Do remittances not promote growth?

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Do remittances not promote growth? A finite mixture-of-regressions approach

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Abstract This paper re-examines the impact of remittance inflows on growth using data for developing countries over the period 1970–2010. We relax the hypothesis that all countries follow the same unique growth regime in favor of multiple regimes, and test whether the impact of remittances on growth depends on the growth regime to which an economy belongs. We follow the recent literature that has applied the finite-mixture-of-regressions method in other circumstances to endogenously identify growth regimes, correcting for unobserved heterogeneity. We find that our data are best described by an econometric model with two different growth regimes: one in which remittances have a positive and significant marginal impact on growth; and another in which the impact of remittances is insignificant. The analysis of the determinants of the probability of being in the remittances growth-enhancing regime shows that being a Sub-Saharan African country increases significantly this probability, while financial development moderately reduces this probability but with strong reservations on the statistical significance of the estimates on the different indicators of financial development.

Keywords Remittances · Growth regimes · Finite-mixture-of-regressions approach

JEL Classification F24 · O47

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1 Introduction

Remittance inflows have significantly increased in many developing countries during last years, surpassing the international official aid inflows, and they are currently ranked as the second-largest external capital flows after foreign direct investment. Remittances lead to desirable development features by boosting human and physical capital, by alleviating poverty and inequality , and by smoothing the consumption of the recipients.[1] At the same time, a heated debate has taken place over the effect of remittances on economic growth. While some evidences support the view that remittances have a positive direct impact on countries' growth rate, the more skeptical view argues that remittances are a curse for the growth rate, or at best have no effect on it.[2] There are different arguments that explain the remittance curse thesis, including the altruistic effect that points out the fact that remittances are mainly oriented to consumption rather than productive activities. It is also noted that remittances have a moral hazard effect by increasing recipients' incentive to switch from labor activities to leisure. At this stage, there is no consensus on whether remittances are beneficial for economic growth, and the debate on the effect of remittance inflows on growth remains inconclusive.

Surprisingly, in this part of the literature, the possibility that countries may follow different growth regimes or growth paths has received very little attention, despite the recent influential literature that has rejected the hypothesis of a single, unique growth regime that is identical for all countries in growth regressions (e.g., Durlauf and Johnson 1995; Owen et al. 2009; Bos et al. 2010). This paper reconsiders the effect of remittances on economic growth in developing countries and postulates that the question of whether remittances enhance growth or not depend on the growth regime to which a given country belongs. We relax the hypothesis that all countries follow a single, unique growth regime in favor of multiple growth regimes such that the marginal impacts of our explanatory variables,[3] including remittances, on growth differ across regimes. This enables us to test whether remittances have a positive effect on growth in some growth regimes and a negative or neutral effect in others. We further investigate the determinants of the probability of a country being in the remittances growth-promoting regime, controlling for instance for geographical location and for financial development.

Although some scholars have tried to divide their samples based on a-priori imposed variables, such as financial development, institutions or geographical location (e.g., Giuliano and Ruiz-Arranz 2009 and Bettin and Zazzaro 2011), and to allow for heterogeneity in the effect of remittances on growth, the possible heterogeneity that may exist in any other explanatory variables included in the estimations are ignored and not

[1] See for instance, Edwards and Ureta (2003), Glytos (2002), Adams and Page (2005), Gupta et al. (2009).

[2] See for instance Catrinescu et al. (2009), World Bank (2006) for evidence on the positive effect of remittances on economic growth Chami et al. (2003) and Singh et al. (2011), Barajas et al. (2009), Rao and Hassan (2011) for evidence on the negative association between remittances and economic growth and ; and Senbeta (2012) and Ahamada and Coulibaly (2013) for recent findings on the neutral impact of remittances on growth.

[3] The variables are all presented in Sect. 3 below.

tested. We apply an endogenous and flexible method to examine heterogeneity, similar to that recently applied in determining the existence of multiple growth regimes in other circumstances.[4] Our strategy consists in applying the finite-mixture-of-regressions method, a semi-parametric approach suited to model unobserved heterogeneity without any *a-priori* grouping of countries based on observed characteristics such as high or low income, geographical location or financial development, as suggested in previous studies. Instead, we leave the data to speak for themselves, and as such countries are classified into growth regimes depending on the similarity of the distribution of their growth rates over time, after controlling for a number of explanatory variables described later in Sect. 3.

This approach has several desirable features and brings new light to bear on the effect of remittances on economic growth in developing countries. First, we leave the data to identify endogenously the optimal number of growth regimes/paths that have generated our data, enabling the marginal effects of remittances and the other control variables on economic growth to vary across the identified regimes. Second, for each country we are able to compute its posterior probabilities of belonging to the different identified growth regimes using the Bayes rule based on the estimated parameters of our model. This allows us to classify countries into different growth regimes based on these estimated probabilities. We also run an analysis of the determinants of these probabilities, testing whether geographical location, financial development and to some extent the quality of the institutions determine the classification of the countries into the remittances growth-enhancing regime.

For our analysis, we use a sample of 120 developing countries, covering the period 1970–2010. Our mixture-of-regressions findings show that our data are best fitted by an econometric model of two different growth regimes. In the first regime, the marginal impact of remittances on growth remains insignificant, while in the second regime, remittances have a positive and significant impact on the growth rate. Roughly 60% of the countries are in the first group, and the remaining 40% are in the second. There is substantial heterogeneity of countries within growth regimes, in terms of their level of development and their amount of remittances received, as well as in terms of their geographical location, indicating that our classification does not coincide with those obtained by ad hoc ex ante classifications.

Our analysis of the determinants of the probability of being in the remittances growth-enhancing regime shows that being a Sub-Saharan African (hereafter SSA) country increases significantly the probability for a given country to be classified in the remittances growth-enhancing regime. In contrast, the level of financial development is not statistically significant regardless on the indicator of financial development that we use. We argue that, in SSA where the financial sector lags behind, remittance inflows are important sources of investments and funding for good and talented entrepreneurs who do not have the much-needed access and use of finance in order to fully realize their economic potential. As such, the positive effect of remittances on investment may boost the growth rate. An additional finding in this paper is that political institutions measured as the level of democracy remains an important determinant of the classification of

[4] See for instance Konte (2013) for studies on natural resources and economic growth, and Flachaire et al. (2014) for evidence on institutions and economic growth.

countries into the identified growth regimes, confirming the results in Flachaire et al. (2014), who argue that political institutions are one of the deep causes of economic growth, setting the stage in which economic institutions and the determinants of growth operate.

2 Review of the literature

2.1 Remittances and economic growth

This paper is first in line with the empirical literature on the impact of remittances on the growth rate. The results are mixed, and the debate remains open-ended. While some scholars have argued that remittances have a negative impact on growth, others have supported the optimistic view, arguing that remittances have a positive impact on the growth rate. Singh et al. (2011), in a sample of SSA countries, found that remittances have on average a negative impact on the growth rate of African countries. Catrinescu et al. (2009) reconsidered the relationship between remittances and long-run economic growth, and extended the framework of Chami et al. (2003) by addressing the heterogeneity issue, which may be a source of inconsistent conclusions. Employing dynamic panel regression techniques, they found that remittances have a positive and robust effect on the long-run growth rate.

Another part of this literature has instead supported a different opinion in this debate, and has argued that the different results from the previous studies may be subject to some econometric issues, and that overall the effect of remittances on growth is not statistically significant. For instance, Ruiz et al. (2009) pointed to the nonlinearity in the relationship between remittances and economic growth, something that may be a source of bias. The authors applied a nonparametric strategy that does not impose any *a-priori* functional form on the relationship between economic growth and remittances. Their results showed a positive and significant effect of remittances on growth, which, however, turned insignificant once the nonlinearity was accounted for. Senbeta (2012), in a sample of developing countries, analyzed the effect of remittances on key important factors for growth: capital accumulation and total factor productivity (TFP). They found a positive impact of remittances on the former but a nonsignificant effect on the latter, a result that enabled them to argue that remittances do not generate growth because of the neutral effect of remittances on TFP, an important factor in the growth process; see Catrinescu et al. (2009), World Bank (2006) among others. Our current paper extends this literature and proposes a new econometric method, the finite-mixture-method, a semi-parametric method that helps to correct possible unobserved heterogeneity. This approach has received increasing attention in the literature on empirical growth, but it has not yet been applied to this part of the literature on the effect of remittances on economic growth.

There are different possible mechanisms through which remittances may enhance or reduce economic growth. On the one hand, remittance inflows may stimulate investment in human capital by raising school expenditures and the incentives of recipient households (Edwards and Ureta 2003). They may also increase the stock of physical capital (Lucas 2005; Glytos 2002), which is a good source of investment for small

businesses and talented entrepreneurs who do not have access to finance (Amuedo-Dorantes and Pozo 2006a) in order to fully realize their potential. On the other hand, it has been pointed out that remittances are not particularly spent on growth-enhancing activities. Instead, these inflows have an altruistic effect since they are oriented to consumption (Stark 1995) rather than productive activities. It has also been argued that remittances may increase recipients' incentive to switch from labor activities to leisure, known as the moral hazard effect (e.g., Amuedo-Dorantes and Pozo 2006b; Lokshin and Glinskaya 2009; Cox-Edwards and Rodríguez-Oreggia 2009, and Ebeke 2012). Remittance inflows are also associated with the appreciation of the real ex-change rate, slowing down export activity, a phenomenon known as the Dutch Disease Hypothesis (Acosta et al. 2009; Bourdet and Falck 2006).

2.2 Remittances, economic growth and financial development

This paper also contributes to the literature that tries to determine the possible indirect mechanisms through which remittances may affect growth. One of the most explored channels is that linking remittances and the level of financial development. For instance, Giuliano and Ruiz-Arranz (2009) tested whether remittances and financial development are substitutes or complements, using panel data of developing countries. They found that remittances do not have a directly significant impact on growth, but their effect depends on the level of financial development. Similar findings were also provided by Nyamongo et al. (2012), but these results are not robust and depend on the indicator of financial development used. In contrast, Bettin and Zazzaro (2011) did not support the substitution theory; instead, their results are in line with the complementary view. These authors used different indicators of financial development that capture the efficiency of the financial system in a country, unlike previous studies that focused on indicators of depth. Additional mechanisms through which remittances may affect growth have been tested, among them, investment in physical capital (see Ahamada and Coulibaly 2013), and capital accumulation and total factor productivity (see Senbeta 2012). In this paper, we propose a new strategy to link financial development to the marginal impact of remittances on the growth rate. We test whether financial development helps to explain the likelihood that a given country follows the growth path where remittances increase the economic growth rate. Our main finding is that financial development is not a significant determinant of the classification of the countries into the remittance growth-enhancing regime.

2.3 Multiple growth regimes

Finally, our paper also follows the recent literature on the existence of multiple growth regimes in growth analysis, placing particular emphasis on the unobserved heterogeneity that may provide biased estimates in growth regressions. Starting with Durlauf and Johnson (1995), the hypothesis that all countries follow the same unique growth regime has been rejected in favor of multiple regimes in a number of papers with different econometrics tools. In the literature of remittances and economic growth, Giuliano and Ruiz-Arranz (2009) have applied an endogenous method to classify countries using

classification and regression tree analysis (Breiman et al. 1984), where countries are grouped based on an optimal determined threshold value for financial development. However, this approach presents a number of limitations in profiling the countries in terms of growth regimes. First, the determination of the different groups of countries is based on a single variable, financial development, without testing the influence that the other variables included in the model may have in grouping countries into regimes. Second, the classification analysis and regression tree method has been criticized because of its lack of an appropriate asymptotic assumption needed for inference on the selection of the threshold values for the sorting variables (Tan 2010). Recently, scholars have proposed the use of the mixture-of-regressions method, which is an endogenous semiparametric clustering method. This approach presents desirable features in terms of flexibility and goodness of fit, which explain its use in recent studies. Starting with Paap et al. (2005) and Owen et al. (2009), who investigated the question of whether countries follow the same growth process/regime, a more recent line of the literature has used this methodology to re-analyze some open-ended debates. For instance, Flachaire et al. (2014) used this approach to examine why it has been so difficult to find a positive and significant impact of political institutions on the growth rate, despite the existing theory that has proven their importance in the growth process. Konte (2013) also used this approach and showed that the impact of natural resources on growth depends on countries' growth regime. No studies have applied this clustering approach in the study of the effect of remittances on economic growth. This paper will fill this gap.

The rest of the paper is organized as follows. Section 2 describes the data used for the estimations, while Sect. 3 presents the econometric method. Section 4 discusses the main findings and provides some robustness checking, and the last section concludes.

3 Data description

We use 5-year panel data that contain more than 120 developing countries for the period 1970–2010, which yields eight different time periods. The dependent variable is the average annual growth of real GDP per capita ($growth_{i,t}$) over 5-year time periods. Data on the GDP per capita are taken from Penn World Table PW 7.1. Our variable remittances is measured as the ratio of total personal inflows to total GDP. Both, the remittance inflows data and the GDP are taken from the World Development Indicators database. The remittance inflows' calculation is based on a number of different sources, including data from the IMF Balance of Payments Statistics database, as well as data from central banks, national statistical agencies, and the World Bank country desks.

As additional explanatory variables, we include the initial level of GDP per capita from PW 7.1, which allows us to assess the convergence versus the divergence hypothesis in our data. We also control for investment in physical capital taken from PW 7.1, averaged over the 5-year periods. Furthermore, we include the following explanatory variables: the average population growth rate from PW 7.1 augmented by a term that accounts for the depreciation rate of the capital and technological change as expressed in Mankiw et al. (1992), who equalized it to 0.05; a proxy for the degree of trade openness defined as the share of the total amount of imports and exports in total GDP from PW 7.1; a variable that measures government consumption relative to GDP; and

an index of inflation from the World Development Indicators. These different variables are all averaged over the 5-year periods.

We also control for financial development using quantitative indicators of financial depth such as domestic credit relative to GDP averaged over the 5-year periods. This indicator is taken from the World Development Indicators. In some of our specifications, we also control for the initial level of human capital as well as for indicators of institutions, distinguishing economic institutions from political institutions since they capture different features and may affect growth differently (Flachaire et al. 2014). Education is measured as the average years of schooling for the total population aged over 15 taken from Barro and Lee (2013). We use the indicator of Economic Freedom of the World (EFW) from the Fraser Institute as our proxy of economic institutions, and the indicator of democracy from the Polity 4 as our main indicator of political institutions. This index is ranked from 0 to 10, where 0 is allocated to full autocracies like Syria and 10 to full democracies like Costa Rica. It is, however, important to highlight that the inclusion of education, economic and political institutions reduces our sample significantly due to a large number of missing values. In order to keep as many observations as possible, we do not control for education and institutions in all our specifications.

Another important question that we address in this paper is the determinants of the classification of the countries into the different growth regimes identified. For that we include concomitant variables in the analysis of the determinants of growth regime membership. We test, for instance, whether financial development helps to explain the likelihood that a given country is better classified in the remittances growth-enhancing regime. We also look at the importance of geographical location, such as being a SSA country or a Latin American (hereafter LA) country in the classification of the countries. Following the recent literature on growth regimes and institutions, we, to some extent, include indicators of institutions in the analysis of the classification of the countries into the various regimes. For the continuous concomitant variables such as financial development, we use the average value over the entire period 1970-2010. In fact, in our framework we do not allow countries to switch from one regime to another over time, following previous studies that have applied the mixture-of-regressions method in other circumstances (Owen et al. 2009; Flachaire et al. 2014).

Table 1 presents the descriptive statistics of the main variables used in the empirical analysis, and some coefficients of correlation among the main variables are shown in Table 2.

4 Empirical strategy

4.1 Baseline model

Our baseline parametric model of estimation is expressed as follows:

$$\begin{aligned}\mathsf{growth}_{i,t} = {} & \beta_0 + \beta_1 \mathsf{remit}_{i,t} + \beta_2 \mathsf{gdp}_{i,t} + \beta_3(\mathsf{pop}_{i,t} + 0.05) + \beta_4 \mathsf{invest}_{i,t} \\ & + \beta_5 \mathsf{openness}_{i,t} + \beta_6 \mathsf{inflat}_{i,t} + \beta_7 \mathsf{govconsump}_{i,t} + \beta_8 \mathsf{credit}_{i,t} \\ & + \beta_8 \mathsf{w}_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

Table 1 Descriptive statistics and data sources

Variable	Obs	Mean	SD	Min	Max	Description	Data source
Growth	951	1.48	3.94	−23.14	24.14	Average annual growth rate over 5-year period	Penn World Table 7.1
Remit	674	.05	.09	0	.89	Average remittance inflows over 5 year period	World Development Indicators
ln(Credit)	798	3.39	.80	−.84	5.77	Log of average domestic credit provided by financial to GDP over 5 year period	World Development Indicators
ln(Pop+0.05)	1040	1.92	.24	−2.52	2.61	Log of population growth over 5 year	Penn World Table 7.1
ln(Gdp)	951	7.74	.95	5.08	10.17	Log of initial GDP per capita	Penn World Table 7.1
ln(Invest)	970	2.98	.57	.43	4.29	Log of average investment over 5 year period	Penn World Table 7.1
ln(Open)	970	4.08	.67	.64	5.53	Log of average trade openness over 5 year period	Penn World Table 7.1
ln(GovCons)	834	2.66	.44	1.43	4.89	Log of average government consumption to GDP over 5 year period	Penn World Table 7.1
ln(Inflation)	847	2.39	1.31	−3.73	8.68	Log of average inflation over 5 year period	World Development Indicators
ln(Educ)	712	1.40	0.70	−3.04	2.39	Log of initial average years of education ofnewline the total population aged over 15	Barro and Lee (2013)
Dem	802	3.12	3.40	0	10	Average index of democracy over 5 year period	Polity IV project
Eco	567	5.48	1.09	2.46	7.81	Average index of economic institutions over 5 year period	Economic Freedom of the world project

Table 1 continued

Variable	Obs	Mean	SD	Min	Max	Description	Data source
ln($\overline{\text{Credit}}$)	952	3.44	.65	2.14	4.93	Log of average domestic credit provided by financial to GDP over the period 1970–2010	World Development Indicators
ln($\overline{\text{Liquid}}$)	968	3.39	.56	1.84	5.38	Log of average liquid liabilities to GDP over the period 1970–2010	World Development Indicators
ln($\overline{\text{Broad}}$)	984	3.48	.53	2.38	5.21	Log of average broad money to GDP over the period 1970–2010	World Development Indicators
$\overline{\text{Dem}}$	896	3.19	2.76	0	10	Average index of democracy over the period 1970–2010	Polity IV project
$\overline{\text{Eco}}$	720	6.01	.69	4.08	7.36	Average index of economic institutions over the period 1970–2010	Economic Freedom of the world project

All the variables at the bottom averaged over the period 1970–2010 are concomitant variables

Table 2 Coefficients of correlation among main variables

	Growth	Remit	ln(Credit)	ln(Pop+0.05)	ln(Gdp)	ln(Invest)	ln(Open)	ln(GovCons)	ln(inflation)	Eco	Dem	Latin-car	SSA
Growth	1												
Remit	0.116**	1											
ln(Credit)	−0.015	0.014	1										
ln(Pop+0.05)	−0.128**	−0.093**	−0.115**	1									
ln(Gdp)	0.035	−0.039	0.449***	−0.254***	1								
ln(Invest)	0.232***	0.178***	0.209***	−0.009	0.343***	1							
ln(Open)	0.134***	0.241***	0.118**	−0.134***	0.238***	0.363***	1						
ln(GovCons)	−0.083**	0.138***	0.217***	−0.0300	0.162***	0.249***	0.360***	1					
ln(inflation)	−0.107**	−0.104**	−0.123**	−0.032	0.004	−0.141***	−0.325***	−0.155**	1				
Eco	0.357***	0.275***	0.179***	−0.140**	0.308***	0.235***	0.438***	0.051	−0.416***	1			
Dem	0.082*	−0.006	0.224***	−0.174***	0.339***	0.064	−0.008	−0.056	0.015	0.409***	1		
Latin-car	−0.055	−0.056	0.178***	−0.065	0.401***	0.012	−0.127***	−0.164***	0.188***	0.137**	0.367***	1	
SSA	−0.192***	−0.053	−0.316***	0.207***	−0.512***	−0.124**	−0.022	0.104**	−0.078*	−0.192***	−0.271***	−0.391***	1

The table reports the Pearson's coefficients of correlation
***, **, * Statistical significance at the 1, 5, and 10% levels, respectively

Our dependent variable, 5-year growth rate, $\text{growth}_{i,t}$ is regressed on a set of explanatory variables, including remittances, $\text{remit}_{i,t}$. The vector w_{it} contains additional explanatory variables that are controlled for in some of our estimations, such as education and institutions for instance. We assume that the error terms ε_{it} are identically and independently distributed and follow a normal distribution with mean zero and variance σ^2.

The key parameter of interest is β_1, which tells us the average marginal impact of increasing the level of remittances on the growth rate. This equation supposes that all countries follow the same unique growth regime or process and that the effects of the explanatory variables, such as remittances, on growth are similar for all countries. This hypothesis of homogeneity may be questionable given the recent literature that has investigated in depth the question of whether all countries follow the same growth process. It has been well established that the models with multiple growth regimes dominate the single growth-regime models. However, little effort has been made to test endogenously, without any ex ante assumption, whether the effect of remittances on growth is heterogeneous and depends on the growth regime to which a given country is assigned. We shall now introduce our mixture-of-regressions method that allows us to test whether the model with multiple growth regimes dominates the model with a single growth regime, expressed in Eq. 1.

Before we describe the mixture-of-regressions method, it is important to note that, while our main aim is to correct possible unobserved heterogeneity by employing the mixture-of-regressions method, our approach does not account for the bias that may result from cross-section error dependence, a source of spurious inference. In the literature, different approaches to correct cross-sectional dependence bias have been proposed (e.g., Pesaran 2006; Chudik et al. 2011). As far as we know, no methods have been developed that enable us to account endogenously for both unobserved heterogeneity and cross-sectional dependence bias, leaving the door open for further research in tackling this econometrics topic.

4.2 Finite mixture-of-regressions method

The finite mixture-of-regressions method has recently been applied in the empirical growth literature in an attempt to detect the existence of multiple growth regimes or paths in different circumstances. It is a semi-parametric method suited to correct possible unobserved heterogeneity that may exist in the data without any a-priori grouping of countries based on observed characteristics (see, Frühwirth-Schnatter 2006; Ahamada and Flachaire 2010). This provides more flexibility and a better fit of the data. In order to define the model in a simple way, let us consider our dependent variable growth, the key explanatory variable of interest remit, and X, the set of additional controls defined above. The mixture-of-regressions model in its general specification is defined as follows:

$$f(\mathsf{growth}_{\mathsf{i,t}}|\mathsf{remit}_{\mathsf{i,t}}, \mathsf{x}_{\mathsf{i,t}}; \Theta) = \sum_{k=1}^{K} \pi_k f_k(\mathsf{growth}_{\mathsf{i,t}}|\mathsf{remit}_{\mathsf{i,t}}, \mathsf{x}_{\mathsf{i,t}}; \beta_k, \sigma_k) \qquad (2)$$

The parameter K is the number of groups or growth regimes which is unknown, and its optimal value will be chosen using some goodness-of-fit criteria such as the Bayesian Information criterion (BIC) and the consistent Akaike information criterion (CAIC) statistics. The parameter π_{k} is the proportion of the countries that belong to the specific growth regime k; $\mathsf{f_k}(\mathsf{growth_{i,t}}|\mathsf{remit_{i,t}}, \mathsf{x_{i,t}}; \beta_{\mathsf{k}}, \sigma_{\mathsf{k}})$ is the conditional density of the growth rate in the latent regime k. The parameters in the latent growth regime k are β_{k} and σ_{k}. Both β_{k} and σ_k are unknown and will be estimated. We suppose that $\mathsf{f_k}(\cdot)$ is a Gaussian distribution.

For simple illustration, if our data are generated by a model with a single growth regime, which implies that $K = 1$, then Eq. 2 is identical to the parametric specification expressed in Eq. 1 above, which can be rewritten as follows:

$$\mathsf{growth_{i,t}} = \beta_0 + \beta_1 \mathsf{remit_{i,t}} + \beta_2 \mathsf{x_{i,t}} + \varepsilon_{i,t}, \quad \varepsilon_{i,t} \sim N(0, \sigma^2) \tag{3}$$

In this case, the impact of remittances on growth is given by β_1 and this value is identical for all countries. In contrast, if we suppose that the data are better generated by two different growth regimes, assuming that $K = 2$, then equation 2 can be simplified as follows:

$$\begin{aligned} \text{Group 1:} \quad & \mathsf{growth_{i,t}} = \beta_{01} + \beta_{11}\mathsf{remit_{i,t}} + \beta_{21}\mathsf{x_{i,t}} + \varepsilon_{1i,t}, \quad \varepsilon_1 \sim N(0, \sigma_1^2), \\ \text{Group 2:} \quad & \mathsf{growth_{i,t}} = \beta_{02} + \beta_{12}\mathsf{remit_{i,t}} + \beta_{22}\mathsf{x_{i,t}} + \varepsilon_{2i,t}, \quad \varepsilon_2 \sim N(0, \sigma_2^2) \end{aligned} \tag{4}$$

In this second scenario, the error terms ε_1 and ε_2 are assumed to be independent. The coefficients on remittances may be different across the two regimes because the environment in which growth occurs may differ across regimes. This implies that countries are heterogeneous and behave differently in their growth process. Hence, ignoring the existence of multiple growth regimes may lead to wrong conclusions on the effect of remittances on the growth rate.

The choice of the number of regimes K is crucial, and to select its optimal value, we mainly refer to some statistical criteria to assess the goodness of fit of our estimations for the different values of k. Our best model will be the one that minimizes both the BIC and the CAIC. We also rely on previous studies to fix the maximum number of growth regimes to be estimated, which is defined as the highest value found in the literature. Once the number of regimes, K, is selected, and the parameters of the model estimated, we can compute the posterior probability of each country being assigned to a given latent growth regime k, using the Bayes rule such that:

$$\hat{\pi}_{\mathsf{ik}} = \frac{\hat{\pi}_{\mathsf{k}} \mathsf{f_k}(\mathsf{growth}|\mathsf{remit}, \mathsf{x}; \hat{\beta}_k, \hat{\sigma}_k)}{\sum_{k=1}^{K} \hat{\pi}_k f_k(\mathsf{growth}|\mathsf{remit}, \mathsf{x}; \hat{\beta}_k, \hat{\sigma}_k)} \tag{5}$$

These estimated probabilities will be used to sort countries into the different growth regimes found in our sample. The rule is that a given country i belongs to the growth regime k rather than j if its estimated probability $\hat{\pi}_{ik}$ is higher than its probability $\hat{\pi}_{ij}$ where $k \neq j$.

For our analysis of the determinants of the classification of the countries into the different growth regimes, we add to the model in Eq. 3 a set of variables Z commonly

known in the literature as concomitant variables. The variables Z include a measure of financial development averaged over the entire period, dummies on geographical location such as being a SSA or a LA country, and different indicators of institutions averaged over the entire period. While standard variables X help to explain inter-heterogeneity within each growth regime, concomitant variables help to explain intra-heterogeneity across the different growth regimes identified. As already mentioned in Sect. 2, we do not allow countries to switch from one regime to another over time, following the same approach used in the literature in other circumstances (e.g., Owen et al. 2009; Flachaire et al. 2014). Addressing the move of the countries across different regimes over time remains an important research question and can be investigated using the Hidden Markov mixture-of-regression approach. However, we should note that this approach may require more data than that we have in our analysis.

As determinants of regime membership, concomitant variables act like covariates in a multinomial regression model. Our estimation model augmented with the concomitant variables consists, then, in endogenizing the parameter π, and then we obtain the following model:

$$f(\mathsf{growth}_{i,t}|\mathsf{remit}_{i,t}, \mathsf{x}_{i,t}, \mathsf{z}_i; \Theta) = \sum_{k=1}^{K} \pi_k(z_i, \alpha) f_k(\mathsf{growth}_{i,t}|\mathsf{remit}_{i,t}, \mathsf{x}_{i,t}; \beta_k, \sigma_k) \tag{6}$$

5 Empirical results

5.1 Parametric method results

Table 3 presents the results of the parametric approach where we assume that all the countries follow the same growth regime or process. For the purpose of robustness, we consider two different sample sizes. The main data include all the 120 countries for which data on remittances are available. The second sample, which contains 93 developing countries, is restricted to countries for which information on remittances is available for at least four time periods, meaning half the total number of periods in our data. The table reports the pooled, FE and RE effects' estimations with and without instrumenting remittances using the first lag. Time dummies are also included in all the different estimations. Results reported in the first five columns are those with the extended sample, while the results in the last seven columns are obtained with the restricted sample. We should mention that, due to significant missing values on education and on the indicators of institutions, the sample size is drastically reduced to 88 and 74 countries, with the extended data as shown in columns (2) and (3). This value decreases to 66 when controlling for both education and institutions using the restricted sample in column (7). Across the different rows, the coefficient on remittances is never significant, even though the sign varies across the columns. Under the hypothesis of a single growth regime, the results seem to indicate that remittances do not help to promote economic growth in developing countries.

Regarding the other explanatory variables included in the model, we can see that the convergence hypothesis, indicated by the negative sign on the coefficient of the initial level of GDP per capita, is strongly supported in our sample, while the negative effect of the growth rate of the population on economic growth remains less robust. The investment in physical capital, which has been considered as one of the most robust

Table 3 Standard regression results

	Pooled-OLS			FE	RE	Pooled-OLS		FE	RE	IV Pooled-OLS	IV FE	IV RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Remit	0.560	−0.889	−2.446	−3.365	0.184	0.669	−1.159	−1.326	0.157	0.864	−2.403	0.000584
	(1.472)	(1.432)	(2.530)	(3.336)	(1.901)	(1.533)	(2.651)	(3.513)	(1.924)	(1.629)	(6.042)	(2.160)
ln(Pop+0.05)	−1.424***	−0.361	−0.431	0.634	−0.547	−1.033**	−0.122	0.659	−0.313	−0.947*	0.848*	−0.164
	(0.487)	(0.476)	(0.467)	(0.468)	(0.482)	(0.499)	(0.473)	(0.466)	(0.489)	(0.498)	(0.467)	(0.485)
ln(Gdp)	−0.253	−0.859***	−1.055***	−5.939***	−0.544**	−0.321*	−1.109***	−5.526***	−0.600***	−0.252	−5.844***	−0.409*
	(0.159)	(0.193)	(0.209)	(0.554)	(0.212)	(0.170)	(0.217)	(0.563)	(0.224)	(0.182)	(0.748)	(0.239)
ln(Invest)	1.607***	1.601***	2.028***	2.070***	1.875***	1.685***	2.100***	2.091***	1.954***	1.546***	1.766***	1.687***
	(0.274)	(0.277)	(0.330)	(0.378)	(0.316)	(0.290)	(0.338)	(0.381)	(0.329)	(0.315)	(0.409)	(0.350)
ln(Open)	0.385	−0.013	−0.187	1.784***	0.781**	0.334	−0.284	1.876***	0.717**	0.179	2.098***	0.550
	(0.245)	(0.247)	(0.263)	(0.450)	(0.318)	(0.255)	(0.271)	(0.453)	(0.322)	(0.277)	(0.540)	(0.353)
ln(GovCons)	−1.158***	−1.131	−0.943**	−1.161**	−1.126***	−1.269***	−1.157***	−1.132**	−1.268***	−1.196***	−0.808	−1.074**
	(0.317)	(0.356)	(0.390)	(0.505)	(0.382)	(0.350)	(0.403)	(0.523)	(0.415)	(0.364)	(0.605)	(0.436)
ln(Credit)	−0.069	0.061	0.175	0.0323	−0.283	0.136	0.265	−0.0128	−0.105	0.0854	−0.0501	−0.178
	(0.178)	(0.182)	(0.205)	(0.282)	(0.210)	(0.197)	(0.209)	(0.295)	(0.233)	(0.210)	(0.370)	(0.249)
ln(Inflation)	−0.009	−0.127	−0.0184	−0.326***	−0.101	−0.0311	0.0122	−0.257**	−0.0798	0.0684	−0.175	−0.00159
	(0.113)	(0.119)	(0.136)	(0.123)	(0.118)	(0.121)	(0.139)	(0.128)	(0.126)	(0.129)	(0.142)	(0.135)
ln(Educ)		1.234***	1.169***				1.068***					
		(0.293)	(0.325)				(0.328)					

Table 3 continued

	Pooled-OLS			FE	RE	Pooled-OLS		FE	RE	IV Pooled-OLS	IV FE	IV RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dem			0.0260				0.0119					
			(0.0435)				(0.0447)					
Eco			0.657***				0.749***					
			(0.205)				(0.213)					
Constant	4.082**	7.063***	2.995	36.44***	3.190	3.446*	2.647	32.77***	2.827	3.094	36.04***	2.144
	(1.877)	(2.009)	(2.229)	(4.636)	(2.225)	(1.920)	(2.240)	(4.704)	(2.256)	(2.010)	(6.164)	(2.363)
Nb country	120	88	74	120	120	93	66	93	93	93	93	93
Nb obs	593	472	398	593	593	536	379	536	536	457	457	457
R-squared	0.185	0.216	0.285	0.368	0.2117	0.184	0.293	0.363	0.2205	0.186	0.3326	0.1850

This table reports results of the standard regression models. Time fixed-effects are included across the different specifications. For IV estimations, the first lag of remittances is used as instrument for the variable remit. Columns 6–12 show results where we used the restricted sample that includes countries for which data on remittances are available for at least 4 different time periods. Standard errors are shown in parentheses

* Significant at 10%, ** significant at 5%, *** significant at 1%

determinants of growth (see Sala-I-Martin et al. 2004), is positive and significant across the different specifications. The investment in human capital, measured as the initial average years of schooling for the total population aged over 15, affects growth positively in the different specifications where we have controlled for it. Degree of openness and inflation affect growth differently, but neither of these effects is robust. Similar to the results on remittances, across the different specifications, the effect of the level of financial development on the growth rate remains insignificant. The effect of financial development on economic growth has been widely discussed and the question of whether financial development benefits the growth rate of less developed countries remains unclear. While some evidence supports the hypothesis that financial development is more beneficial for the economic growth of less advanced countries (e.g., Arcand et al. 2015; Samargandi et al. 2015; Law and Singh 2014), other evidence indicates a limited effect of financial development on economic growth for developing countries (e.g, Menyah et al. 2014; Henderson et al. 2013).

In summary, the results in Table 3 show that under the hypothesis of the existence of a single, unique growth regime for all countries, remittances have neither a negative nor a positive significant impact on growth. Indeed, across the different columns, remittances have a neutral effect on the growth rate of countries. Such a result confirms the findings in previous studies that have supported a neutral effect of remittances on the growth rate using different samples and different techniques (e.g., Rao and Hassan 2011; Barajas et al. 2009; Ahamada and Coulibaly 2013 among others). However, if our data are better generated by a model with more than one growth regime, the results presented in this section may be biased, and the conclusion found on the impact of remittances on the growth rate would be inappropriate. To deal with this issue, we proceed by trying to determine whether or not the observations in our data are generated by multiple growth regimes and test whether the effect of remittances on the growth rate varies across the identified regimes using the mixture-of-regressions method.

5.2 Finite-mixture-of-regressions results

We estimate a finite-mixture-of-regressions model where we assume that our data may be generated between one and four growth regimes, estimating four different mixture-of-regressions models. In fact, the previous investigation on the existence of multiple growth regimes using the mixture-of-regressions method have generally supported the existence between two and three different growth regimes (e.g., Paap et al. 2005; Alfo et al. 2008; Owen et al. 2009).[5] Therefore, in our study the maximum number of regimes is fixed at four. It is also worth noting that the number of parameters to estimate increases significantly with the number of growth regimes, which may induce some instability in the results if the number of observations is not sufficient enough. For instance, we have observed that, in some of our estimations, results are unstable when the number of growth regimes is higher than three.[6]

[5] See also Owen and Temesvary (2014), Flachaire et al. (2014) and Konte (2013) among others.

[6] We consider that the results are unstable when the results change each time we run the same model with the same number of growth regimes.

Table 4 Goodness of fit

The table presents the goodness of fit for the mixture-of-regressions model using the full sample. Selected model is in bold

Number of regimes	BIC	CAIC
$K = 1$	2971.48	2988.48
K = 2	**2939.42**	**2974.42**
$K = 3$	2951.92	3004.92
$K = 4$	2977.90	3048.90

Table 5 Finite mixture-of-regressions results

This table reports results of the mixture-of-regression model selected from Table 4 with two components. The dependent variable is output growth. Estimations include time dummies. Standard errors are shown in parentheses
* Significant at 10%,
** significant at 5%,
*** significant at 1%

	Group 1 $\pi_1 = 60\%$	Group 2 $\pi_2 = 40\%$
Remit	0.1692	2.3447**
	(3.3756)	(1.1249)
ln(Credit)	−0.4288	−0.1034
	(0.2707)	(0.2169)
ln(Inflation)	0.0223	−0.1701
	(0.1763)	(0.1125)
ln(Pop + 0.05)	−5.8341***	0.1954
	(1.0468)	(0.3503)
ln(Gdp)	−1.2479***	−0.0291
	(0.2868)	(0.1665)
ln(Invest)	2.0194***	1.2892***
	(0.431)	(0.2574)
ln(Open)	2.7455***	−1.1678***
	(0.5229)	(0.2165)
ln(GovCons)	−2.1055***	−0.1856
	(0.4598)	(0.3515)
Constant	13.3338***	3.3563**
	(3.5996)	(1.5809)
R-squared	0.3070	0.3752
Nb country	72	48
Nb obs	314	279

Table 4 shows the goodness of fit obtained when we estimate the model in Eq. 2 using different values for the number of growth regimes named K in the equation. Recall that the model in Eq. 2 does not include any concomitant variables since we want first to test whether there exist different growth regimes such that the marginal effect of remittances on economic growth varies across the regimes. Table 4 reports the Bayesian and the consistent Akaike information criterion, which allow us to select our best model, meaning the one that minimizes these two statistical values. To ensure convergence in our estimations, we run each model several times with different starting values and 10,000 iterations. We find that the econometric model with two regimes records the lowest BIC (2939.42) and the lowest CAIC (2974.42), which indicates that our data are best generated by a model that contains two growth regimes.

Table 5 presents the estimated coefficients of our selected model with $K = 2$. We observe that 60% of the countries are more likely to be classified in the first growth regime versus 40% in the second growth regime. When we focus on our parameter of interest, the coefficient on remittances, we find that in the first regime remittances do not have a significant impact on the growth rate, while in the second group the coefficient on remittances is positive and significant at the conventional 1% level. This result is in line with the hypothesis that the effect of remittances on economic growth is heterogeneous and depends on the growth regime to which a country belongs.

Turning now to the other variables included in our model, we observe that our indicator of financial development measured as domestic credit relative to GDP does not have a significant effect in either the first or the second regime. Recent empirical studies have highlighted a lack of common consensus on the effect of financial development on economic growth, and related literature on this issue has been highlighted in the previous section on the parametric results. The convergence hypothesis indicated by the sign of the coefficient on the initial level of GDP is well established within the first regime where the coefficient on $ln(Gdp)$ is negative and very significant. Similarly, the population growth rate and the share of government consumption relative to GDP reduce the growth rate in the first regime but remain insignificant in the second. The investment in physical capital, which has been one of the most robust determinants of economic growth in different studies, stimulates the growth rate of the GDP in the two regimes but with a greater impact in the first regime than in the second. Countries in the first regime have a higher gain in terms of economic growth by increasing their degree of trade openness than do countries in the second growth regime, where the degree of trade openness seems to be negatively associated with the growth rate.

Table 6 presents the classification of the countries into the two growth regimes, including the estimated posterior probability membership. Countries are classified into the regime where they record the highest estimated probability. For instance, Afghanistan is placed in the first growth regime, where its estimated probability is 0.86, while Benin is placed in the second growth regime, where its estimated probability is 0.68. There is substantial heterogeneity of countries within growth regimes, indicating that our classification does not coincide with those obtained in ad hoc *ex ante* classifications.

We next extend our model by incorporating concomitant variables in order to analyze the determinants of the classification of the countries into the different growth regimes. We run a number of estimations using the model set in Eq. 2 where we use different combinations of concomitant variables, thus running six independent models with a different number of growth regimes for each model. For the first three models we control only for financial development as a concomitant variable, using different indicators of financial development. In model 4, we use dummies on being a SSA country and being a LA country as concomitants. In model 5, we control for both financial development and the dummies for geographical location. Finally, model 6 uses the same specification than that in model 5, but in addition it includes education and institutions as explanatory variables. The goodness-of-fit criteria are reported in Table 7 where the first number in each bracket is the BIC and the second number is the CAIC. We can highlight that across these different specified models, the specifications with two growth regimes are the ones that minimize the BIC and the CAIC.

Table 6 Classification of countries into regimes

Group 1		Group 2	
Country	Prob	Country	Prob
Afghanistan	0.86	Algeria	0.77
Albania	0.99	Argentina	0.89
Angola	1	Bangladesh	0.98
Armenia	1	Benin	0.68
Azerbaijan	1	Bolivia	0.99
Belarus	1	Bosnia and Herzegovina	0.59
Belize	0.99	Brazil	1
Bhutan	0.82	Burkina Faso	0.99
Botswana	0.89	Colombia	0.99
Bulgaria	0.96	Congo, Dem, Rep,	0.94
Burundi	0.78	Costa Rica	0.99
Cambodia	0.99	Cote d'Ivoire	0.82
Cameroon	1	Djibouti	0.53
Cape Verde	0.71	Ecuador	0.91
Central African Republic	0.99	El Salvador	0.56
Chad	1	Fiji	0.93
Comoros	1	Ghana	0.86
Congo, Republic of	0.99	Guatemala	0.89
Dominica	0.99	Guinea	0.96
Dominican Republic	0.97	Haiti	0.56
Egypt	1	Honduras	0.93
Eritrea	0.94	India	0.99
Ethiopia	0.65	Iran	0.87
Gabon	0.99	Iraq	0.52
Gambia, The	0.97	Kenya	0.98
Georgia	1	Lebanon	0.58
Grenada	1	Lesotho	0.99
Guinea-Bissau	0.99	Libya	0.87
Guyana	0.99	Macedonia	0.76
Indonesia	0.99	Madagascar	0.99
Jamaica	0.99	Mali	0.98
Jordan	1	Mexico	0.99
Kazakhstan	1	Morocco	0.95
Kyrgyzstan	0.91	Namibia	0.81
Laos	0.99	Nepal	0.85
Liberia	0.99	Pakistan	0.97
Malawi	0.74	Paraguay	0.92
Malaysia	1	Philippines	0.97

Table 6 continued

Group 1		Group 2	
Country	Prob	Country	Prob
Maldives	0.90	Rwanda	1
Mauritania	0.69	Senegal	0.89
Mauritius	0.89	South Africa	0.99
Moldova	0.99	Sudan	1
Mongolia	0.63	Togo	0.95
Montenegro	0.89	Tunisia	0.95
Mozambique	0.99	Turkey	1
Nicaragua	0.99	Uganda	0.92
Niger	0.99	Yemen	0.88
Nigeria	0.82	Zimbabwe	0.97
Panama	1		
Papua New Guinea	0.99		
Peru	0.89		
Romania	0.99		
Sao Tome and Principe	0.78		
Serbia	0.54		
Sierra Leone	1		
Solomon Islands	0.99		
Sri Lanka	0.99		
St. Lucia	0.99		
St.Vincent Grenadines	0.99		
Suriname	1		
Swaziland	1		
Syria	0.72		
Tajikistan	1		
Tanzania	0.81		
Thailand	1		
Tonga	0.77		
Turkmenistan	0.82		
Ukraine	1		
Vanuatu	0.99		
Venezuela	0.54		
Vietnam	0.99		
Zambia	0.74		

This table reports the classification of the countries into the two growth regimes identified. For each country, we report the estimated posterior probability of belonging to either regime 1 or regime 2

One exception is for model 3, where the value of the BIC is slightly lower for $K = 3$ than for $K = 2$, but the CAIC is higher for the former case than for the latter. For parsimony, we prefer the case with $K = 2$, which also introduces less parameters to be estimated than the case where the number of growth regimes is fixed at three.

Table 7 Goodness of fit for models with concomitant variables

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$K = 1$	[2946.45;2963.45]	[3036.17;3053.17]	[2786.49;2803.49]	[2967.43;2984.43]	[2767.33;2784.33]	[2068.57;2110.57]
$K = 2$	**[2918.03;2954.03]**	**[3009.495;3045.49]**	**[2748.54;2784.54]**	**[2939.50;2976.50]**	**[2732.78;2770.78]**	**[2064.36;2083.36]**
$K = 3$	[2924.01;2979.01]	[3013.95;3068.95]	[2742.98;2797.98]	[2948.88;3005.88]	[2742.36;2801.36]	[2080.85;2145.85]
$K = 4$	[2946.41;3020.41]	[3030.78;3104;78]	[2778.18;2852.18]	[2972.07;3049.07]	[2763.16;2843.16]	[2105.38;2193.38]

This table reports the goodness of fit for different models that include different concomitant variables. The first number in the brackets represents the BIC value, while the second number is the CAIC value. In model 1, we use the logarithm of the average domestic credit to GDP over the period 1970–2010 as concomitant. Model 2 replaces the indicator of credit by broad money, while in model 3 we use the indicator of liquid liabilities as our proxy of financial development. In model 4, we use the indicators of geographical location as concomitant variables. In model 5, we control for both geographical location and liquid liabilities as concomitant variables. Model 6 adds education and democracy as explanatory variables. The specifications with two growth regimes have the lowest BIC and CAIC values and are in bold. For model 3, the BIC with $K = 3$ is slightly lower than the BIC with $K = 2$ but the CAIC value is higher for the former than for the latter. By parsimony, we prefer the value $K = 2$ that contains less parameters to estimate than the case where $K = 3$

The estimation results for each of these six models with two different growth regimes are reported in Table 8. Our previous results, in which remittance inflows have a positive effect on economic growth for the countries in the second regime but do not have a statistically significant effect in the first regime, remain robust across the different models. In models 1, 2 and 3, where we have controlled for financial development as a concomitant variable, we find that the coefficients on financial development are negative, indicating that higher the level of financial development, the lower the probability for a given country to be located in the growth regime where remittances have a positive effect on economic growth. This is a confirmation already found in the literature of the substitution effect between remittances and financial development in promoting economic growth (Giuliano and Ruiz-Arranz 2009). However, despite the expected sign on financial development, the coefficients are not significant. Therefore, we keep open the question of the role that financial development may play in defining the environment in which remittances may affect the economic growth of developing countries.

In contrast, results reported in model 4, where we have controlled for dummies for geographical location, show that being a SSA country or being a LA country seems to explain the classification of the countries into the remittances growth-enhancing regime. Indeed, being a SSA or being a LA country or increases significantly the probability for a country to be classified in the remittances growth-enhancing regime. Similar results hold in model 5, where we have controlled for both the dummies for geographical location and financial development. Table 9 and Table 10 show the classification of the countries into the different growth regimes using the estimations in model 1 and model 4, respectively. The obtained classifications are very similar to the ones drawn in the previous Table 6. Some countries like Bosnia and Herzegovina, Macedonia, Ethiopia, Gabon, Malawi, Niger, Nigeria are located in different regimes across Table 10 and the baseline Table 6.

Overall, our findings have pointed out that countries follow two different growth regimes, one in which remittances have a positive effect on the growth rate and one in which they do not have a significant effect. Our analysis of the determinants of the probability of being in the remittances growth enhancing regime indicates that financial development has a weak effect; however, geographical location, such as being a SSA or a LA country, significantly increases the likelihood for a country to be located in the remittances growth-enhancing regime.

For purpose of robustness, we extend our analysis using restricted data, where we include only countries for which we have data on remittances available for at least four different time periods out of eight. We again run a number of models that include different combinations of concomitant variables. In the first model, we include as concomitant variable financial development measured as domestic credit to GDP; in the second model, we control only for dummies on geography as concomitants; in the third model, we include indicators of economic and political institutions simultaneously as standard explanatory variables and as concomitant variables. Finally, in the last model we add financial development, geographical location and political institutions all together.

The goodness-of-fit values are reported in Table 11 and show that, for the different estimated models using different values for the number of regimes K, the BIC and

Table 8 Mixture-of-regression results with concomitants

	Model 1		Model 2		Model 3	
	Group 1 ($\pi_1 = 60.7\%$)	Group 2 ($\pi_2 = 39.3\%$)	Group 1 ($\pi_1 = 64\%$)	Group 2 ($\pi_2 = 36\%$)	Group 1 ($\pi_1 = 56.3\%$)	Group 2 ($\pi_2 = 43.7\%$)
Remit	−0.3204	2.212**	−0.2825	2.6431**	−2.4842	3.3153***
	(3.3686)	(1.1121)	(3.3717)	(1.1211)	(3.2441)	(1.2619)
ln(Inflation)	0.0272	−0.1495	0.0874	−0.1354	−0.0745	−0.0736
	(0.1762)	(0.1122)	(0.1812)	(0.1132)	(0.1947)	(0.1135)
ln(Pop+0.05)	−5.8849***	0.1773	−5.5952***	0.191	−7.3019***	0.1274
	(1.0451)	(0.3491)	(1.0386)	(0.3472)	(1.1231)	(0.362)
ln(Gdp)	−1.2516***	0.0273	−1.3434***	−0.0362	−1.6778***	0.0429
	(0.2838)	(0.1654)	(0.2887)	(0.1538)	(0.324)	(0.1389)
ln(Invest)	2.0008***	1.4218***	2.0496***	1.3589***	2.1478***	0.8937***
	(0.4281)	(0.2672)	(0.44)	(0.2677)	(0.4928)	(0.2703)
ln(GovCon)	−2.1117***	−0.2551	−2.0979***	−0.1999	−1.9377***	−0.2428
	(0.4598)	(0.3618)	(0.4272)	(0.3583)	(0.4418)	(0.3765)
ln(Open)	2.8169***	−1.1129***	2.7156***	−1.0904***	2.7625***	−1.093***
	(0.5155)	(0.2175)	(0.5177)	(0.2135)	(0.5573)	(0.2206)
Educ						
Dem						
ln(Credit)	−0.4374*	−0.1964				
	(0.2621)	(0.2016)				

Table 8 continued

	Model 1		Model 2		Model 3	
	Group 1 ($\pi_1 = 60.7\%$)	Group 2 ($\pi_2 = 39.3\%$)	Group 1 ($\pi_1 = 64\%$)	Group 2 ($\pi_2 = 36\%$)	Group 1 ($\pi_1 = 56.3\%$)	Group 2 ($\pi_2 = 43.7\%$)
ln(Broad)			0.0242	−0.1396		
			(0.3526)	(0.2992)		
ln(Liquid)					−0.523	0.2954
					(0.344)	(0.248)
Constant	13.2282***	2.8148*	12.0767***	2.9871*	20.7267***	1.8624
	(3.5804)	(1.5752)	(3.5201)	(1.5851)	(3.9418)	(1.7582)
Concomitant						
$\ln(\overline{Credit})$		−0.0603				
		(0.3273)				
$\ln(\overline{Broad})$				−0.2503		
				(0.4199)		
$\ln(\overline{Liquid})$						−0.3584
						(0.4112)
Latin-car						
Sub-Africa						
Constant		−0.199		0.4088		0.9371
		(1.1482)		(1.4627)		(1.3989)
R-squared	0.3121	0.384	0.2904	0.3792	0.3271	0.3929
Nb countries	71	46	77	43	67	52
Nb obs	313	276	333	272	270	286

Table 8 continued

	Model 4		Model 5		Model 6	
	Group 1 ($\pi_1 = 55\%$)	Group 2 ($\pi_2 = 45\%$)	Group 1 ($\pi_1 = 53.5\%$)	Group 2 ($\pi_2 = 46.5\%$)	Group 1 ($\pi_1 = 76\%$)	Group 2 ($\pi_1 = 24\%$)
Remit	−0.7858	3.1145***	−2.6453	3.3864***	0.8226	4.1727***
	(3.2763)	(1.1992)	(3.2745)	(1.2923)	(3.0201)	(1.1117)
ln(Inflation)	−0.0284	−0.0843	−0.1097	−0.0503	−0.0568	−0.3864***
	(0.1745)	(0.1142)	(0.1994)	(0.1136)	(0.1495)	(0.1348)
ln(Pop+0.05)	−5.4232***	0.2365	−6.4652***	0.1376	−0.1617	0.2347
	(1.0537)	(0.3787)	(1.1418)	(0.3749)	(0.5021)	(1.3121)
ln(Gdp)	−1.0735***	−0.199	−1.3717***	−0.0595	−1.0409***	−0.1151
	(0.3225)	(0.1503)	(0.3698)	(0.135)	(0.2259)	(0.2511)
ln(Invest)	2.2552***	1.0393***	2.2483***	0.8265***	1.1531***	0.7961**
	(0.4368)	(0.272)	(0.4786)	(0.2734)	(0.3275)	(0.4027)
ln(GovCon)	−2.2931***	−0.1972	−1.9098***	−0.1812	−1.2384***	−0.0966
	(0.4558)	(0.3713)	(0.4942)	(0.3922)	(0.4719)	(0.3486)
ln(Open)	2.5867***	−1.1733***	2.6698***	−1.1962***	0.2338	−0.88***
	(0.502)	(0.2312)	(0.5588)	(0.227)	(0.3034)	(0.2697)
Educ					1.235***	1.3974***
					(0.3899)	(0.3334)
Dem					0.0721	0.1802***
					(0.0471)	(0.0428)
ln(Credit)	−0.8268***	0.3122				
	(0.2735)	(0.1976)				

Table 8 continued

	Model 4		Model 5		Model 6	
	Group 1 ($\pi_1 = 55\%$)	Group 2 ($\pi_2 = 45\%$)	Group 1 ($\pi_1 = 53.5\%$)	Group 2 ($\pi_2 = 46.5\%$)	Group 1 ($\pi_1 = 76\%$)	Group 2 ($\pi_1 = 24\%$)
ln(Broad)						
ln(Liquid)			−0.8425**	0.3903	0.4807*	−0.7965**
			(0.4022)	(0.2544)	(0.2732)	(0.362)
Constant	14.3987***	3.4244**	17.8777***	2.6834	7.7353***	3.6151
	(3.7314)	(1.6646)	(4.0539)	(1.8403)	(2.2612)	(4.38)
Concomitant						
$\ln(\overline{Credit})$						
$\ln(\overline{Broad})$						
$\ln(\overline{Liquid})$				−0.2247		
					(0.523)	
Latin-car		1.1549*		1.4264**		2.7593***
		(0.6237)		(0.6923)		(0.9122)
Sub-Africa		1.239**		1.5416**		1.8348**
		(0.5398)		(0.6209)		(0.9203)
Constant		−1.0072**		−0.388		−4.8179*
		(0.4006)		(1.8018)		(2.6775)
R-squared	0.3389	0.3434	0.3184	0.371	0.2247	0.7377
Nb countries	66	53	65	52	63	20
Nb obs	279	312	262	291	318	110

This table reports the estimations results of the models selected from Table 7 above that presents different models with different concomitant variables. The dependent variable is output growth. Estimations include time dummies. Standard errors are shown in parentheses

*Significant at 10%, ** significant at 5%, *** significant at 1%

Table 9 Classification of countries

Country	Class 1	Country	Class 2
Afghanistan	0.8051	Algeria	0.7832
Albania	0.9881	Argentina	0.9125
Angola	1	Bangladesh	0.9775
Armenia	1	Benin	0.6435
Azerbaijan	1	Bolivia	0.9845
Belarus	1	Bosnia and Herzegovina	0.5874
Belize	0.9982	Brazil	1
Bhutan	0.7793	Burkina Faso	0.9942
Bulgaria	0.9482	Colombia	0.9998
Burundi	0.7236	Congo. Dem. Rep.	0.9597
Cambodia	0.9998	Costa Rica	0.988
Cameroon	1	Cote d'Ivoire	0.8362
Cape Verde	0.704	Djibouti	0.5625
Central African Republic	0.9823	Ecuador	0.9233
Chad	1	El Salvador	0.5806
Comoros	1	Fiji	0.9395
Congo. Republic of	0.9998	Ghana	0.8503
Dominica	0.9998	Guatemala	0.8953
Dominican Republic	0.9505	Guinea	0.9565
Egypt	1	Haiti	0.566
Eritrea	0.9246	Honduras	0.935
Ethiopia	0.6206	India	0.9986
Gabon	0.9996	Iran	0.8807
Gambia	0.9816	Kenya	0.9833
Georgia	1	Lebanon	0.5654
Grenada	1	Lesotho	0.9988
Guinea-Bissau	0.9999	Libya	0.8711
Guyana	0.9994	Macedonia	0.7722
Indonesia	0.9912	Madagascar	0.9864
Jamaica	0.9971	Mali	0.9734
Jordan	1	Mexico	0.9957
Kazakhstan	1	Morocco	0.9535
Kyrgyzstan	0.9078	Namibia	0.8185
Laos	0.9892	Nepal	0.8516
Liberia	0.9994	Pakistan	0.9732
Malawi	0.7309	Paraguay	0.9242
Malaysia	1	Philippines	0.9665
Maldives	0.9011	Rwanda	1
Mauritania	0.657	Senegal	0.8879
Mauritius	0.866	South Africa	0.9978

Table 9 continued

Country	Class 1	Country	Class 2
Moldova	0.9923	Sudan	1
Mongolia	0.5352	Togo	0.9558
Montenegro	0.8751	Tunisia	0.9547
Mozambique	0.9986	Turkey	1
Nicaragua	0.9985	Uganda	0.9209
Niger	0.9949	Yemen	0.876
Nigeria	0.8138		
Panama	1		
Papua New Guinea	0.9976		
Peru	0.8868		
Romania	0.9863		
Sao Tome and Principe	0.8009		
Serbia	0.5345		
Sierra Leone	1		
Solomon Islands	0.9992		
Sri Lanka	0.9935		
St. Lucia	0.9988		
St.Vincent Grenadines	0.9998		
Suriname	1		
Swaziland	1		
Syria	0.7444		
Tajikistan	1		
Tanzania	0.7781		
Thailand	1		
Tonga	0.8086		
Turkmenistan	0.733		
Ukraine	1		
Vanuatu	0.9998		
Venezuela	0.6493		
Vietnam	0.9984		
Zambia	0.7321		

This table reports the classification of the countries into the two growth regimes detected using the estimations of model 1. For each country, we report the estimated posterior probability of belonging to either regime 1 or regime 2

CAIC are minimized when we use the specifications with two growth regimes. We should note that for model 1 the BIC is higher when $K = 3$ than when $K = 2$, but by parsimony we prefer the specification with $K = 2$ that has a lower CAIC over the one with $K = 3$. The estimated coefficients are reported in Table 12. Estimates on our key variable, remittances, are similar to our previous findings, where remittances have a positive and significant effect on growth in the second regime but remain insignificant in the first regime. we have found that financial development has a weak effect on the classification of countries into different growth regimes, while the dummies, geogra-

Table 10 Classification of countries

Country	Class 1	Country	
Afghanistan	0.9709	Algeria	0.6311
Albania	0.9935	Argentina	0.8695
Angola	1	Bangladesh	0.9213
Armenia	1	Benin	0.9588
Azerbaijan	1	Bolivia	0.9905
Belarus	1	Brazil	1
Belize	0.9981	Burkina Faso	0.998
Bhutan	0.917	Colombia	0.9988
Bosnia and Herzegovina[a]	0.554	Congo, Dem, Rep,	0.9813
Botswana	0.9672	Costa Rica	0.9614
Bulgaria	0.9819	Cote d'Ivoire	0.885
Burundi	0.7071	Djibouti	0.6511
Cambodia	1	Ecuador	0.7668
Cameroon	0.9999	El Salvador	0.7533
Cape Verde	0.5359	Ethiopia[a]	0.7974
Central African Republic	0.9098	Fiji	0.6274
Chad	0.9999	Gabon[a]	0.9685
Comoros	0.9978	Ghana	0.9673
Congo Republic of	0.9998	Guatemala	0.9333
Dominica	0.9996	Guinea	0.9923
Dominican Republic	0.9884	Haiti	0.5929
Egypt	1	Honduras	0.9482
Eritrea	0.949	India	0.9951
Gambia	0.7411	Iran	0.6739
Georgia	1	Iraq	0.9217
Grenada	1	Kenya	0.9899
Guinea-Bissau	0.9849	Lebanon	0.5148
Guyana	0.9797	Lesotho	0.9994
Indonesia	0.9975	Libya	0.7291
Jamaica	0.9726	Madagascar	0.9995
Jordan	0.9999	Malawi[a]	0.5984
Kazakhstan	1	Mali	0.9885
Kyrgyzstan	0.9469	Mexico	0.9949
Laos	0.9989	Morocco	0.8288
Liberia	0.9997	Namibia	0.7545
Macedonia[a]	0.5341	Nepal	0.6697
Malaysia	1	Niger[a]	0.9951
Maldives	0.9456	Nigeria[a]	0.623

Table 10 continued

Country	Class 1	Country	
Mauritania	0.8539	Pakistan	0.9185
Mauritius	0.8281	Paraguay	0.9707
Moldova	0.9851	Philippines	0.9519
Mongolia	0.8233	Rwanda	1
Montenegro	0.9595	Sao Tome and Principe	0.5974
Mozambique	0.9983	Senegal	0.9596
Nicaragua	0.991	South Africa	0.9986
Panama	1	Sudan	1
Papua New Guinea	0.951	Togo	0.9991
Peru	0.876	Tunisia	0.8325
Romania	0.9933	Turkey	0.9997
Sierra Leone	1	Uganda	0.8829
Solomon Islands	0.9955	Venezuela	0.8476
Sri Lanka	0.9959	Yemen	0.833
St. Lucia	0.9986	Zimbabwe	0.994
St. Vincent Grenadines	0.999		
Suriname	1		
Swaziland	1		
Syria	0.7808		
Tajikistan	0.9999		
Tanzania	0.8153		
Thailand	1		
Tonga	0.8352		
Turkmenistan	0.9378		
Ukraine	1		
Vanuatu	0.9999		
Vietnam	0.9981		
Zambia	0.5886		

This table reports the classification of the countries into the two growth regimes identified using the estimations of model 4. For each country, we report the estimated posterior probability of belonging to either regime 1 or regime 2

[a] Countries that are in different regime compared to the classification in Tables 6 and 9

phy in particular, show that being a SSA country significantly increases the probability for a given country to be classified into the remittances growth-enhancing regime.

In the last two models, we assess the role of institutions in the analysis of the classification of countries into the different identified growth regimes. During the last decade, a heated debate has occurred on the role of institutions in the growth process. The question whether institutions are deep causes or proximate causes in the growth process has been of major interest. Therefore, some scholars have recently applied the mixture-of-regressions method (e.g., Flachaire et al. 2014) in an attempt

Table 11 Goodness of fit for estimations with the small sample

	Model 1	Model 2	Model 3	Model 4
$K = 1$	[2653.88;2670.88]	[2670.88;2687.88]	[1965.47;1984.47]	[1956.16;1975.16]
$K = 2$	**[2624.12;2660.12]**	**[2640.59;2677.59]**	**[1938.10;1979.10]**	**[1929.13;1972.13]**
$K = 3$	[2622.57;2677.57]	[2644.64;2701.64]	[1939.91;2002.91]	[1945.74;2012.74]
$K = 4$	[2636.57;2710.57]	[2668.92;2745.82]	[1959.97;2047.97]	[1955.71;2046.71]

This table reports the BIC criteria for different models using the small sample that is restricted to countries for which data on remittances are available for at least 4 time periods. The specifications with two growth regimes have the lowest BIC values and are in bold

to test whether economic and political institutions play different roles in the growth process, testing whether political institutions such as democracy are a proximate cause of growth, as previously argued by Acemoglu et al. (2005). Our findings indicate that democracy has a significant effect in classifying countries into growth regimes, while economic institutions are deep causes of economic growth as shown by its positive and significant estimates, but do not explain this classification. This result confirms the recent findings by Flachaire et al. (2014). It is also worth noting that these results indicate that countries that have a high level of democracy are less likely to belong to the remittances growth-enhancing regime. This finding is in line with the conclusion in Ruiz et al. (2009) who find that the impact of remittances on economic growth diminishes with the quality of institutions. Turning to the other variables included in the analysis of the classification of countries into the different growth regimes, the coefficients on financial development and on SSA are robust to our previous findings even though we have lost some significance on the dummy SSA in the last model, where we have controlled for financial development and democracy.

6 Concluding remarks

This paper has sought to explain why it has been so difficult to find a positive impact of remittances on growth despite the growing amount of remittances in many developing countries and the different studies that have emphasized the positive effect of remittances on poverty and inequality. We take into account the possible unobserved heterogeneity that may exist in data and consider the possibility of the existence of multiple growth regimes or paths. We relax the hypothesis that all countries follow a single, unique growth regime in favor of multiple growth regimes such that the marginal impacts of the explanatory variables, including remittances, may differ across the different growth regimes identified. Our approach consists of applying the finite-mixture-of-regressions method, a semi-parametric method suitable for taking into account endogenously the possible heterogeneity that may exist in the data. This approach has recently gained a great deal of attention in other circumstances but has not yet been applied in the extensive literature on economic growth and remittances.

Our results have provided evidence that for the period 1970–2010 our data are better fitted with a model that contains two different growth regimes. In one regime,

Table 12 Mixture-of-regression results using the restricted data

	Model 1		Model 2		Model 3		Model 4	
	Group 1 ($\pi_1 = 56\%$)	Group 2 ($\pi_2 = 44\%$)	Group 1 ($\pi_1 = 48\%$)	Group 2 ($\pi_2 = 52\%$)	Group 1 ($\pi_1 = 76\%$)	Group 2 ($\pi_2 = 24\%$)	Group 1 ($\pi_1 = 75\%$)	Group 2 ($\pi_2 = 25\%$)
Remit	0.6897	2.516**	0.035	3.3215***	−2.1476	35.8154**	−3.3537	32.4614**
	(3.8518)	(1.1134)	(3.7498)	(1.1933)	(2.3194)	(15.479)	(2.2458)	(14.0873)
ln(Inflation)	0.024	−0.1835	−0.0363	−0.1197	−0.1052	2.01***	−0.1255	1.6897***
	(0.1968)	(0.1132)	(0.1961)	(0.116)	(0.1208)	(0.5155)	(0.1203)	(0.5441)
ln(Credit)	−0.1272	−0.0257	−0.6419**	0.3948*	−0.0409	−0.1869	−0.2647	0.5798
	(0.2975)	(0.2029)	(0.3198)	(0.2087)	(0.211)	(0.6768)	(0.2157)	(0.5652)
ln(Pop+0.05)	−5.5535***	0.2561	−5.2729***	0.2799	−4.9722***	0.814	−5.271***	0.9226
	(1.173)	(0.3447)	(1.1724)	(0.3754)	(1.016)	(0.5791)	(0.9709)	(0.6015)
ln(Gdp)	−1.3717***	−0.0285	−1.1539***	−0.1734	−0.9177***	−1.60**	−0.6804***	−2.6534***
	(0.305)	(0.163)	(0.3555)	(0.1503)	(0.1727)	(0.6419)	(0.1826)	(0.5382)
ln(Invest)	2.0106***	1.3387***	2.415***	0.9818***	2.3188***	3.41***	2.7818***	3.4329***
	(0.4714)	(0.2736)	(0.5079)	(0.2723)	(0.3461)	(0.7689)	(0.3749)	(0.7692)
ln(GovCons)	−2.5875***	−0.3147	−2.8866***	−0.1747	−0.5929*	−2.9538*	−0.7754**	−2.0869
	(0.5451)	(0.344)	(0.5644)	(0.3645)	(0.347)	(1.562)	(0.3455)	(1.4596)
ln(Open)	3.0498***	−1.1724***	2.842***	−1.1788***	−0.7965***	3.403***	−0.6333***	3.6419***
	(0.565)	(0.2121)	(0.5506)	(0.2281)	(0.242)	(0.8991)	(0.2385)	(0.8473)
Eco					1.2057***	1.8667***	0.9812***	2.1429***
					(0.2114)	(0.6353)	(0.2007)	(0.612)
Demo					0.0569	−0.4542**	0.0216	−0.6675***
					(0.0437)	(0.1932)	(0.0427)	(0.2008)

Table 12 continued

	Model 1		Model 2		Model 3		Model 4	
	Group 1 ($\pi_1 = 56\%$)	Group 2 ($\pi_2 = 44\%$)	Group 1 ($\pi_1 = 48\%$)	Group 2 ($\pi_2 = 52\%$)	Group 1 ($\pi_1 = 76\%$)	Group 2 ($\pi_2 = 24\%$)	Group 1 ($\pi_1 = 75\%$)	Group 2 ($\pi_2 = 25\%$)
Constant	12.8383***	3.2066***	14.0995***	3.1139*	10.6486***	−24.9064***	10.0731***	−22.8787***
	(3.8562)	(1.5869)	(3.9848)	(1.67)	(2.7822)	(7.3389)	(2.7382)	(6.9547)
Concomitant								
$\ln(\overline{Credit})$		−0.0832						−1.2042
		(0.3672)						(0.9237)
Latin-car				1.0048				2.0043
				(0.6465)				(3.6147)
Sub-Africa				1.3927**				2.2912*
				(0.6138)				(1.2851)
$\overline{Dem}$						−0.9613***		−1.6788**
						(0.3606)		(0.6658)
$\overline{Eco}$						−0.9541		
						(0.7174)		
Intercept		0.0321		−0.8607**		6.6215		5.0583
		(1.2916)		(0.437)		(4.263)		(3.6529)
R-squared	0.315	0.3761	0.3446	0.3413	0.4098	0.6278	0.4144	0.5914
Nb country	51	40	45	48	55	17	53	18
Nb observations	267	266	233	303	319	84	325	77

This table reports the estimations results of the models selected from Table 11 above that presents different models with different concomitant variables. The dependent variable is output growth. Estimations include time dummies. Standard errors are shown in parentheses

* Significant at 10%, ** significant at 5%, *** significant at 1%

remittances do not have a significant impact on growth, while in the second regime, remittances have a positive and significant impact on the growth rate. We have further tried to establish the determinants of the classification of the countries into the two identified growth regimes, focusing on the role that the level of financial development, the geographical location and to some extent the quality of institutions may play in sorting countries into the remittance growth-enhancing regime. Our evidence support strongly that being a Sub-Saharan African country significantly increases the probability for a country to be a member of that regime. The quality of the institutions, in particular the level of democracy, is a significant determinant of the growth regime membership, confirming the previous studies that have found that democracy is a proximate determinant of economic growth by determining the environment in which growth occurs.

However, our estimations on the different indicators of financial development used are statistically insignificant, keeping open the question of the role that financial development may play in classifying countries in the remittances growth-enhancing regime. This finding is indeed in contrast to the previous studies that have found a significant substitution effect between financial development and remittances, arguing that when the financial sector lags behind, remittances can be seen as sources of investment for good and talented entrepreneurs who do not have access to finance in order to fully realize their potential.

The classification of the countries into the different growth regimes detected shows substantial heterogeneity of countries in terms of level of development, financial development and geographical location within growth regimes. This suggests that our classification does not coincide with those obtained by ad hoc ex ante classifications.

As regards policy, our findings indicate that Sub-Saharan African countries that have received an increasing amount of remittances during recent years are likely to experience a considerable gain in terms of economic growth by receiving more remittances. It is also true that many Sub-Saharan African nations are lagged behind in terms of financial development. Therefore, if we interpret being a Sub-Saharan African country as proxy for the limited access to financial services, we may argue that in SSA remittance inflows are important sources of capital for the most prominent and profitable projects that have the potential to yield high growth performance. However, the poor statistical power on the estimates of our different indicators of financial development raises some questions on the role of financial development, and therefore, further analyses on the importance of financial development in setting countries into the remittance growth-enhancing regime need to be further explored. This calls for the use new indicators of financial development that better capture the quality of the financial sectors in contrast to the existing and commonly used indicators of financial depth that have been criticized for their limitation in capturing the efficiency of the financial sector.

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References

Acemoglu D, Johnson S, Robinson JA (2005) Institutions as the fundamental cause of long-run economic growth. In: Aghion P, Durlauf S (eds) Handbook of economic growth. Elsevier, North Holland, pp 385–472

Acosta PA, Lartey EKK, Mandelman FS (2009) Remittances and the Dutch disease. J Int Econ 79:102–116

Adams RH, Page J (2005) Do international migration and remittances reduce poverty in developing countries? World Dev 33:1645–1669

Ahamada I, Coulibaly D (2013) Remittances and growth in Sub-Saharan African countries: evidence from a panel causality test. J Int Dev 25:310–324

Ahamada I, Flachaire E (2010) Non-parametric econometrics. Oxford University Press, Oxford

Alfo M, Trovato G, Waldmann R (2008) Testing for country heterogeneity in growth models using a finite mixture approach. J Appl Econ 23:487–514

Amuedo-Dorantes C, Pozo S (2006a) Migration, remittances and male and female employment patterns. Am Econ Rev 96:222–226

Amuedo-Dorantes C, Pozo S (2006b) Workers's remittances and business ownership in the Dominican Republic. World Econ 29:939–956

Arcand JL, Berkes E, Panizza U (2015) Too much finance? J Econ Growth 20:105–148

Barajas A, Chami R, Fullenkam C, Gapen M, Montiel P (2009) Do workers remittances promote economic growth. IMF working paper WP 09/153

Barro R, Lee J-W (2013) A new data set of educational attainment in the world, 1950–2010. J Dev Econ 104:184–198

Bettin G, Zazzaro A (2011) Remittances and financial development: substitutes or complements in economic growth? Bull Econ Res 64:509–536

Bos J, Economidou C, Koetter M, Kolari J (2010) Do all countries grow alike? J Dev Econ 91:113–127

Bourdet Y, Falck H (2006) Emigrants' remittances and Dutch disease in Cape Verde. Int Econ J 20:267–284

Breiman L, Friedman JH, Olshen RA, Stone CI (1984) Classification and regression trees. Wadsworth, Belmont

Catrinescu N, Leon-Ledesma M, Piracha M (2009) Remittances, institutions, and economic growth. World Dev 37:81–92

Chami R, Fullenkam, C, Jajah S (2003) Are immigrant remittance flows a source for development? IMF working paper 03/189

Chudik A, Hashem M, Tosetti E (2011) Weak and strong cross-section dependence and estimation of large panels. Econ J 14:C45–C90

Cox-Edwards A, Rodríguez-Oreggia E (2009) Remittances and labor force participation in Mexico: an analysis using propensity score matching. World Dev 37:1004–1014

Durlauf S, Johnson PA (1995) Multiple regimes and cross-country behavior. J Appl Econ 10:365–384

Ebeke CH (2012) Do remittances lead to a public moral hazard in developing countries? An empirical investigation. J Dev Stud 48:1009–1025

Edwards AC, Ureta M (2003) International migration, remittances, and schooling: evidence fron El Salvador. J Dev Econ 72:429–461

Flachaire E, García-Peñalosa C, Konte M (2014) Political versus economic institutions in the growth process. J Comp Econ 42:212–229

Frühwirth-Schnatter S (2006) Finite mixture of markov switching models. Springer series in statistics. Springer, New York

Giuliano P, Ruiz-Arranz M (2009) Remittances, financial development, and growth. J Dev Econ 90:144–152

Glytos NP (2002) The role of migrant remittances in development: evidence from Mediterranean countries. Int Migr 40:5–26

Gupta S, Pattillo CA, Wagh S (2009) Effect of remittances on poverty and financial development in Sub-Saharan Africa. World Dev 37:104–115

Henderson DJ, Papageorgiou C, Parmeter CF (2013) Who benefits from financial development? New methods, new evidence. Eur Econ Rev 63:47–67

Konte M (2013) A curse or a blessing? Natural resources in a multiple growth regimes analysis. Appl Econ 45:3760–3769

Law SH, Singh N (2014) Does too much finance harm economic growth? J Bank Finance 41:36–44

Lokshin M, Glinskaya E (2009) The effect of male migration on employment patterns of women in nepal. World Bank Econ Rev 23:481–507

Lucas REB (2005) International migration and economic development. Swedish Ministry for Foreign Affairs, Stockholm
Mankiw NG, Romer D, Weil DN (1992) A contribution to the empirics of economic growth. Q J Econ 107:407–437
Menyah K, Nazlioglu S, Wolde-Rufael Y (2014) Financial development, trade openness and economic growth in African countries: new insights from a panel causality approach. Econ Model 37:386–394
Nyamongo EM, Misati RN, Kipyegon L, Ndirangu L (2012) Remittances, financial development and economic growth in Africa. J Econ Bus 64:240–260
Owen AL, Videras J, Davis L (2009) Do all countries follow the same growth process. J Econ Growth 14:265–286
Owen AL, Temesvary J (2014) Heterogeneity in the growth and finance relationship: how does the impact of bank finance vary by country and type of lendig? Int Rev Econ Finance 31:275–288
Paap R, Franses P, Dijk D (2005) Does Africa grow slower than Asia, Latin America and Middle East? J Dev Econ 77:553–570
Pesaran MH (2006) Estimation of inference in large heterogeneous panels with multifactor error structure. Econometrica 74:967–1012
Rao BB, Hassan GM (2011) A panel data analysis of the growth effects of remittances. Econ Model 28:701–709
Ruiz I, Shukralla E, Vargas-Silva C (2009) Remittances, institutions and growth: a semiparametric study. Int Econ J 23:111–119
Sala-I-Martin X, Doppelhofer G, Miller R (2004) Determinants of long-term growth. Am Econ Rev 94: 813–835
Samargandi N, Fidrmuc J, Ghosh S (2015) Is the relationship between financial development and economic growth monotonic? Evidence from a sample of middle-income countries. World Dev 68:66–81
Senbeta A (2012) Remittances and the sources of growth. Appl Econ Lett 20(6):572–580
Singh RJ, Haacker M, Lee K, Goff ML (2011) Determinants and macroeconomic impact of remittances in Sub-Saharan Africa. J Afr Econ 20:312–340
Stark O (1995) Altruism and beyond. Basil Blackwell, Oxford
Tan CM (2010) No one true path: uncovering the interplay between geography, institutions, and fractionalization in economic development. J Appl Econ 25:1100–1127
World Bank (2006) The development impact of workers' remittances in Latin America, vol 2. World Bank, Washington