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Do Financial and Institutional Variables Enhance the Impact of Remittances on Economic Growth in Latin America and the Caribbean? A Panel Cointegration Analysis.

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Abstract

Using recently developed panel unit root and panel cointegration tests and the Fully-Modified OLS methodology, this paper estimates the impact of remittances on the economic growth of selected upper and lower income Latin American & Caribbean (LAC) countries over the 1990-2007 period. Despite the large flow of remittances to the region, there have been relatively few empirical studies assessing the impact of remittances on economic growth in LAC. Panel unit root tests suggest that several of the macro variables included in the model exhibit unit roots, yet, at the same time, Pedroni's panel cointegration test determined that there is a cointegrating relationship among the variables in the estimated model. The FMOLS estimates suggest that remittances have a positive and significant effect on economic growth in both groups of countries. The estimates also indicate that both the degree of economic freedom and credit provided by the banking system have a positive and significant effect on economic growth in upper (middle) income LAC countries. The sign of the interaction term between remittances and the credit (and EFI) variables suggest that remittances act as substitutes for these variables. Finally, the effect of remittances on both sets of countries is stronger in the presence of a financial (credit) variable.

I.   Introduction.

For the better part of a decade, remittance flows to Latin America and the Caribbean have

increased dramatically, even surpassing the region's FDI inflows for selected years.   Figure 1

below shows that remittance flows to Latin America and the Caribbean increased steadily from

US$21.3 bn in 2001 to US$53 bn in 2005, before jumping to US$61.5 bn in 2006 and almost

US$70 bn in 2008. The figure also reveals that the onset of the Great Recession in 2008-09 led

to a significant reduction in these flows, but not as much as anticipated and considerably less

than other private and official flows, such as FDI, portfolio investment, and ODA flows. In

Latin America and the Caribbean, Mexico is by far the largest recipient of remittance flows

(estimated $22bn in 2010, and the third largest recipient in the world, after India, $53bn, and

China, $51bn), followed far behind by Brazil, Colombia, El Salvador, Guatemala, the Dominican

Republic, Peru, Honduras, and Jamaica (see ECLAC, 2011; World Bank, 2011). In relative

terms, remittance flows represent at least 2 percent of GDP for the larger countries, such as

Mexico (3.8%), Brazil (2.29%) and Colombia (2.31%), while for the smaller ones, such as El

Salvador, Guatemala, Honduras and Jamaica, these flows easily surpass double-digits, ranging

from 12.7 percent of GDP in Guatemala to 21.6 percent Honduras. For many of the smaller

countries and some of the larger ones, notably Mexico, remittance flows far exceed FDI inflows

and have become an important source of foreign exchange earnings as well as a potential source

for the financing of private capital formation. For example, in the case of Mexico, remittance

flows ranked third over the decade of the 2000s, just behind Mexico's earnings from

maquiladoras (assembly-line industry) and oil; while over the 2004-10 period, these flows

averaged an impressive 15.5 percent of gross domestic private (fixed) capital formation (see

Canas et. al., 2007; and ECLAC, 2011).

Figure 1. FDI and Remittance Flows to Latin America, 2000-2010 (Billions of dollars).
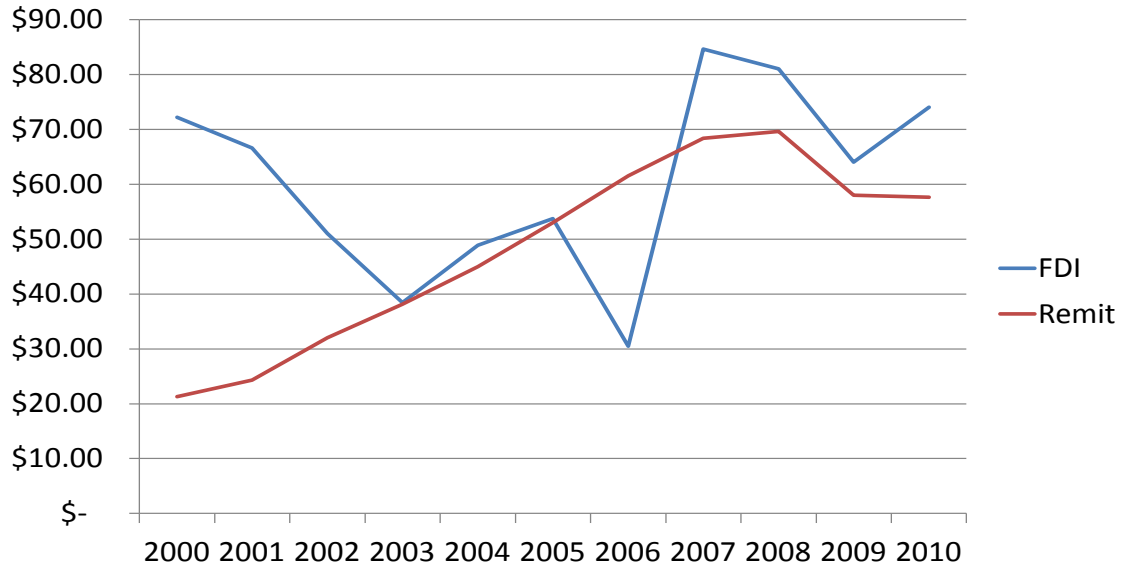
In the extant literature, there is considerable controversy and disagreement as to what economic (and social) factors determine remittance flows, as well as what impact, if any, do these flows have on economic growth and other variables of interest, such as investment (and savings) rates. For example, Chami et al. (2005) found that remittances do not behave like foreign investment flows, but rather act as compensatory transfers, viz., remittances were found to be counter-cyclical in nature, and thus do not promote economic growth. On the other hand, Giuliano et al. (2006) argue that remittances help boost the growth rate of the economy in less financially developed countries by providing credit which would otherwise not be available.

However, Giuliano et al. (2006) found a negative relation between remittance flows and growth in economies with a highly developed financial sector.

In view of the growing economic importance of remittance flows and the contradictory findings in the literature, this paper utilizes recently developed panel unit root and panel cointegration tests to assess empirically the effects of remittance flows on the economic growth of 23 Latin American and Caribbean countries during the 1990-2007 period. The paper also assesses the role of financial (banking) and institutional variables in determining the relative effectiveness of remittance flows to the region. The results suggest that remittances have a positive and significant effect on economic growth in the region, and that the impact is more pronounced when financial and institutional development variables are included in the model. Thus, the findings reported in this study represent a significant contribution to the extant literature, particularly because they have been generated utilizing estimation techniques that address the inherent endogeneity of the included variables.

The paper is organized as follows. Section II reviews some of the, by now, voluminous extant literature. Section III presents the estimation methodology and data, while Section IV presents the panel results. Finally, Section V summarizes the main results and suggests avenues for future research.

II.   Literature Review.

There is now a significant and growing literature that attempts to assess empirically the impact of remittances on economic growth for selected developing countries, including several in Latin America and the Caribbean. In general, remittances are expected to have a positive effect on the economic growth of the recipient countries when they complement national savings and augment the total pool of financial resources for investment projects. In this connection,

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Solimano (2003) reports that migrants in the United States, including Ecuadorans, Guatemalans, Mexicans, and Salvadorans, have formed permanent associations known as Home Town Associations (HTAs) which regularly send donations back to their communities to finance investments in small businesses and infrastructure projects such as water treatment plants, roads, bridges, and schools. To the extent that these flows become "institutionalized," their positive effects on growth are likely to become more permanent.[1]

Similarly, Ratha (2003) found that remittances had a positive and significant effect on investment in receiving countries such as Mexico, Egypt, and Sub-Saharan Africa. In this connection, Aitymbetov (2006) discovered that approximately 10 percent of remittances were used as some form of investment in Kyrzastan, and thus had a positive impact on the economy. Giuliano et al. (2006) also conclude that remittances help boost the growth rate of the economy in less financially developed countries by providing credit which would otherwise not be available. That is, Guiliano et al. find that "remittances "…become a substitute for inefficient or nonexistent credit markets by helping local entrepreneurs bypass lack of collateral or high lending costs and start productive activities" (p. 1). Insofar as Mexico is concerned, investigators have found that remittances are used to finance investment in micro-enterprises. For example, Woodruff (2006) found that there is, in general, a positive relation between investment spending and the growth of micro-enterprises. Woodruff determined that about 5 percent of remittance flows are invested in micro-enterprises and that this could have a significant impact on the long-term growth of these labor-intensive enterprises.

Other authors have found a positive and statistically significant relationship between remittance flows and economic growth. For example, Mundaca (2005), in a study assessing the impact of remittances on growth in selected countries in Central America, found a strong correlation

between remittances and economic growth. Remittances had a significant impact on the growth of these economies, and the impact was stronger when the financial sector was included in the model. Mundaca carried out several estimations on the impact of remittances on growth using different variables to proxy for financial development. When domestic credit from banks was used as one of the explanatory variables, a 10 percent increase in remittances as a percentage of GDP increased GDP per capita by 3.49%. However, when no variables were included to proxy for financial development, a 10 percent increase in remittances as a percentage of GDP increased GDP per capita at a lower rate of 3.18%. Giuliano et al. (2006) conducted a similar study which examined financial development as one of the explanatory variables. They used several indicators like M2/GDP and private credit provided by the banking sector as proxies for financial development. They found that remittances have a positive and significant impact on growth in less financially developed countries. They hypothesize that remittances act as substitutes for financial sector variables and provide credit to the people who need it for investment purposes. However, they too found a negative impact of remittances in financially developed economies. In financially developed economies, credit is easily available and people need not wait for remittances for investment purposes. In a related study, Ziesemer (2006) reports estimates which suggest that remittances have a higher impact in countries with low per capita income (below $1200). Remittances were found to have accounted for about 2% of the steady-state level of per capita GDP and the ratio of steady-state growth with remittances compared to the growth rate without remittances was 1.39.

However, the positive effects of remittances on economic growth are not readily accepted by other scholars working on this topic. As noted in the previous section, Chami et al. (2005) report a negative correlation between remittances and growth, while, in a more recent IMF panel study

for 84 countries, Barajas et al. (2009) find that workers' remittances have little or no effect on long run economic growth. By and large, remittances were found to be counter-cyclical in nature. For example, Chami et al. argue that remittances act like compensatory transfers and, hence, do not aid in the process of economic growth. They contend that remittances are intended for consumption rather than investment. In a related study, Poonam Gupta (2005) carried out a study which examined the macroeconomic determinants of remittances in India, one of the largest recipients of remittances in the world, and found that remittances are counter-cyclical in nature. Interestingly, she found that interest rates and exchange rate depreciation had no significant impact on the flow of remittances. Most of the increase in remittance flows was attributable to increased migration and increased earnings of those migrants. This finding is also supported by the work of Solimano (*op. cit.)* and Bendixen and Associates (2003). They report that in the case of Ecuador around 60 percent of remittances are spent on food, medicines, house rents, and other basic commodities.

Another possible negative effect on growth associated with remittances may result from the possibility of a "Dutch Disease" effect via an induced real appreciation of the domestic currency for countries with sizable remittance flows. For example, in a recent study Acosta et al. (2008) report (unbalanced) panel estimates for 109 developing and transition economies over the 1990-2003 period which suggest that rising levels of remittance flows lead to real exchange appreciation and resource movements that favor the non-tradable sector at the expense of the tradable sector. To the degree that this happens, traditional and non-traditional exports (and import-competing industries) may be adversely affected, thus undermining investment spending and growth.

Finally, there are a several economic, institutional and social factors which have a potential effect on the size of remittance flows, and thus economic growth. The size of the migrant population, the length of stay away from their home country, the migrants' income and that of family members back home, volatility of exchange rates, the economic freedom of the source country, the transfer costs, and the migrants' motivation to go back. For example, Canas et al. (2007) raise the issue of falling money-transfer costs and the new measurement techniques adopted by the Banco de Mexico as the most important factors in determining the increased remittance flows to this country. They have determined that the size of the Mexican migrant population, income, and their attachment to the home country as being less important in determining the size of the flow. So, remittances have the potential to increase irrespective of the home-country situation if the costs of money transfer decrease. In the future, the cost of transferring funds will continue to fall, and thus remittance flows are likely to increase.

In order to assess the impact of remittances on growth, this paper estimates different models, some of which take into account the financial development of the country. For example, some of the models use variables such as domestic credit provided by the banking sector as a percentage of GDP and the money supply (M2/GDP) as proxies for financial development (see Giuliano et al. 2006)

    III.   Data and Estimation Methodology.

Most of the data for the Latin American and the Caribbean countries are obtained from the World Bank's World Development Indicators (WDI, 2008-10). Thus, all of the data limitations mentioned in the WDI will also affect the reliability of our estimates. For example, a significant portion of remittances is transferred through unofficial channels, more so in the 1990s than in the 21st century due to the lack of accessible official channels during that period. Many people used

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to take the money home themselves or send it via someone they knew. Unofficial remittances are not included in our study, and thus will impact the validity of our study. It is extremely difficult to account for the amount of unofficial remittances as there are several channels of transmission. Arbitrary input of unofficial remittances will not be reliable either. So, one way or the other, we are going be affected by the poor data set.

Basically, remittances are comprised of the money sent by the workers and the compensation of employees received by a country. The estimated model utilizes data for 23 countries in the Latin America and Caribbean region during the 1990-2007 period. It excludes countries such as The Bahamas, Cayman Islands, Cuba, Puerto Rico etc. due to lack of remittance flow data. Even for the 23 included countries, not all of them have a continuous data set starting in 1990. We also partition the data into lower and upper (middle) income countries utilizing the World Bank's definition, viz., upper (middle) income countries are those whose Gross National Income (GNI) per capita is between $936 and $11,455, while low-income countries are those with a GNI per capital below $935 (World Bank, 2009).

Estimation Methdology.

Following the lead of Giuliano et al. (2006), we first estimate the model without the interaction of financial and institutional variables. However, in the second model, remittances are allowed to interact with one of the financial development variables. This enables us to determine the impact of remittances on growth through the various financial development variables.

Initially, a basic (panel) OLS model is estimated for 23 countries over the 1990-2007 period for a total of 414 observations, including time-specific and unobserved country-specific fixed variables.

$$Growth_{it} = \alpha_0 + \alpha_1 * Growth_{i, t-1} + \alpha_2 * \operatorname{Re}mit\tan ces_{it} + \alpha_3 * X_{it} + \mu_t + \eta_i + \upsilon_{it} \qquad (1)$$

Where *Growth* is the change in the log of real per capita GDP in constant dollars, *Remittances* refers to the log of remittances as a percentage of GDP, *X* refers to the control variables, μ is the time-specific effect, η refers to the country-specific fixed effects and finally υ refers to the error term. The control variables are fixed capital formation as a percentage of GDP, openness [(X + M)/GDP], the money supply (M2/GDP) or credit provided by the banking sector as a percentage of GDP, and the labor force. Initially, the model is estimated without any variables that proxy for the financial development of a country.

In order to assess whether the countries in question have a legal-institutional framework that is perceived by investors (and remittance senders) as conducive to economic growth and business activity, the well-known economic freedom index (EFI) generated by the Fraser Institute was included in the model. This index is a summary measure of a number of a number of components of "economic freedom," such as monetary policy and price stability, the top marginal tax rate, legal structure and property rights, viability of contracts, and the rule of law. The index has a scale that ranges from 1 to 10, where a score of 10 represents the highest attainable level of economic freedom. It is anticipated that this variable will have a positive and statistically significant effect on economic growth, and attract more remittance flows to the region. It should be noted that most of the countries in this study report indices that range between 2 and 8, with Chile and Costa Rica at the high end, and Ecuador and Haiti at the low end.[2] Also, in view of the fact the Fraser institute did not report economic freedom indices on a consistent (reliable) basis for the lower income countries in this study during the 1990s, the fully modified ordinary least squares (FMOLS) estimates that include the EFI variable are only for the set of countries belonging to the upper (middle) income group.

Next, financial development variables are included to determine if there is any relation between financial development and the impact of remittances on growth. The sign of the coefficient of the interaction term is important, given that a positive (negative) sign would imply that remittances and financial development act as complements (substitutes).[3]

$Growth_{it} = \alpha_o + \alpha_1*Growth_{i, t-1} + \alpha_2*Remittances_{it} + \alpha_3*Financialdev_{it} + \alpha_4*EFI_{it} +$

$\alpha_5*(Remittances_{it}*Financialdev_{it}) + \alpha_6*X_{it} + \mu_t + \eta_i + \upsilon_{it}$ (2)

The OLS estimates are not reliable because they suffer from several problems not addressed in the extant literature. For example, most of the macroeconomic variables employed in these studies are likely to exhibit either stochastic and/or deterministic time trends and are therefore non-stationary; thus, the reported estimates are likely be spurious in nature (see Engle and Granger, 1987). It is therefore highly important to test for the presence of unit roots (non-stationarity) the variables in the model.

This study uses several panel unit root testing methodologies to determine the order of integration of these variables. If the order of integration is zero, the series is considered to be stationary and thus free from a unit root. Traditionally, DF (Dickey-Fuller) or ADF (Augmented Dickey Fuller) tests have been used to test for the presence of unit roots in univariate time series data. However, these tests suffer from low power in rejecting the null of a non-stationary series as well as limiting distributions which are complicated and not well-defined. In order to avoid these problems, this study uses the more reliable and well-behaved panel unit root tests such as those developed by Levin, Lin and Chu (LLC, 2002), Im, Pesaran and Shin (IPS, 2003) and Hadri (HD, 2000). The aforementioned investigators have shown that panel unit root tests are more powerful (less likely to commit a Type II error) than unit root tests applied to individual

series because the information in the time series is enhanced by that contained in the cross-section data. Moreover, in contrast to individual unit root tests which have complicated limiting distributions, panel unit root tests lead to statistics with a normal distribution in the limit (see Baltagi, 2000). The LLC and IPS are based on ADF principles, while HD is based on KPSS. The former two tests are based on the null of a unit root, while the Hadri test assumes the null of stationarity against the alternative of non-stationarity of the series.

The IPS (2003) test allows for heterogeneity across different panel members. Thus, there are different sets of ADF regressions for each panel member which can be specified as follows:

$$\Delta y_{i,t} = \alpha_i + \beta_i\, y_{i,t-1} + \sum_{j=1}^{p^i} \rho_{i,j}\, \Delta y_{i,t-j} + \varepsilon_{i,t}, \tag{3}$$

where $i=1,\ldots,N$ and $t=1,\ldots,T$

The error terms are assumed to be independently and normally distributed with zero means and potentially finite heterogenous variances for all countries and years, while the lag order (ρ) as well as β_i' s are allowed to vary across countries. A simple average of the individual countries is taken to calculate the t-statistics. The null hypothesis in this case is:

H0: $\beta_i = 0$ for all i's against the alternatives:

H1: $\beta_i = 0$ for some i's OR $\beta_i < 0$ for at least one i.

Hence, the IPS-test enables investigators to have two different alternative hypotheses allowing β_i to vary across groups, and thus allowing some series (not all) to exhibit unit roots. Under the null hypothesis, all the series are assumed to be non-stationary processes. IPS differs from LLC because all the series in the alternative hypothesis are stationary processes in LLC, while in IPS some series can still be non-stationary in the alternative hypothesis.

If the presence of a unit root is detected in the variables, then it is necessary to check for the presence of a cointegrating (long-run) relationship among the variables. To determine if such a

long-run relationship exists, panel cointegration techniques generated by Pedroni (1999) are utilized. Pedroni develops seven different statistics to test for panel cointegration and they are based on either a within-dimension or between-dimension statistics. Within-dimension based statistics are referred to as panel cointegration statistics, while between-dimension based statistics are termed as group mean cointegration statistics. Pedroni extends the two-step residual-based strategy of Engle and Granger (1987) to develop these panel cointegration tests. These tests are based on the null of no cointegration and work with the assumption of heterogenous panels. All of the seven tests are based on the following panel regression:

$$y_{i,t} = \alpha_i + \beta_1 X_{1,i,t} + \beta_2 X_{2,i,t} + \ldots + \beta_n X_{n,i,t} + \mu_{i,t} \quad, \tag{4}$$

where $X_{i,t}$ are the regressors for n cross sections. Time effects and fixed effects can be included as needed in the estimated regressions. Next, a regression of the following form is performed on the residuals from equation (4):

$$\mu_{i,t} = \rho_i \, \mu_{i,t-1} + \nu_{i,t} \tag{5}$$

where $\mu_{i,t}$ refers to the actual residuals from the previous regression.

Based on this estimation, seven different statistics are calculated. Panel-v, panel-rho, panel non-parametric-t and panel parametric-t are based on the within dimension, while group-rho, group non-parametric-t and group parametric-t are based on the between dimension of the panel. In the within-dimension framework, the null of no cointegration is given as

H0: $\rho_i = 1$ for all i,

against the alternative of H1: $\rho_i = \rho < 1$ for all i. On the other hand, in the between-dimension framework, the null of no cointegration is measured against the alternative hypothesis of H1: $\rho_i < 1$ for at least one i. Thus, the between-dimension test is less restrictive and allows for

heterogeneity across members. In the case of the within-dimension test, a common value for all cross sections is imposed, i.e., $\rho_i = \rho$.

Once cointegration has been established among (between) the relevant variables, the model is estimated utilizing the fully modified ordinary least squares (FMOLS) technique first proposed by Pedroni (1996, 2000). According to Pedroni (2000), standard OLS estimation of a panel will lead to an asymptotically biased estimator because the estimates will be dependent on the nuisance parameters that are associated with the dynamics of the underlying system. He argues that only in the case of exogeneity of the regressors and homogenous dynamics across the individual members of the panel, is it possible for the OLS estimator to be unbiased.

The superior FMOLS estimator is able to account for both serial correlation and potential endogeneity problems, and hence is preferable to simple OLS estimation. One of the advantages of using FMOLS techniques is that it allows for the country-specific fixed effects to be heterogenous while estimating the long-run relationships (Pedroni, 2000). Pedroni (2000) also contends that t-statistics for group mean panel FMOLS offers more flexible alternative hypothesis than pooled panel FMOLS because the former are based on the between-dimension as opposed to within-dimension of the panel; thus it estimates the cointegrating vectors for a common value under the null hypothesis, while under the alternate hypothesis the values for the cointegrating vectors are allowed to vary across groups. This is of special importance in the context of Pesaran and Smith's (1995) finding that under heterogenous cointegrating vectors across different countries, group mean estimators give consistent estimates of the sample mean of cointegrating vectors while pooled within dimension estimators fail to do so.

Hence, we will look at the FMOLS estimator which is based on the estimation of the following cointegrated panel:

$y_{i,t} = \alpha_i + \beta x_{i,t} + \mu_{i,t}$ and,   (6)

$x_{i,t} = x_{i,t-1} + v_{i,t}$

where, α_i allows for the country specific fixed effects, β is a cointegrating vector if y_i,t is integrated of order 1. At the same time, the vector error process $\varepsilon_{i,t} = (\mu_{i,t} , v_{i,t})$ is a stationary process. Pedroni (2000) shows that the group-mean FMOLS estimator is consistent and that the test statistic performs reasonably well even in small samples as long as the time period under consideration is not smaller than the number of cross sections, and this is clearly the case in this study.

IV.   Estimation Results.

The analysis begins with an examination of the integration properties of the variables included in this study. As indicated earlier, two different sets of data are analyzed based on the income level of the countries in our sample. One set of estimations deals with the presence of unit roots and cointegration in the upper level income data set, while the other assesses the existence of unit roots and cointegration in the lower income level data set. Subsequently, two long-run models are estimated to determine the impact of remittances on growth in selected Latin American and Caribbean countries. In view of space limitations, the various panel unit roots results are summarized below and specific estimates are available upon request.

 Insofar as the upper (middle) income group is concerned, most of the variables exhibit unit roots in level form when both individual effects and individual linear trends are included, except for the growth variable. For example, the Breitung t-stat suggests that both remittances as a percentage of GDP and the EFI variable exhibit a unit root in level form. The Breitung t-stat has a test statistic of -0.36 with a p-value of 0.36 for the null of a unit root in the case of the

remittances variable, while, in the case of the EFI variable, it has a t-stat of 0.33 and a p-value of 0.63. Similarly, in the case of the capital variable, the IPS and ADF-Fisher Chi-square fail to reject the null of unit roots at 5% and 10% levels, respectively, while the PP-Fisher Chi-square fails to reject the null of a unit root at the 1% level when the model is estimated with both individual effects and linear trends.

All of the above tests show that the money supply (M2/GDP) exhibits a unit root when using individual effects and individual linear trends in the model. The Breitung t-stat also favors unit roots in levels at the 10% level. The results based on the Hadri test indicate that all of the variables are non-stationary (including the EFI variable). This might be due to the fact that, in the presence of autocorrelation, this test generates over-rejection of the null hypothesis of stationarity. Even though panel unit root tests are much more powerful compared to unit root tests for individual time series, it is still important to interpret these results with caution. Often, these tests reject the null when it should not be rejected or fail to reject the null when in fact it should be rejected.

All the tests show that the variables are stationary in first differences except for the Hadri test which still rejects the null of stationarity in half the cases (including the EFI variable). However, based on most of the other tests, it is reasonable to assume that these variables are integrated of order zero in first differences. It is interesting to note that all the tests, except for the Hadri test, reject the null of non-stationarity at the 1% level of significance. Again, in the presence of high serial correlation, there is a size distortion in the Hadri test and this may be the reason for over-rejection of the null of stationarity.

The reported estimates for the integration properties of the variables in the lower income group are mixed. Remittances as a percentage of GDP, labor, and openness seem to exhibit unit roots.

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The Hadri test rejects the null of stationarity for all the variables in level form. These results are based on the models specified with individual effects only. The models were also estimated with both individual effects and individual linear trends and, in view of space limitations, the results are discussed below.

The Breitung t-stat ,IPS, and ADF-Fisher Chi-square tests all indicate that the M2/GDP variable in level form exhibits a unit roots when both individual effects and individual linear trends are included. Similarly, the aforementioned tests show that the domestic credit/GDP variable exhibits a unit root when estimated with both individual effects and individual linear trends. However, the LLC test rejects the null of a unit root in these circumstances as well.

All the tests, except again for the Hadri test, show that the relevant variables are stationary in first differences, mostly at the 1% level of significance. The Hadri test rejects the null of stationarity for some of the variables (e.g., the EFI variable) despite the fact that most of the other tests show the opposite. As we discussed earlier, this might again be due to severe size distortion associated with autocorrelation.

Panel Cointegration Analysis.

Although it is well-known in the literature that it is not possible for two series integrated of different orders to form a cointegrated series, it is less well-recognized that it is possible for *more* than two series integrated of different orders to combine to form a cointegrated series of lower order of integration. More precisely, if x_t~I(1) and y_t~I(0), then x_t and y_t cannot be cointegrated. However, if x_t~I(2), z_t~I(2) and y_t~I(1), then x_t and z_t can cointegrate to form an I(1) series which can then cointegrate with y_t to give a I(0) series (see Pagan and Wickens, 1989). Harris (1995) indicates that there can be up to n-1 linearly independent cointegrating vectors, where n is the number of variables. Hence, even if some of our tests for the order of integration are

inconclusive, it is still possible to find multiple cointegrating vectors which can then form a linear combination (cointegrate) to generate an I(0) series. In the estimations below we use both GDP per capita in levels as well as in first differences to estimate possible cointegrating relationships.

Furthermore, given that the inclusion of a lagged dependent variable increases the bias towards finding a cointegrating relationship, it is not included when testing for a cointegrating relationship among the variables in our growth equation. This study uses either the M2/GDP variable or domestic credit provided by the private sector (as a percent of GDP) to proxy for financial development. Hence, there are two different set of statistics based on whether M2 or domestic credit provided by the private sector is used to proxy for the financial development of a country. We begin with Pedroni's residual cointegration test for the upper income data set.

Table 1: Pedroni's Residual Cointegration Test: Results for Ten Upper Income Level Countries (with Growth in Per Capita GDP as dependent variable)

Models including	Panel Statistics				Group Statistics			
	No financial Dev. Var.	Credit	Money Supply	EFI	No finan. Dev. Var.	Credit	Money Supply	EFI
Variance ratio	-1.70	-1.43	-1.47	-1.38				
Rho statistic	1.82	2.46	1.46	2.34	2.87	3.45	2.20	3.34
PP statistic	-6.09*	-6.74*	-5.75*	-4.35*	-8.26*	-8.1*	-8.15*	-8.82*
ADF statistic	-2.35*	-5.52*	-5.17*	-4.17*	-2.90*	-6.72*	-9.48*	-5.20*

Note: The models have been specified with deterministic intercept and trend. *, ** and *** mean the rejection of null hypothesis of no cointegration at 1% , 5%, and 10% level respectively.

As indicated above, it is possible for variables of different orders of integration to combine to form a cointegrating relationship as long as there are multiple cointegrating vectors. Table 1 above presents Pedroni's test for potential cointegrating relationships among the following variables: change in the log of per capita real GDP, remittances as a percentage of GDP, and other control variables such as the credit and EFI variables. Again, the lagged dependent variable is not included in the test in order to avoid thebias towards finding a cointegrating relationship.

From the above estimates, particularly the PP and ADF statistics, it is evident that there is a strong cointegrating relationship among the variables when the dependent variable is growth. The cointegrating relationship was also estimated with per capita GDP in level form, but the results show that the cointegrating relationship is more pronounced when growth is used as a dependent variable. The estimates reported in Table 1 show that, despite the presence of different orders of integration in some of the included variables (the growth variable), it is nevertheless possible to find a stable long-term cointegrating relationship among them.

We also performed Kao's Residual Cointegration test and found a strong cointegrating relationship among the variables irrespective of whether a financial development variable was used or not. In both cases, Kao's test rejected the null of no cointegration at the 1% level of significance. Table 2 below reports the panel cointegration estimates for the lower income dataset.

Table 2: Pedroni's Cointegration Test Results for Thirteen Lower Income Level Countries (with Growth as the dependent variable)

	Panel Statistics			Group Statistics		
Models including	No Finance Dev. Var.	Credit	Money Supply	No Finance Dev. Var.	Credit	Money Supply
Variance ratio	-3.39	-3.85	-3.90			
Rho statistic	2.44	3.11	3.04	3.58	4.41	4.49
PP statistic	-8.12*	-9.84*	-14.2*	-9.48*	-16..3*	-21.6*
ADF statistic	-2.65*	-2.12**	-5.15*	-2.36*	-1.93**	-5.02*

Note: The models have been specified with deterministic intercept and trend. *, ** and *** mean the rejection of null hypothesis of no cointegration at 1% , 5%, and 10% level respectively.

Again, all of the reported PP statistics and most of the ADF statistics suggest the presence of a strong cointegrating relationship among the variables in the model at the 1% level of significance. In the ADF case, the significance level drops a bit to 5 percent when the credit variable is included in the model. Still, Kao's test suggests that there is a strong cointegrating relationship among these variables. In both cases, Kao's test statistic is significant at the 1% level. Cointegration tests were also performed using per capita GDP in level form, but there was a stronger cointegrating relationship among the variables when growth in per capita GDP was used as the dependent variable

FMOLS Estimation.

Having established that there is a linear combination that keeps the pooled variables in proportion to one another in the long run, the paper proceeds to estimate a long-run growth equation in order to assess the impact of remittances. Initially, the model was estimated via OLS but the results were not reliable as they suffer from several problems, including positive serial correlation and endogeneity. Tables 3, 4 and 5 below report the estimates generated using the Fully Modified OLS (FMOLS) estimator for the fifteen lower income and eight upper (middle) income countries. The FMOLS estimator, as opposed to the OLS estimator, corrects for both serial correlation and potential endogeneity.

Two models are estimated for the lower income region. One set of estimates includes domestic credit provided by the banking sector to proxy for financial depth and an interaction term between remittances and the financial development variable. The other model was estimated with the M2/GDP variable as a proxy for financial depth, but the estimates were contrary to those reported in the literature. The M2/GDP variable may not be a good proxy for financial depth because M2 can increase significantly during periods of high inflation without any relation to economic growth. Thus, it is more likely that increases in M2 as a percentage of GDP represent greater financial depth if there is a relatively stable macroeconomic environment. Unfortunately, this was not the case for many countries in the Latin American region which were suffering from high rates of inflation during the period under review. In view of this, we report results from the models in which domestic credit provided by the banking sector as a percentage of GDP is used as a proxy for financial depth.

Table 3: Dependent Variable: Growth in GDP per capita Income (Lower Income Group—Thirteen cross sections)

Variable	Without Financial Dev. Variable		With Financial Dev. Variable	
	Coefficient	t-stat	Coefficient	t-stat
Growth(-1)	-0.69	-11.01	-0.56	-16.93
Remittances(-1)	0.01	1.80	0.05	6.31
Capital	0.07	6.65	0.02	8.76
Openness	-0.11	-5.13	0.07	-1.20
Labor	0.53	4.56	0.17	8.32
Credit			0.04	4.74
Remittances*Credit			-0.01	-3.94

Note: All the variables are as specified in the variables section and are expressed in natural logs. The models include common time dummies.

Table 3 shows that remittance flows have a positive and significant impact on economic growth in both models. However, the impact is more pronounced when the financial development (credit) variable is included. The sign of the coefficient of the interaction term (remittances*domestic credit) is negative implying that remittances can act as a substitute for the financial sector variable. This result is consistent with the previous results found by Giuliano et al. in 2006.

In addition, the signs of the coefficients for capital and labor are as expected and the variables are statistically significant. The openness coefficient is not significant when the financial development variable is included, but it is significantly negative when domestic credit provided

by the banking sector is excluded from the model. It is not surprising to find a negative coefficient for openness in less developed Latin American countries because they might be importing a lot of consumer goods and/or exporting primary goods which are notoriously volatile in their behavior over time. The lagged dependent variable has a negative and statistically significant coefficient. There might be several factors in play here, including expectations. Expectations can be positive or negative depending upon several other macroeconomic variables. If there is pessimism about the future state of the economy, then the future growth rates are likely to decrease. If, on the other hand, economic agents are optimistic about the future of the economy, then future growth rates are likely to increase. If the economy is not performing well, people might expect the economy to get better. If the economy is growing at a high rate of growth, they might expect the economy to slow down in the future.

Turning now to the estimates for the ten upper income countries of Latin America displayed in Table 4 below, it is readily apparent that there is a positive and significant effect of remittances on the growth rate of real GDP per capita. Both models have statistically significant coefficients, but the impact of remittances is higher when domestic credit was used to proxy for the financial development of the country. The coefficient of the interaction term (Remittances*Credit) is negative implying that remittances and domestic credit provided by the banking sector act like substitutes; i.e., when the level of domestic credit provided by the banking sector is low, remittance flows are high, and vice versa. However, the coefficient of the credit variable is negative and significant.

Table 4: Dependent Variable: Growth in GDP per Capita Income (Upper Middle Income Group—10 cross-sections)

Variable	Without Financial Dev. Variable and EFI variable		With Financial Dev. Variable	
	Coefficient	t-stat	Coefficient	t-stat
Growth(-1)	0.08	3.45	0.03	0.95
Remittances(-1)	0.01	4.53	0.02	4.76
Capital	0.07	17.2	0.09	10.9
Openness	0.03	4.97	0.07	4.71
Labor	0.08	3.23	0.14	6.48
Credit			-0.05	-8.11
Remittances*Credit			-0.01	-6.55

Note: All the variables are as specified in the variables section and are expressed in natural logs.

This is an unexpected result but can be explained by the financial turmoil some of these Latin American countries went through during part of the period under consideration in this study. For instance, Argentina went into deep recession in the late 20th century which lasted until 2002-03, but the domestic credit provided by the banking sector as a percent of GDP was continuously going up. Moreover, financial depth as measured by the domestic credit provided by the banking sector in the upper income countries was higher compared to the lower income countries. So, there might have been more imprudent lending in the upper income countries for the period under review. If the financial sector is inefficient, then higher lending does not necessarily help promote the growth process. Moreover, it is important to note that the results for individual countries might be different given that the reported estimates represent the overall effect of domestic credit on growth in the upper income group.

In sharp contrast to the lower income group, openness has a positive and significant impact on the growth rate of per capita GDP in the upper income group, particularly when the financial variable is included. This is reasonable because these countries are more developed and are in a better position to exploit the opportunities associated with international trade and finance. The sign of the coefficient for capital is positive and highly significant, and that for the lagged dependent variable, contrary to the lower income case, is positive in both models but statistically significant only in the first model. The coefficient for labor is positive and significant in both models.

Finally, Table 5 below reports the FMOLS estimates for eight upper (middle) income countries when the proxy for institutional development, the EFI index, is included.[4] The estimates suggest that, without the financial (credit) variable, a ceteris paribus increase in the degree of economic freedom is positively and significantly associated with economic growth. Moreover, the impact of remittances on economic growth remains positive and significant when controlling for the degree of economic freedom variable, thus suggesting that remittance flows are more likely to be invested productively (rather than just consumed) in countries that promote the rule of law and the freedom of exchange. When the credit variable, the EFI variable, and the interaction term between remittances and credit are included in the estimation, the estimates are consistent with those reported in Table 4, viz., the credit variable continues to have an unexpected negative sign, the interaction term, once again, suggests that remittances act as substitutes for credit provided by the banking sector, and finally, the magnitude of the EFI variable is reduced somewhat but remains positive and highly significant. Finally, the last column of Table 5 reports estimates that include an interaction term between remittances and the degree of economic freedom. As in the case of the credit variable, the negative estimate for the

interaction term suggests that remittances act as substitutes for the degree of economic freedom; i.e., when the degree of economic freedom or institutional development is shallow, remittances boost economic growth by providing an alternative way to finance investment and overcome poor property rights and the lack of monetary and price stability. This is not an implausible result given that, at high levels of institutional and/or financial development, households and small businesses can turn to a number of alternative sources of funding (rather than remittances) to finance their investment (and consumption) spending.

Table 5: Dependent Variable: Growth in GDP per Capita Income (Upper Income Group—eight cross sections). Note: All the variables (except for the EFI index) are expressed in natural logs

Variable	Without Financial Dev. Variable and EFI Variable		Without Credit Variable but with EFI Variable		With both EFI Variable and Credit interaction Term		With both Credit Variable and EFI Interaction Term	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Growth(-1)	0.08	3.45	0.04	0.90	0.03	0.87	0.04	0.74
Remittances(-1)	0.01	4.53	0.01	2.71	0.02	3.89	0.02	6.10
Capital	0.07	17.2	0.04	5.49	0.04	4.71	0.06	5.37
Openness	0.03	4.97	0.08	4.80	0.09	4.75	0.10	7.69
Labor	0.08	3.23	0.10	3.67	0.11	4.29	0.14	4.25
EFI			0.03	6.42	0.02	3.64	0.01	2.30
Credit					-0.07	-9.65	-0.06	-5.28
Remitt.*Credit					-0.005	-4.52		
Remitt.*EFI							-0.003	-4.62

V.   Conclusion.

Several important conclusions emerge from this empirical study. First, the panel unit root estimates indicate that most of the variables are integrated of order one when both individual effects and individual linear trends are included, except for the growth variable.   Second, Pedroni's test suggests that there exists a cointegrating relationship among the variables that keeps them in proportion to one another over time. Third, FMOLS estimates for the upper (middle) income and lower income groups suggest that remittances have positive and significant effect on real per capita GDP growth in selected Latin American & Caribbean countries. The reported estimates corroborate those obtained by Giuliano et al. (IMF, 2006) which suggest that remittance flows can act as substitutes for credit provided by the banking system. In the case of the lower income group, both domestic credit provided by the banking sector and remittances have a positive and significant effect on real per capita GDP growth.   In the upper (middle) income group countries, domestic credit provided by the banking sector has a negative impact on growth while remittances have a positive and significant effect on growth. Moreover, the negative interaction term between remittances and domestic credit provided by the banking sector suggests that these variables act as substitutes for one another. All of these results suggest that remittances are able to alleviate credit constraints faced by economic agents in these countries.

   Another interesting result reported in this study is that the economic impact of remittances is positive and significant for both sets of countries, but greater in the lower income group than in the upper (middle) income group, particularly in the presence of a credit variable. These results are different from those generated in the extant literature and have to be interpreted carefully. For

example, Giuliano et al. (2006) found a negative impact of remittances for countries with a high level of financial development, while Chami et al. (2005) found a negative effect of remittances on economic growth without considering the degree of financial development and/or the degree of economic freedom. Our sample estimates for LAC countries suggest that remittances have a positive and significant effect on growth regardless of whether the countries in question belong to the upper or lower income group. Even though our results are somewhat surprising, they are not totally unexpected. The countries in our study are all developing countries, whether they belong to the upper (middle) income group or the lower income group.

Finally, this paper examined other institutional conduits via which remittances can affect growth, viz., the opportunity to invest remittances more productively because households have more secure property rights and greater freedom of exchange. The reported FMOLS estimates in Table 5 suggest that, controlling for the degree of economic freedom as measured by the EFI index generated by the Fraser Institute, remittance flows have a positive and significant effect on economic growth. However, the negative interaction term between remittances and the EFI index suggests that remittances have a greater effect on economic growth when the level of institutional development is low. This is not an altogether surprising result and is consistent with the negative estimate obtained for the credit interaction term. That is, in the presence of more secure property rights or more developed financial markets, households and small businesses can (and are more likely to) turn to alternative sources of funding for their consumption or investment projects, such as commercial and investment banks or their own domestically generated savings.

To summarize, the reported estimates suggest that remittance flows have a positive and significant impact on economic growth in selected Latin American and Caribbean countries

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during the 1990-2007 period, and that the effect of remittances is more pronounced once the countries' financial development and degree of economic freedom is taken into account. In this regard, future research might want to investigate other channels, such as the level of educational attainment of a country, through which increased remittance flows can positively affect economic growth. That is, remittance flows can boost economic growth in developing nations if they are used to finance increased levels of spending on primary and secondary education.

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Endnotes

1.Ellerman (2003) reports that Mexican migrant associations send home between US $5000-$25, 000 per year, while migrant associations from El Salvador send home donations of about US $ 10,000 per year. See also Solimano (2003).

2. It is important to not confuse economic freedom with political and civil liberties. Countries mau confer upon their citizens a substantial amount of political and civil liberty in the form of fair and competitive elections and freedom of the press, but still pursue policies that are inimical to economic freedom such as high levels if taxation and excessive government intervention and regulation.

3. This study also estimated eq. (2) with an interaction term between remittances and the EFI variable to determine whether these variables were complements or substitutes.

4. Two upper middle income Caribbean (St. Lucia and St. Vincent and the Grenadines) countries had to be removed from the estimation because the Fraser Institute did not report EFI indexes for them.