
	(0.050)	(0.054)	(0.051)	(0.049)
Complete Sec. Sch. Attained in Pop.	0.008	0.005	0.010	0.005
	(0.006)	(0.007)	(0.006)	(0.006)
Government expenditure/GDP	0.002	-0.000	0.002	-0.004
	(0.009)	(0.009)	(0.009)	(0.008)
Trade Openness (log)	0.148	0.123	0.168	0.171
	(0.104)	(0.115)	(0.108)	(0.116)
Remittance inflows/GDP (log)	0.032	0.261*	0.296**	0.005
	(0.031)	(0.156)	(0.121)	(0.055)
Financial development measure (log)	-0.005	-0.008	-0.044	-0.015
	(0.008)	(0.079)	(0.055)	(0.026)
Remittance-finance interaction term	-0.013**	-0.065	-0.081**	0.012
	(0.005)	(0.042)	(0.036)	(0.022)
Observations	258	248	248	195
Countries	54	53	53	50
average no. of obs. per country	4.778	4.679	4.679	3.900
Number of instruments	57	57	57	55
p-value for Hansen's test	0.597	0.494	0.576	0.793
p-value for AR(1) in residuals test	0.217	0.308	0.154	0.189
p-value for AR(2) in residuals test	0.167	0.144	0.126	0.063

Table 4: Main QML-FE results

	(1) Overall fin.cond. b/se	(2) Financial systems deposits/GDP b/se	(3) Priv. credit/GDP b/se	(4) Interest rate spread b/se
L.Real GDP per capita (log)	0.818***	0.825***	0.824***	0.744***
	(0.043)	(0.043)	(0.042)	(0.046)
Investment/GDP	0.007***	0.007***	0.007***	0.005***
	(0.002)	(0.002)	(0.002)	(0.002)
Population growth	-0.044*	-0.049*	-0.050*	-0.034*
	(0.026)	(0.025)	(0.026)	(0.019)
Complete Sec. Sch. Attained in Pop.	-0.001	-0.001	-0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Government expenditure/GDP	-0.007**	-0.008***	-0.007**	-0.011**
	(0.003)	(0.003)	(0.004)	(0.005)
Trade Openness (log)	0.049*	0.046	0.050*	0.118***
	(0.029)	(0.030)	(0.030)	(0.037)
Remittance inflows/GDP (log)	-0.015	0.063	0.048	-0.039
	(0.010)	(0.053)	(0.041)	(0.028)
Financial development measure (log)	-0.003	-0.038	-0.024	-0.006
	(0.004)	(0.034)	(0.020)	(0.011)
Remittance-finance interaction term	-0.004*	-0.022	-0.019	0.016
	(0.002)	(0.016)	(0.013)	(0.011)
Observations	258	239	239	175
Countries	54	51	51	48
average no. of obs. per country	4.778	4.686	4.686	3.646

Notes: Bootstrapped standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
All regressions include time dummies.

Table 5: Average growth rate of remittances and financial development (over 5-year periods)

Country	**Remittance growth**	**Fin.dev. growth**
Algeria	-22.4	-50.9
Argentina	5.2	68.2
Bangladesh	23.0	190.1
Barbados	19.1	57.1
Belize	-10.9	87.5
Benin	-6.2	-48.9
Bolivia	35.8	130.5
Botswana	-38.3	26.7
Brazil	3.9	-10.8
Bulgaria	71.5	87.2
Cameroon	6.1	-72.0
China	11.3	91.8
Costa Rica	23.7	31.2
Cote d'Ivoire	9.5	-50.3
Dominican Rep.	25.1	20.2
Ecuador	56.7	21.5
El Salvador	37.1	-65.6
Gabon	1.8	-32.1
Guatemala	45.0	75.3
Honduras	55.2	61.5
Hungary	37.8	121.8
India	20.7	86.6
Indonesia	21.3	99.8
Iran	-36.1	17.4
Jordan	3.2	111.6
Kenya	19.6	-17.1
Lesotho	-9.3	12.0
Malaysia	9.9	94.1
Maldives	-7.9	251.2
Mali	2.0	-42.1
Mauritius	-61.8	86.2
Mexico	23.3	3.0
Morocco	4.9	99.4
Namibia	-8.6	43.9
Pakistan	-3.1	36.0
Panama	-13.7	67.0
Papua New Guinea	-7.2	35.9
Paraguay	22.7	4.7
Peru	26.5	173.5
Philippines	26.7	46.7
Poland	41.1	116.6
Senegal	27.3	17.4
South Africa	2.3	21.4
Sri Lanka	8.3	54.1
Sudan	25.9	1.4
Swaziland	-11.6	-29.4
Syrian Arab Rep.	-14.3	102.5
Tanzania	0.7	148.3
Thailand	7.2	120.6
Togo	41.5	-19.2
Trinidad & Tobago	9.0	-58.3
Tunisia	3.9	14.7
Turkey	-33.3	62.3
Venezuela	1.7	-148.2
Total	10.2	37.4

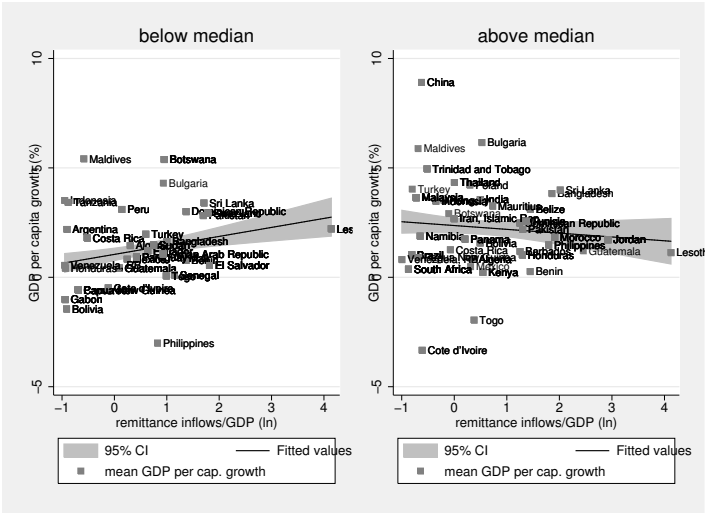
Table 6: Coefficient estimates for the whole sample and for the sample truncated in 2007

SGMM results								
Coefficient:	Remittance inflows/GDP		Financial development		Remittance-finance interaction term		Mean marginal effect of remittances	
Measure of financial development used:	whole sample	before fin.crisis	whole sample	before fin.crisis	whole sample	before fin.crisis	whole sample	before fin.crisis
Overall financial development	0.032	0.002	-0.005	0.002	-0.013**	-0.017***	0.043	0.021
s.e.	(0.031)	(0.041)	(0.008)	(0.009)	(0.005)	(0.007)	(0.059)	(0.079)
Financial system deposits to GDP ratio	0.261*	0.243	-0.008	0.028	-0.065	-0.068	0.047	0.024
s.e.	(0.156)	(0.168)	(0.079)	(0.080)	(0.042)	(0.050)	(0.04)	(0.042)
Private credit by fin. inst. to GDP ratio	0.296**	0.374**	-0.044	-0.022	-0.015	-0.107**	0.039	0.036
s.e.	(0.121)	(0.156)	(0.055)	(0.059)	(0.026)	(0.049)	(0.063)	(0.084)
Interest rate spread	0.005	0.001	-0.081**	-0.027	0.012	0.009	0.026***	0.016**
s.e.	(0.055)	(0.067)	(0.036)	(0.034)	(0.022)	(0.026)	(0.01)	(0.008)
QML-FE results								
Coefficient:	Remittance inflows/GDP		Financial development		Remittance-finance interaction term		Mean marginal effect of remittances	
Measure of financial development used:	whole sample	before fin.crisis	whole sample	before fin.crisis	whole sample	before fin.crisis	whole sample	before fin.crisis
Overall financial development	-0.015	-0.026*	-0.003	-0.001	-0.004*	-0.005**	-0.012	-0.021
s.e.	(0.010)	(0.016)	(0.004)	(0.004)	(0.002)	(0.003)	(0.017)	(0.023)
Financial system deposits to GDP ratio	0.063	0.079	-0.038	-0.035	-0.022	-0.030	-0.008	-0.018
s.e.	(0.053)	(0.064)	(0.034)	(0.032)	(0.016)	(0.020)	(0.014)	-0.019
Private credit by fin. inst. to GDP ratio	0.048	0.049	-0.024	-0.015	-0.019	-0.022	-0.012	-0.02
s.e.	(0.041)	(0.048)	(0.020)	(0.022)	(0.013)	(0.015)	(0.015)	-0.017
Interest rate spread	-0.039	-0.038	-0.006	-0.007	0.016	0.016	-0.01	-0.012
s.e.	(0.028)	(0.033)	(0.011)	(0.010)	(0.011)	(0.011)	(0.013)	(0.013)

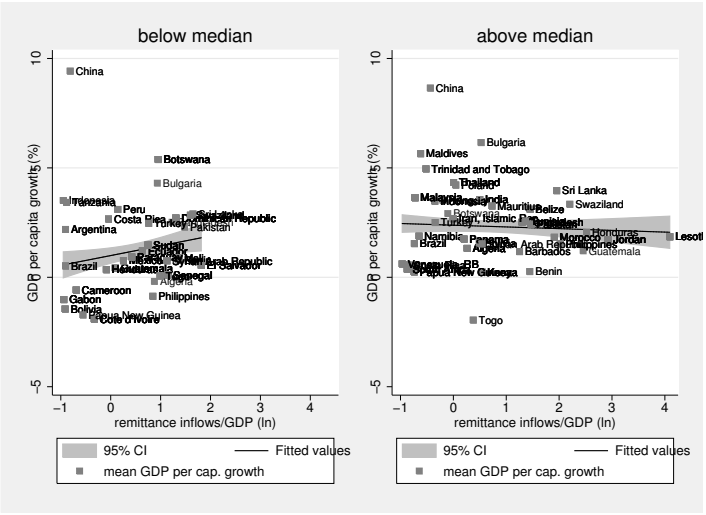
Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figures

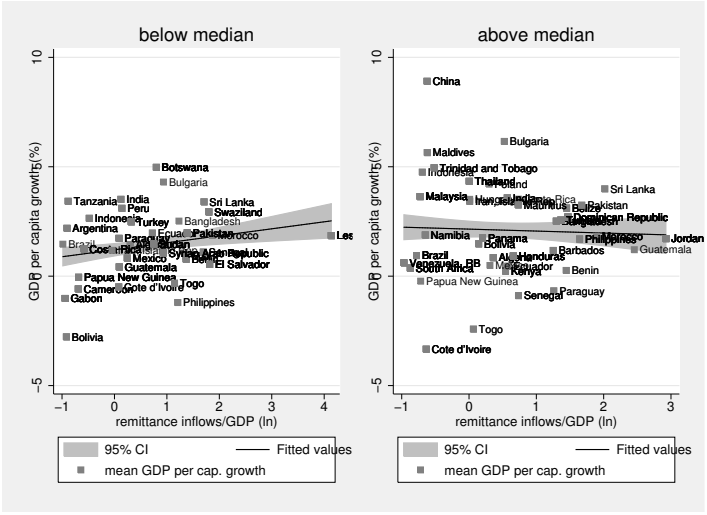
Figure 1: Remittances-growth relationship for different levels of financial development



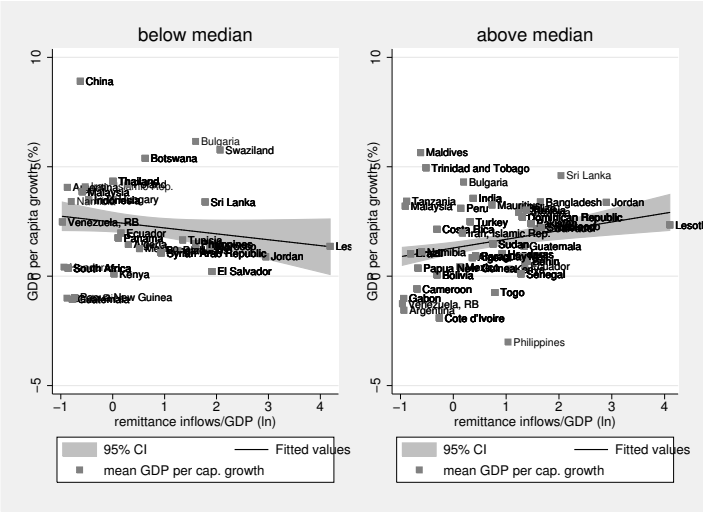
(a) Overall financial development



(b) Financial system deposits to GDP ratio

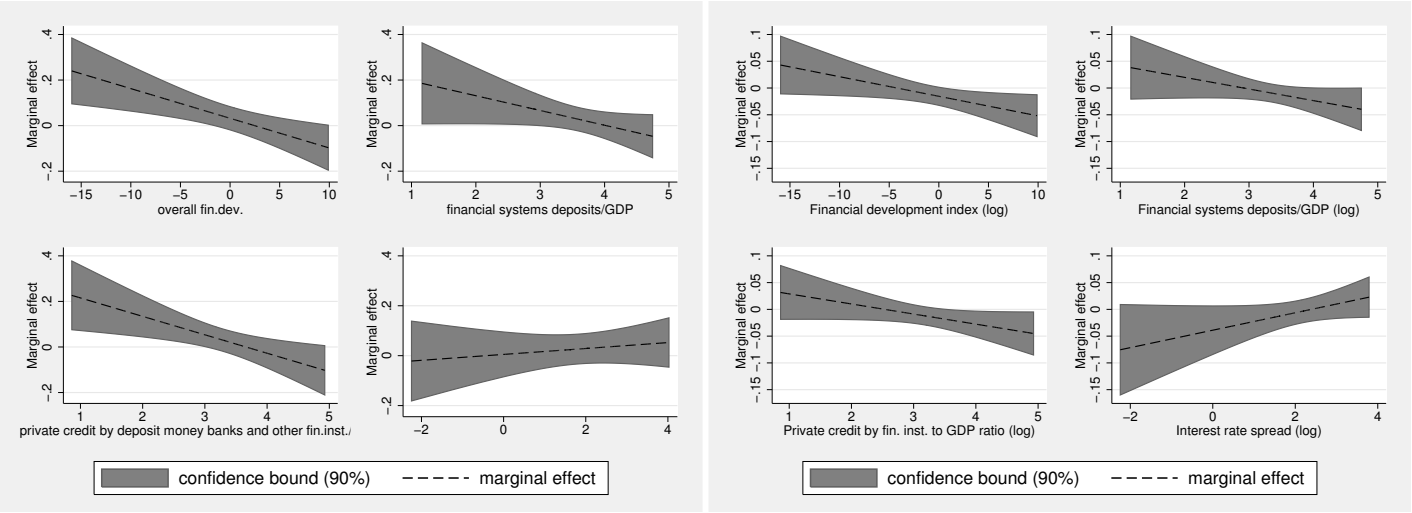


(c) Private credit by fin. inst. to GDP ratio



(d) Interest rate spread

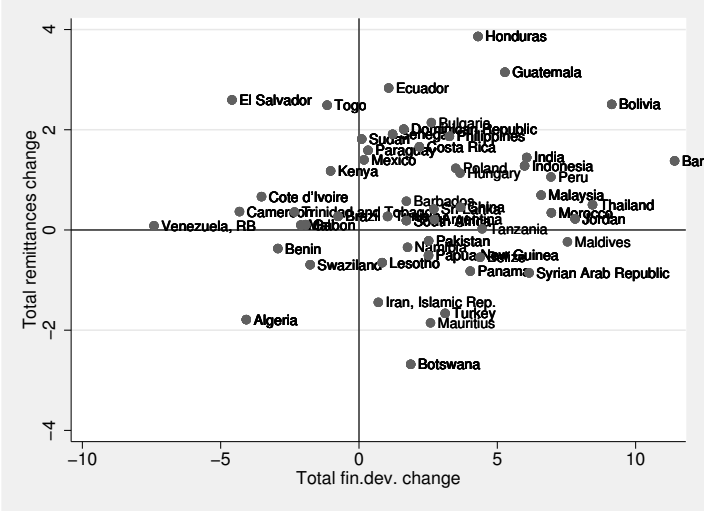
Figure 2: Marginal effects of remittances on economic growth for different levels of financial development - system GMM and QML-FE results



(a) system GMM

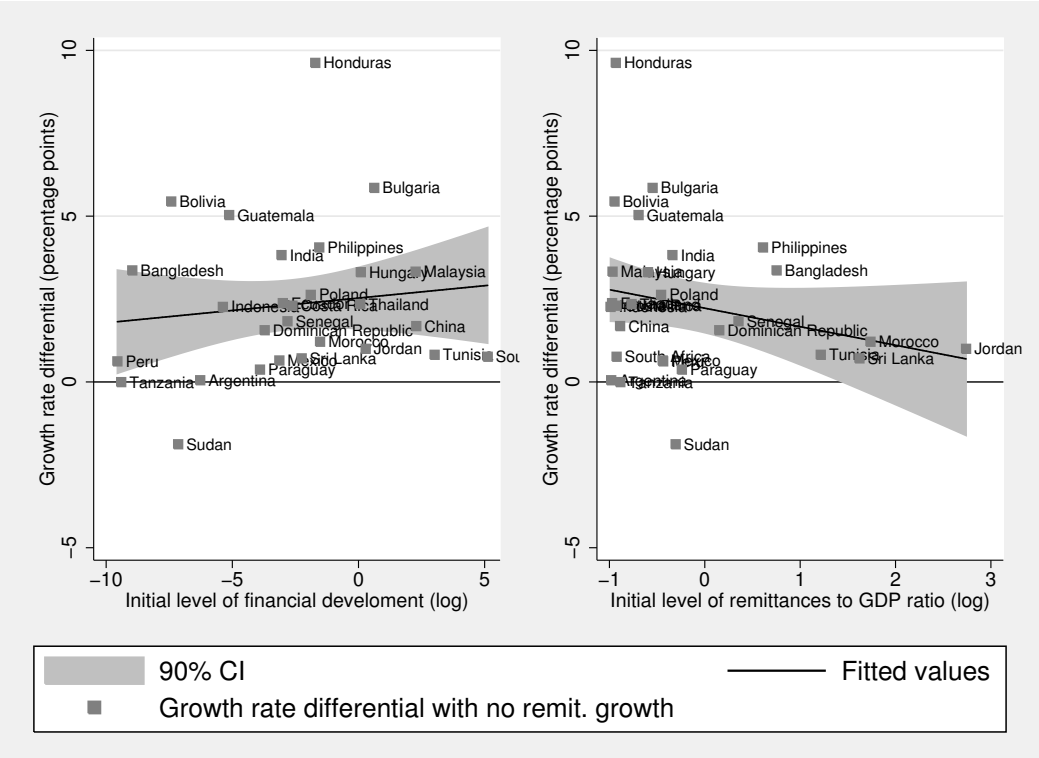
(b) QML-FE

Figure 3: Total changes of remittance inflows to GDP ratio and financial development for each country

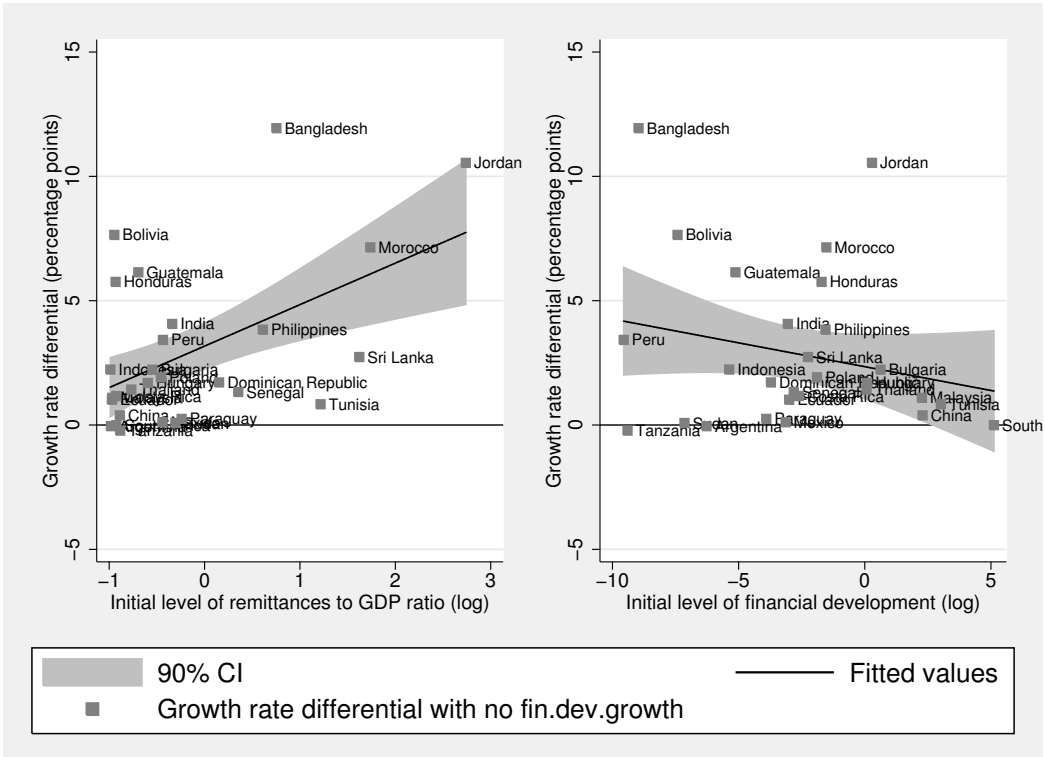


The total changes for each country are computed as differences of remittance inflows to GDP ratio and financial development in natural logarithms.

Figure 4: Difference in total growth of GDP per capita if remittances or fin. dev. were held constant at their initial level.



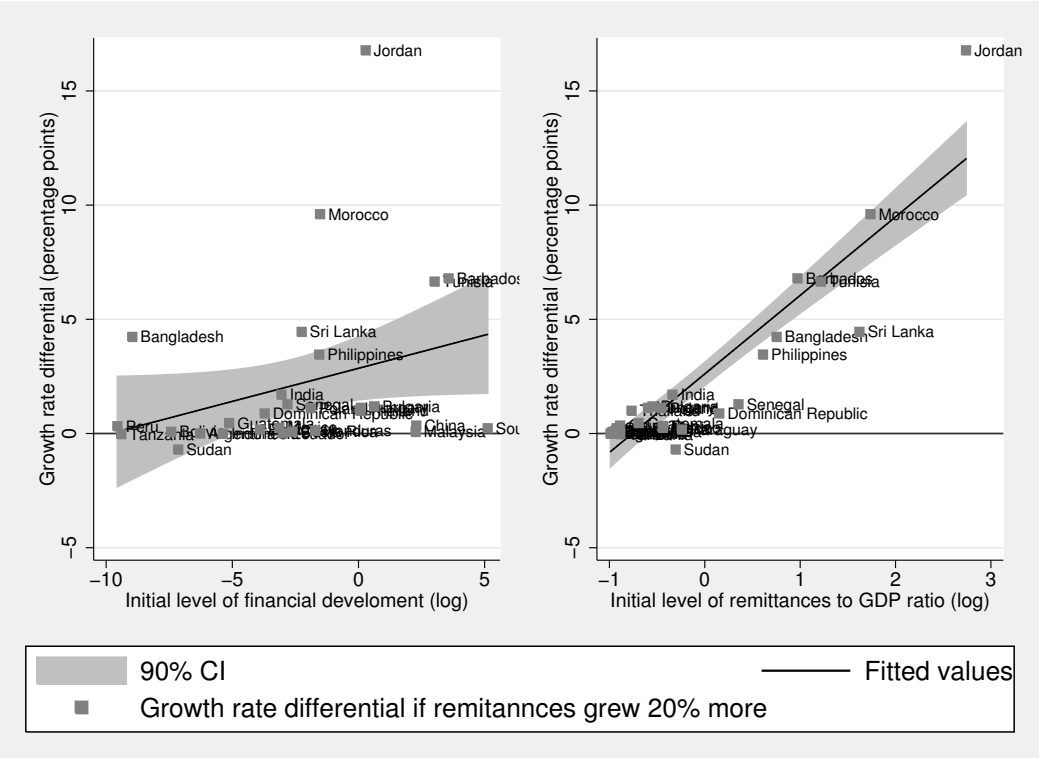
(a) No remittance change



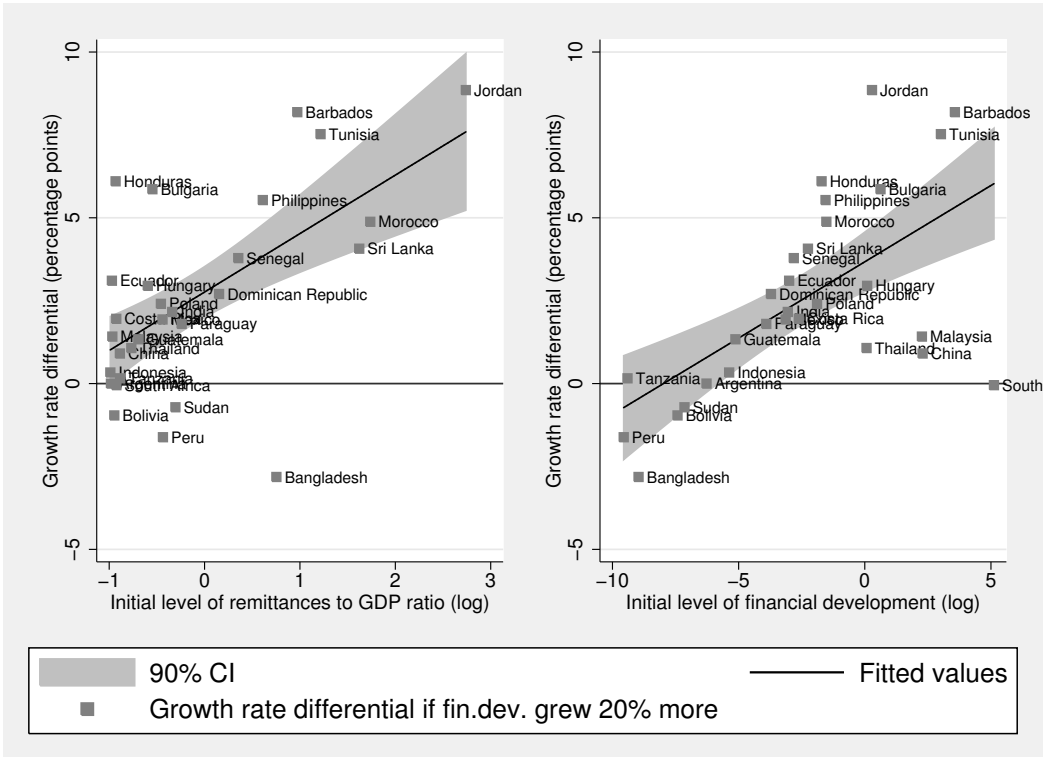
(b) No fin. dev. change

Note: The graphs show the difference between the counterfactual and real total growth of GDP per capita (in percentage points). Positive numbers indicate output gains from the counterfactual scenario.

Figure 5: Difference in total growth of GDP per capita if remittances or fin. dev. grew 20% more in total.



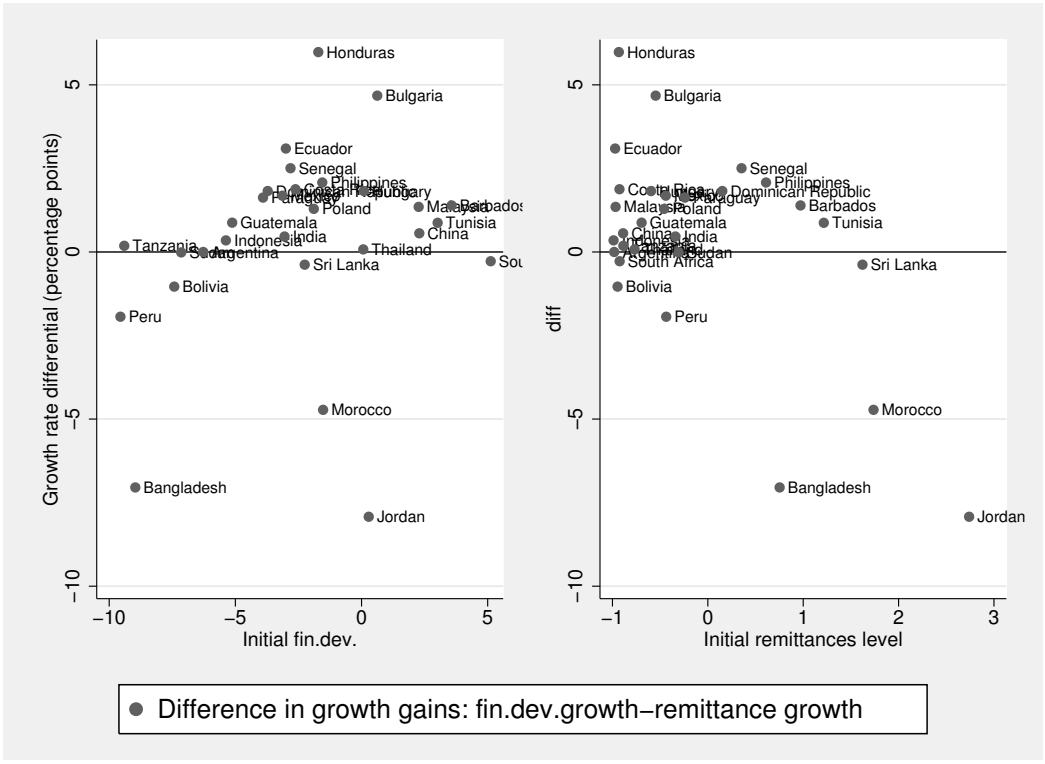
(a) 20% higher overall remittances inflows (log)



(b) 20% higher overall fin.development (log)

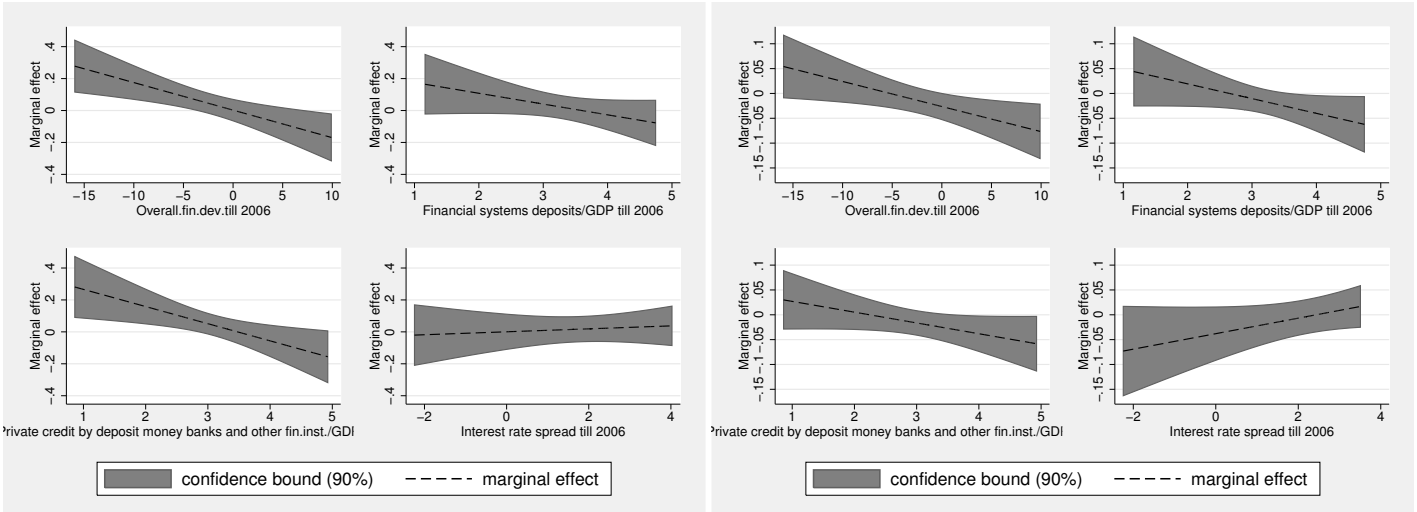
Note: The graphs show the difference between the counterfactual and real total growth of GDP per capita (in percentage points).

Figure 6: Difference in potential growth gains from higher financial development vs. higher remittance inflows



Note: The graph shows the difference between the counterfactual growth gains from increasing financial development and from increasing remittances (in percentage points).

Figure 7: Marginal effects of remittances on economic growth for different levels of financial development – before the financial crisis – SGMM and QML-FE results



(a) SGMM

(b) QML-FE

8 Appendix

8.1 Estimation sample - country list

Country	No.	N	From	To
Albania	1	4	1995	2010
Algeria	2	8	1975	2010
Bangladesh	3	5	1990	2010
Barbados	4	8	1975	2010
Belize	5	6	1985	2010
Benin	6	4	1995	2010
Bolivia	7	7	1980	2010
Botswana	8	8	1975	2010
Brazil	9	6	1985	2010
Cameroon	10	7	1980	2010
China	11	5	1990	2010
Colombia	12	8	1975	2010
Congo, Rep.	13	5	1990	2010
Costa Rica	14	7	1980	2010
Cote d'Ivoire	15	8	1975	2010
Cyprus	16	7	1980	2010
Czech Republic	17	4	1995	2010
Dominican Rep.	18	8	1975	2010
Ecuador	19	5	1990	2010
Egypt	20	7	1980	2010
El Salvador	21	7	1980	2010
Fiji	22	7	1980	2010
Gabon	23	7	1980	2010
Ghana	24	7	1980	2010
Guatemala	25	7	1980	2010
Honduras	26	8	1975	2010
India	27	8	1975	2010
Indonesia	28	6	1985	2010
Iran, Islamic Rep.	29	4	1995	2010
Israel	30	8	1975	2010
Jordan	31	7	1980	2010
Kenya	32	8	1975	2010
Malawi	33	4	1995	2010
Mali	34	5	1990	2010
Malta	35	8	1975	2010
Mauritius	36	4	1995	2010
Mexico	37	7	1980	2010
Morocco	38	8	1975	2010
Mozambique	39	5	1990	2010
Nepal	40	4	1995	2010
Niger	41	6	1985	2010
Pakistan	42	7	1980	2010
Panama	43	6	1985	2010
Papua New Guinea	44	6	1980	2005
Paraguay	45	4	1995	2010
Peru	46	4	1995	2010
Philippines	47	7	1980	2010
Poland	48	4	1995	2010
Romania	49	4	1995	2010
Rwanda	50	7	1980	2010
Senegal	51	8	1975	2010
South Africa	52	8	1975	2010
Sri Lanka	53	8	1975	2010
Sudan	54	7	1980	2010
Swaziland	55	8	1975	2010
Syrian Arab Rep.	56	7	1980	2010
Thailand	57	8	1975	2010
Togo	58	6	1985	2010
Trinidad and Tobago	59	8	1975	2010
Tunisia	60	6	1985	2010
Turkey	61	8	1975	2010
Total	393	Av. per country	6.44	

8.2 Estimated pairwise correlations for the 5-year averaged data

		1	2	3	4	5	6	7	8
1	Real GDP per capita (log)	1.000							
2	Investment/GDP	-0.003	1.000						
3	Population growth	-0.399***	0.054	1.000					
4	Complete Sec. Sch. Attained in Pop.	0.431***	0.017	-0.522***	1.000				
5	Government expenditure/GDP	0.182**	0.313***	-0.025	0.118*	1.000			
6	Trade Openness (log)	0.160**	0.344***	-0.054	0.233***	0.327***	1.000		
7	Remittance inflows/GDP (log)	-0.303***	0.285***	0.019	-0.026	0.143*	0.271***	1.000	
8	Financial development index (log)	0.307***	0.219***	-0.148**	0.314***	0.209***	0.297***	-0.050	1.000
9	Financial systems deposits/GDP (log)	0.268***	0.252***	-0.162**	0.332***	0.247***	0.353***	0.054	0.926***
10	Liquid liabilities (M3)/GDP (log)	0.139*	0.299***	-0.088	0.318***	0.237***	0.324***	0.069	0.867***
11	Private credit by fin. inst. to GDP ratio (log)	0.319***	0.155**	-0.127*	0.295***	0.130*	0.271***	-0.120*	0.956***
12	Domestic credit to the private sector/GDP (log)	0.373***	0.130*	-0.208***	0.290***	0.156**	0.226***	-0.082	0.857***
13	Interest rate spread (log)	0.003	-0.187**	-0.034	-0.016	0.019	0.017	0.012	-0.079

		9	10	11	12	13
1	Real GDP per capita (log)					
2	Investment/GDP					
3	Population growth					
4	Complete Sec. Sch. Attained in Pop.					
5	Government expenditure/GDP					
6	Trade Openness (log)					
7	Remittance inflows/GDP (log)					
8	Financial development index (log)					
9	Financial systems deposits/GDP (log)	1.000				
10	Liquid liabilities (M3)/GDP (log)	0.939***	1.000			
11	Private credit by fin. inst. to GDP ratio (log)	0.794***	0.754***	1.000		
12	Domestic credit to the private sector/GDP (log)	0.653***	0.583***	0.912***	1.000	
13	Interest rate spread (log)	-0.060	-0.139*	-0.086	-0.083	1.000

Notes: Significance levels: * 10%, ** 5%, *** 1%

8.3 Kalman filter and MLE

The overall financial development index has been obtained by applying the Kalman filter to panel data. The procedure can be summarized as follows (with the country index i dropped for simplicity). The estimation has been done in Stata/Mata.

1. Initialization: $s_{0|0} = 0$ (for a stationary process) or other arbitrary or estimated initialization (from a normal distribution) for a nonstationary process, $P_{0|0} = \frac{1}{1-\gamma^2}$, initial guess for $\boldsymbol{\theta} = (\boldsymbol{\alpha}, \boldsymbol{\beta}, \text{vech}\boldsymbol{\Sigma})$
2. Kalman forecasting and updating
   - $s_{t+1|t} = \hat{\gamma} s_{t|t}$ (financial development index forecast)
   - $P_{t+1|t} = \hat{\gamma}^2 + 1$ (variance of the index forecast)
   - $\boldsymbol{\eta_t} = \boldsymbol{y_{t+1}} - \boldsymbol{y_{t+1|t}} = \boldsymbol{y_{t+1}} - \hat{\boldsymbol{\alpha}} - \hat{\boldsymbol{\beta}}\boldsymbol{\iota} s_{t+1|t} = \hat{\boldsymbol{\beta}}\boldsymbol{\iota}(s_{t+1} - s_{t+1|t}) + w_{t+1}$
   - $\boldsymbol{F_t} \equiv \mathbb{E}(\boldsymbol{\eta_t}\boldsymbol{\eta_t}') = \hat{\boldsymbol{\beta}}\boldsymbol{\iota} P_{t+1|t} \boldsymbol{\iota}' \hat{\boldsymbol{\beta}}' + \boldsymbol{\Sigma}$
   - $s_{t+1|t+1} = s_{t+1|t} + P_{t+1|t} \boldsymbol{\iota}' \hat{\boldsymbol{\beta}}' \boldsymbol{F_t}^{-1} \boldsymbol{\eta_t}$
   - $P_{t+1|t+1} = P_{t+1|t} - P_{t+1|t} \boldsymbol{\iota}' \hat{\boldsymbol{\beta}}' \boldsymbol{F_t}^{-1} \boldsymbol{\iota} \hat{\boldsymbol{\beta}} P_{t+1|t}$
3. Maximum likelihood estimation:
   $\max_{\boldsymbol{\theta}} \sum_{t=1}^{T} \boldsymbol{l}(Y_t|\mathbf{I}_{t-1}) = \sum_{t=1}^{T} [-\frac{1}{2}(\log(2\pi) + \log|\boldsymbol{F_t}| + \boldsymbol{\eta_t'} \boldsymbol{F_t^{-1}} \boldsymbol{\eta_t})]$

   $\Leftrightarrow \min_{\boldsymbol{\theta}} \sum_{t=1}^{T} [\log|\boldsymbol{F_t}| + \boldsymbol{\eta_t'} \boldsymbol{F_t^{-1}} \boldsymbol{\eta_t}]$

4. State smoothing:

$s_{t|T} = s_{t|t} + \boldsymbol{J_t}(s_{t+1|T} - s_{t+1|t})$

$P_{t|T} = P_{t|t} + \boldsymbol{J_t}(P_{t+1|T} - P_{t+1|t})\boldsymbol{J_t}'$

where $\boldsymbol{J_t} = P_{t|t}\gamma P_{t+1|t}^{-1}$

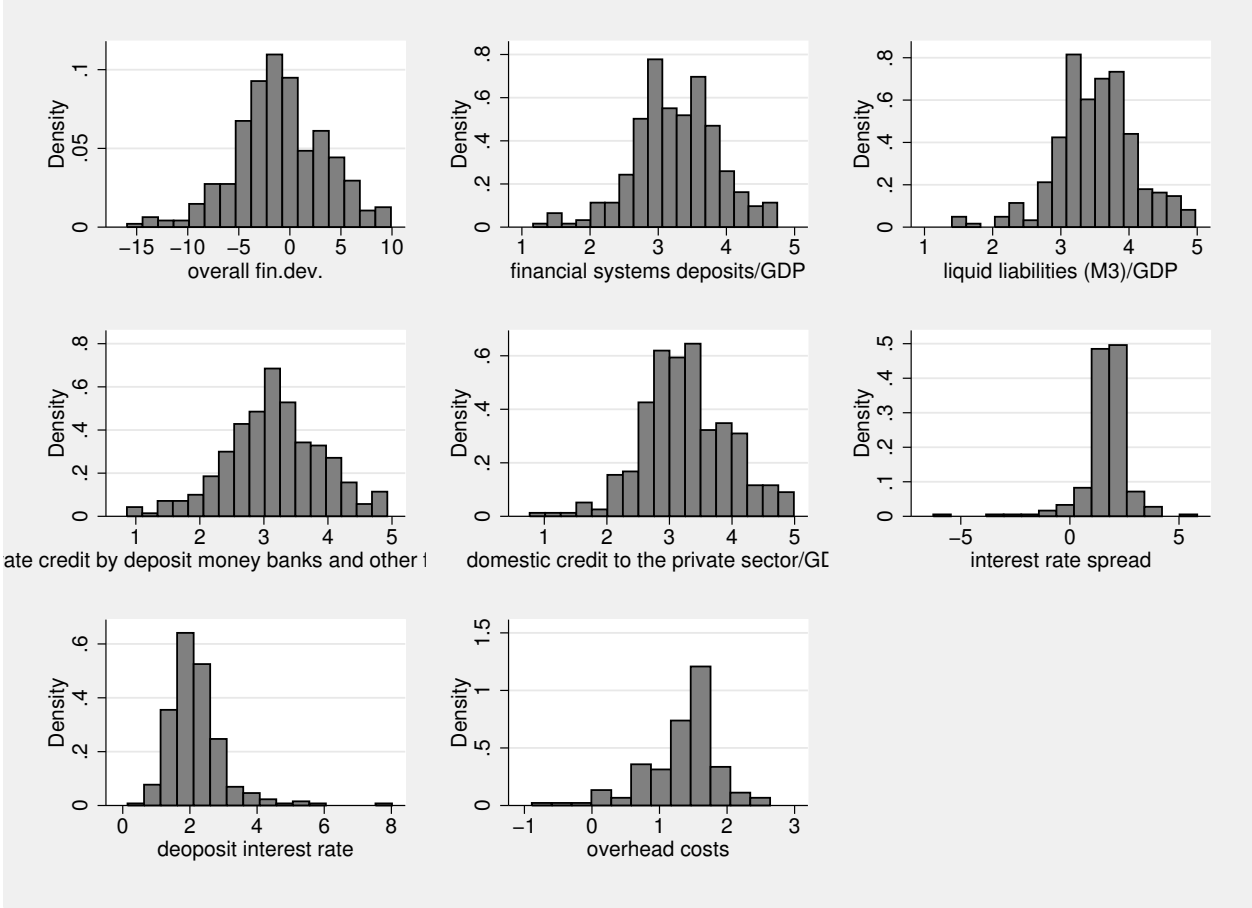
8.4 Ranking of countries by financial development

Rank	Country	Fin.dev.	Ranks - other measures (1)	(2)	(3)	Rank	Country	Fin.dev.	Ranks - other measures (1)	(2)	(3)
1	Hong Kong SAR, China	12.50	2	3	51	72	Tonga	-0.33	92	82	71
2	Japan	11.88	5	2	14	73	Seychelles	-0.35	57	118	95
3	Luxembourg	11.14	4	9	17	74	Iran, Islamic Rep.	-0.36	80	80	4
4	Switzerland	9.76	7	5	7	75	Venezuela, RB	-0.45	96	110	19
5	Cyprus	9.12	9	7	22	76	Nicaragua	-0.49	78	85	124
6	United States	8.05	23	6	170	77	Zimbabwe	-0.85	71	111	56
7	Netherlands	7.70	19	19	21	78	Uruguay	-0.86	93	95	1
8	Macao SAR, China	7.62	6	32	55	79	Pakistan	-0.97	89	97	91
9	Portugal	7.46	13	16	16	80	Suriname	-1.14	85	106	134
10	Germany	7.33	14	8	75	81	Colombia	-1.21	120	88	126
11	Singapore	7.31	16	14	36	82	Oman	-1.33	86	69	23
12	Spain	7.22	18	11	30	83	Indonesia	-1.37	105	91	27
13	Malta	7.13	8	27	29	84	Dominican Republic	-1.45	121	78	142
14	Canada	6.89	21	17	26	85	Cape Verde	-1.60	110	103	102
15	Austria	6.85	20	18	39	86	Samoa	-1.62	91	109	103
16	France	6.66	24	13	49	87	Solomon Islands	-1.70	99	101	123
17	Malaysia	6.63	15	21	35	88	Mauritania	-1.78	126	90	136
18	United Kingdom	6.29	182	4	8	89	Papua New Guinea	-1.78	95	116	79
19	St. Kitts and Nevis	6.17	11	41	70	90	Maldives	-2.03	36	24	100
20	Sweden	6.14	90	12	53	91	Sri Lanka	-2.33	102	115	6
21	Lebanon	5.95	3	22	93	92	Cote d'Ivoire	-2.38	128	94	114
22	South Africa	5.79	45	15	50	93	Costa Rica	-2.44	113	104	140
23	Italy	5.29	29	28	87	94	Turkey	-2.47	100	117	170
24	Thailand	5.17	33	29	33	95	Mexico	-2.54	108	113	81
25	Ireland	5.12	34	31	62	96	Togo	-2.55	112	114	121
26	Vanuatu	4.97	10	66	112	97	Swaziland	-2.58	104	120	77
27	St. Lucia	4.80	31	38	96	98	Lesotho	-2.70	83	146	106
28	China	4.72	79	10	15	99	Senegal	-2.75	136	99	115
29	Jordan	4.71	17	30	42	100	Bolivia	-2.99	137	100	160
30	Norway	4.62	50	25	38	101	Ecuador	-3.03	133	102	3
31	Antigua and Barbuda	4.59	12	26	82	102	Paraguay	-3.19	131	107	159
32	Grenada	4.38	26	45	92	103	Ethiopia	-3.24	114	123	45
33	Israel	4.28	39	40	132	104	Benin	-3.26	124	140	114
34	Belgium	4.11	40	59	74	105	Guatemala	-3.33	119	122	89
35	Finland	4.03	52	35	24	106	Libya	-3.39	143	150	20
36	Panama	3.99	53	37	57	107	Mongolia	-3.52	118	131	163
37	Denmark	3.99	61	55	69	108	Botswana	-3.63	107	132	40
38	Barbados	3.94	38	52	72	109	Bangladesh	-3.72	73	86	41
39	St. Vincent and the Grenadines	3.81	28	62	99	110	Mali	-3.88	146	133	114
40	Tunisia	3.79	55	33	44	111	Argentina	-4.17	141	135	43
41	Bahamas, The	3.79	49	42	18	112	Peru	-4.32	135	126	167
42	Bahrain	3.68	42	47	64	113	Nepal	-4.37	117	139	25
43	Australia	3.52	48	44	11	114	Gambia, The	-4.74	132	138	146
44	Aruba	3.49	44	49	83	115	Cameroon	-5.13	149	129	138
45	Dominica	3.46	37	61	84	116	Zambia	-5.30	140	159	113
46	Korea, Rep.	3.16	70	34	5	117	Haiti	-5.33	127	148	164
47	Kuwait	3.08	35	51	13	118	Saudi Arabia	-5.36	155	65	170
48	Iceland	2.86	75	43	48	119	Madagascar	-5.52	152	134	147
49	Chile	2.83	68	20	97	120	Malawi	-5.62	134	152	148
50	New Zealand	2.81	56	57	9	121	Syrian Arab Republic	-5.77	106	157	34
51	Mauritius	2.72	43	68	80	122	Nigeria	-5.77	145	145	54
52	Greece	2.71	47	67	68	123	Burkina Faso	-5.92	160	136	115
53	Namibia	2.56	59	48	98	124	Gabon	-6.18	157	141	170
54	Slovenia	2.38	63	64	107	125	Congo, Rep.	-6.36	164	174	125
55	Hungary	2.10	66	70	31	126	Liberia	-6.52	144	156	143
56	Brazil	2.03	87	74	169	127	Burundi	-7.21	163	144	117
57	Egypt	2.00	46	77	66	128	Niger	-8.32	168	151	115
58	Bulgaria	1.90	67	84	153	129	Sudan	-8.48	162	163	170
59	Belize	1.80	58	54	85	130	Lao PDR	-8.57	154	165	158
60	Trinidad and Tobago	1.55	64	71	105	131	Bhutan	-8.77	167	181	129

61	Morocco	1.51	62	72	12	132	Ghana	-8.89	159	167	101
62	Guyana	0.94	22	46	76	133	Guinea-Bissau	-8.98	174	180	162
63	Fiji	0.54	76	81	52	134	Rwanda	-9.36	169	175	122
64	Philippines	0.47	84	76	63	135	Central African Republic	-9.41	179	162	127
65	Kenya	0.32	77	87	94	136	Myanmar	-10.12	166	173	67
66	Poland	0.18	81	96	116	137	Uganda	-10.27	172	179	131
67	Algeria	0.04	69	112	46	138	Chad	-10.41	180	176	133
68	Qatar	-0.02	60	75	37	139	Equatorial Guinea	-10.60	175	164	145
69	India	-0.15	82	92	170	140	El Salvador	-11.35	177	166	32
70	Honduras	-0.16	97	73	128	141	Sierra Leone	-11.56	142	161	139
71	Jamaica	-0.22	74	98	130	142	Tanzania	-12.26	158	169	141

Fin.dev. refers to the mean of the financial development index over the whole period for which data for the given country was available
Ranks based on other measures: (1) Deposits/GDP, (2) Private credit/GDP, (3) Interest rate spread

8.5 Distribution of the financial data



8.6 Computation of the counterfactual scenarios - details

This analysis has only been done for 29 countries for which both remittance inflows and financial development levels have increased between 1970-2010. Values of δ_1, δ_2 and δ_3 are taken from the main QML-FE results.

1. GDP per capita in the last period can be estimated as:

$$y_{iT} = \alpha + \gamma y_{i,T-1} + \delta_1 \text{Rem}_{iT} + \delta_2 \text{FinDev}_{iT} + \delta_3 \text{Rem}_{iT} \text{FinDev}_{iT} + \boldsymbol{\beta X_{iT}} + \eta_t \quad (8)$$

2. Scenario I - no remittances change or no financial development change

   (a) No remittance change $\Rightarrow \text{Rem}_{iT} = \text{Rem}_{i1}$
   In this case GDP per capita in the last period could be approximated by:

$$\hat{y}_{iT} = \alpha + \gamma y_{i,T-1} + \delta_1 \text{Rem}_{i1} + \delta_2 \text{FinDev}_{iT} + \delta_3 \text{Rem}_{i1} \text{FinDev}_{iT} + \boldsymbol{\beta X_{iT}} + \eta_t \tag{9}$$

   and the growth rate differential (in percentage points is:):

$$100 * (\hat{y}_{iT} - y_{iT})_{\text{noremitgrowth}} = -\delta_1 \Delta \text{Rem}_{iT} - \delta_3 \Delta \text{Rem}_{iT} \text{FinDev}_{iT} \tag{10}$$

   where $\Delta \text{Rem}_{iT} = \text{Rem}_{iT} - \text{Rem}_{i1}$

   (b) No financial development change $\Rightarrow \text{FinDev}_{iT} = \text{FinDev}_{i1}$
   Similarly to (10):

$$100 * (\hat{y}_{iT} - y_{iT})_{\text{nofindevgrowth}} = -\delta_2 \Delta \text{FinDev}_{iT} - \delta_3 \Delta \text{FinDev}_{iT} \text{Rem}_{iT} \tag{11}$$

   and $\Delta \text{FinDev}_{iT} = \text{FinDev}_{iT} - \text{FinDev}_{i1}$

3. Scenario II - Larger than observed increase of remittances or financial development between 1970 and 2010

   (a) Remittance overall growth 20% higher than observed $\Rightarrow \hat{\text{Rem}}_{iT} = 1.2 * (\text{Rem}_{iT} - \text{Rem}_{i1}) + \text{Rem}_{i1}$
   In this case GDP per capita in the last period could be approximated by:

$$\hat{y}_{iT} = \alpha + \gamma y_{i,T-1} + \delta_1 \hat{\text{Rem}}_{i1} + \delta_2 \text{FinDev}_{iT} + \delta_3 \hat{\text{Rem}}_{i1} \text{FinDev}_{iT} + \boldsymbol{\beta X_{iT}} + \eta_t \tag{12}$$

   and the growth rate differential (in percentage points is:):

$$100 * (\hat{y}_{iT} - y_{iT})_{\text{remitgrowth20}} = (\hat{\text{Rem}}_{iT} - \text{Rem}_{iT}) * (\delta_1 + \delta_3 \text{FinDev}_{iT}) \tag{13}$$

   (b) Financial development overall growth 20% higher than observed $\Rightarrow \hat{\text{FinDev}}_{iT} = 1.2 * (\text{FinDev}_{iT} - \text{FinDev}_{i1}) + \text{FinDev}_{i1}$

$$100 * (\hat{y}_{iT} - y_{iT})_{\text{findevgrowth20}} = (\hat{\text{FinDev}}_{iT} - \text{FinDev}_{iT}) * (\delta_2 + \delta_3 \text{Rem}_{iT}) \tag{14}$$

8.7 Estimation results for the sample limited to 2006 (before the financial crisis

Table 8: System GMM results

	(1) Overall fin.cond. b/se	(2) Financial systems deposits/GDP b/se	(3) Priv. credit/GDP b/se	(4) Interest rate spread b/se
L.Real GDP per capita (log)	0.667***	0.680***	0.784***	0.671***
	(0.151)	(0.174)	(0.169)	(0.168)
Investment/GDP	0.006	0.006	0.007	0.010**
	(0.005)	(0.005)	(0.005)	(0.005)
Population growth	-0.137***	-0.149***	-0.095*	-0.127**
	(0.052)	(0.056)	(0.057)	(0.059)
Complete Sec. Sch. Attained in Pop.	0.004	0.002	0.006	0.006
	(0.008)	(0.009)	(0.008)	(0.010)
Government expenditure/GDP	0.005	-0.001	0.007	-0.003
	(0.009)	(0.010)	(0.011)	(0.010)
Trade Openness (log)	0.103	0.061	0.151	0.150
	(0.118)	(0.118)	(0.117)	(0.148)
Remittance inflows/GDP (log)	0.002	0.243	0.374**	0.001
	(0.041)	(0.168)	(0.156)	(0.067)
Financial development measure (log)	0.002	0.028	-0.022	-0.027
	(0.009)	(0.080)	(0.059)	(0.034)
Remittance-finance interaction term	-0.017***	-0.068	-0.107**	0.009
	(0.007)	(0.050)	(0.049)	(0.026)
Observations	207	198	198	154
Countries	54	52	52	48
average no. of obs. per country	3.833	3.808	3.808	3.208
Number of instruments	47	47	47	45
p-value for Hansen's test	0.378	0.424	0.213	0.551
p-value for AR(1) in residuals test	0.233	0.275	0.229	0.152
p-value for AR(2) in residuals test	0.280	0.355	0.186	0.038

Table 9: QML-FE results

	(1) Overall fin.cond. b/se	(2) Financial systems deposits/GDP b/se	(3) Priv. credit/GDP b/se	(4) Interest rate spread b/se
L.Real GDP per capita (log)	0.757***	0.764***	0.764***	0.738***
	(0.051)	(0.052)	(0.049)	(0.064)
Investment/GDP	0.008***	0.008***	0.008***	0.005***
	(0.002)	(0.002)	(0.002)	(0.002)
Population growth	-0.051*	-0.057**	-0.060**	-0.043*
	(0.027)	(0.026)	(0.027)	(0.022)
Complete Sec. Sch. Attained in Pop.	-0.002	-0.001	-0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.003)
Government expenditure/GDP	-0.007**	-0.010***	-0.008**	-0.012**
	(0.003)	(0.003)	(0.004)	(0.006)
Trade Openness (log)	0.041	0.049	0.042	0.118**
	(0.034)	(0.035)	(0.035)	(0.047)
Remittance inflows/GDP (log)	-0.026*	0.079	0.049	-0.038
	(0.016)	(0.064)	(0.048)	(0.033)
Financial development measure (log)	-0.001	-0.035	-0.015	-0.007
	(0.004)	(0.032)	(0.022)	(0.010)
Remittance-finance interaction term	-0.005**	-0.030	-0.022	0.016
	(0.003)	(0.020)	(0.015)	(0.011)
Observations	201	185	185	127
Countries	48	45	45	39
average no. of obs. per country	4.188	4.111	4.111	3.256

Notes: Bootstrapped standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$