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Abstract

Many development economists believe that remittances by the migrant workers are an important source of long rum growth. Therefore, recent studies have investigated the indirect and direct effects remittances on the growth rates of the recipient countries. This paper analyses the strength of these effects with a common data set and with alternative methods of estimation. It is found that while the evidence supports the indirect effects of remittances, the direct growth effects of remittances seem to be insignificant.

Keywords: Remittances, Growth, Panel Data, System GMM

JEL Classification: F22 F43 O16

1. **Introduction**

Remittances by migrant workers are now an important source of funds for many developing countries. The inflow of these funds has been also rapidly growing. Barajas et. al., (2009) and Chami et. al., (2008) have discussed in some detail the significance of remittances as a source of funds for the developing countries. According to their estimates remittances through official channels during 2007 were $300 billion in addition to unknown amounts transferred through unofficial channels. The ratio of remittances to *GDP* exceeds 1% in 60 countries. While a significant proportion of these inflows are for altruistic reasons to support the living standards of family members, some are also motivated by pecuniary gains and take advantage of the incentives offered by the recipient countries. For example deposits by nonresidents attract higher interest rates and are exempt from income tax in counters like India.

Remittances have both welfare and growth effects. They directly alleviate poverty levels by increasing recipient family's income and living standards; see Adams and Page (2005), Insights (2006) IDS, Siddiqui and Kemal (2006) and Gupta, Pattillo, and Wagh (2007). At the same time remittances have significant indirect and direct macroeconomic effects. Given that there is a robust and negative relationship between growth of output and its volatility (see Ramey and Ramey, 1995, Kroft and Lloyd-Ellis, 2002 and Hnatkovska and Loayza, 2003), IMF (2005), World Bank (2006) and Chami et al (2008) have investigated the relationship between volatility and remittances. Their findings imply that remittances by reducing volatility indirectly increase the growth rate. Similarly, there is evidence that development of the financial sector increases the growth rate and therefore remittances indirectly increase growth rate by improving the progress of the financial sector.[1] A third indirect growth effect of remittances is through its effect on the real exchange rate. Amuedo-Dorantes and Pozo (2004), Lopez, Molina and Bussolo (2007) and Lartey, Mandelman and Acosta (2008) have found that the exchange rate appreciates in countries with large remittances, which in turn has a negative effect on the growth rate; also see Acosta, Lartey and Mandelman (2007). Two other indirect effects of remittances that receive scant attention are firstly its effects on human capital

[1] Growth effects of finance sector developments have been investigated by a number of works; see Ang (2008) for a survey. Aggarwal et.al (2006) and Giuliano and Ruiz-Arranz (2009) have investigated, among others, the relationship between remittances and growth of the finance sector.

formation, through its effects on education, and secondly its effects on the investment ratio. Both human capital formation and investment ratio are generally seen to have growth effects on output. In contrast to these growth effects of remittances through the aforesaid indirect channels, some have tried to estimate their direct growth effects by regressing the growth rate on remittances and a set of control variables. Barajas et. al., (2009) recently found that these direct growth effects are generally small and insignificant. However, this is contrary to what is generally expected by some development economists who view remittances are akin to foreign direct investment and other private capital inflows in their effects on growth.[2] Therefore, additional studies based on different data sets and estimation methods would be useful to lend support or contradict the findings by Barajas et. al.[3] However, a single paper is inadequate to examine both the indirect and direct growth effects of remittances. Furthermore, it is also necessary to analyze how strong and significant are the relationships between growth and the intermediate variables, e.g., progress of the financial sector, through which remittances may effect growth. Therefore, this paper examines only the direct effects of remittances and it differs from the earlier papers in that it examines some methodological issues and uses alternative approaches.

The outline of this paper is as follows. Section 2 examines some methodological issues concerning the specification and estimation of the growth effects of remittances. Our empirical results are presented and discussed in Section 3 and Section 4 concludes.

[2] Barajas et. al., observe that "Policy-oriented economists have also made similar claims about remittances. Ratha (2003), for example, calls remittances "an important and stable source of external development finance" but mainly suggests that remittances could and should enhance economic growth rather than show that remittances have actually done so.

[3] Data of Barajas et. el., consists of 80 countries for the period 1970 to 2004. Our data consists of 40 countries with remittances to *GDP* ratio of 1% and above for the period 1960 to 2007. However, due to the unbalanced nature of our panel data and the non availability of data on capital stock we have actually used data from 1965 to 2004. Our methodology and specifications also differ from the earlier works.

2. Specification and Estimation Issues

The specifications used for estimating the growth effects of one or another growth enhancing variable, in both the cross country and country specific studies, need examination. Although most of these studies claim that they are estimating the permanent long run growth effects, there is no distinction between the permanent long run and the transitory short run growth effects of variables. The dependent variable is usually the annual growth rate of output in the country specific time series studies and either this or its five year average in the cross country studies. Neither of these growth rates can said to be a good proxy for the unobservable long run growth rate in the steady state i.e., the steady state growth rate (*SSGR*). The short run growth rates are also important for the policy makers especially of the developing countries because they persist for more than five years and will have permanent level effects; see Rao and Cooray (2009).

Likewise, many studies claim that their specifications are based on one or another endogenous growth model, but it is hard to understand how their specifications are derived from the claimed endogenous growth model. Commenting on the unsatisfactory nature of specifications in many such empirical works, Easterly, Levine and Roodman (2004) have noted that "This literature has the usual limitations of choosing a specification without clear guidance from theory, which often means there are more plausible specifications than there are data points in the sample." Rogers (2003) also took a similar view about the *ad hoc* nature of specifications in many cross-country studies but justified the *ad hoc* specifications because though this is less than ideal, the complexity of economic growth and the lack of an encompassing model make it a necessity. Consequently, as found by Durlauf, Johnson, and Temple (2005), the number of potential growth improving variables used in various empirical works is as many as 145. Given these reservations it is hard to select a few uncontroversial control variables to estimate the growth effects of remittances or financial developments or exchange rate etc.

3. Methodological and Specification Issues

It is worth recalling the observation made by Easterly et al. (2004). Many panel data studies have often used 5 year average growth rates of per capita or per worker output to measure the unobservable steady state growth rate (*SSGR*). However, when perturbed a time span of 5 years is too short for an economy to attain the steady state. This is so because simulations with the closed form solutions show that an economy takes a few decades to converge anywhere close to its steady state. This transition period may be more than 50 years even for small perturbations; see Sato (1963) and Rao (2006). For example when Easterly et al. (2004) have used 8 year average growth rates of output, instead of the popular 5 year growth rates, to check the robustness of the results the Burnside and Dollar (2000) effects of aid on the long run growth. The coefficient of aid and the conditionality variables became insignificant in the Easterly et. al., regressions. They have also experimented with various lengths for panels—ranging from annual growth rates to the average growth rate for the entire sample period of 1970 to 1993 used by Burnside and Dollar—and found that this did not alter their finding that the growth effects of aid are insignificant. This is an indication that even average growth rate of over two decades is not a good proxy for the *SSGR*. This limitation is also recognized by Demirgüç-Kunt and Levine (2008) with the observation "To the extent that five years does not adequately proxy for long-run growth, the panel methods may be less precise in assessing the finance growth relationship than methods based on lower frequency data." This limitation of measuring the unobservable *SSGR*s did not so far receive much attention of the growth economists and econometricians.[4]

In light of such limitations, what can be estimated at best, with annual data or even with short panels, seems to be the production function but not the direct and permanent growth effects of growth enhancing variables like remittances, reforms and globalization etc., by regressing the growth rate on these variables. The production function can be modified to capture the permanent growth effects of variables like remittances through their effects on the total factor productivity (*TFP*). Edwards (1998) and Dollar and Kraay (2004) suggest a similar procedure, but our method is different because this approach

[4] Winters (2004) also recognized that 5 year average growth rates are inadequate to measure the unobservable *SSGR*s. However, he suggests that 5 year growth rates are a pragmatic option to capture at least the transitional growth rates.

depends on the selected growth model. We select the Solow (1956) growth model for a few reasons. Firstly, the Solow exogenous growth model, with constant returns, is easy to extend and estimate compared to a variety of endogenous growth models which need more complicated non-linear dynamic specifications. Greiner et al. (2004) have estimated such endogenous growth models with country specific time series data to determine the permanent growth effects of R&D expenditure. Secondly, there is no convincing evidence that endogenous growth models, with increasing returns, empirically perform better than the Solow model; see Jones (1995), Korcherlkota and Ke-Mu Yi (1996), Parente (2001) and Solow (2000). Solow (2000) observed that "The second wave of runaway interest in growth theory—the endogenous-growth literature sparked by Romer and Lucas in the 1980s, following the neoclassical wave of the 1950s and 1960s—appears to be dwindling to a modest flow of normal science. This is not a bad thing. Nevertheless, a wider variety of growth models is now available for trying out; and some of the main empirical uncertainties have been specified, and perhaps narrowed down even if not settled."

Our extended Solow model may be called the Solow model with an endogenous framework. The well known extension to the Solow model by Mankiw, Romer and Weil (1991, MRW hereafter) is based on a similar approach. However, our extension differs somewhat but its underlying spirit is similar. While our model directly estimates the effects of variables on the *SSGR*, the MRW method is more suitable for estimating the level effects of human capital or improved measures of inputs.

Let the Cobb-Douglas production function with the constant returns and Hicks-neutral technical progress be

$$y_t = A_t k_t^{\alpha} \qquad 0<\alpha<1 \qquad (1)$$

where y = per worker output, A = stock of technology and k = capital per worker. It is well known that the *SSGR* in the Solow model equals the rate of growth of A which is the same as total factor productivity (*TFP*). It is common in the Solow model to assume that the evolution of technology is given by

$$A_t = A_0 e^{gT} \qquad (2)$$

where A_0 is the initial stock of knowledge and T is time. Therefore, the steady state growth of output per worker equals g. The modified production function for estimation will be:

$$\ln y_{it} = \ln A_0 + gT + \alpha \ln k_{it} \qquad (3)$$

It is also plausible to assume for our purpose that

$$A_t = f(T, Z_t) \quad f_T \text{ and } f_Z \leq 0 \text{ or } \geq 0 \qquad (4)$$

where Z is a vector of growth improving variables like remittances and control variables like the investment ratio, financial developments etc. This is consistent with the views of Edwards (1998) and Dollar and Kraay (2004) who take the view that a more convincing and robust evidence between, for example, openness and growth should be derived from its effects on productivity.[5] The effect of remittances or some other variable on *TFP* can be captured with a few alternative empirical specifications for (4) but we shall use only a simple linear specification and express the extended production function as follows.

$$y_t = A_0 e^{(g_1 + g_2 Z_t)T} k_t^{\alpha} \qquad (5)$$

It is also possible to introduce conditionality variables into the above specifications, but we shall ignore this extension. Our alternative specification implied that *SSGR* is:

$$\Delta \ln y^* = SSGR = g_1 + g_2 \, \mathrm{Z} \qquad (6)$$

where g_1 captures the growth effects trended and ignored variables and g_2 captures the growth effects of the variables in the Z vector. Our extended specification is well suited to

[5] Edwards (1998) has used an alternative method which is particularly useful for estimates with panel data. In his approach *TFP* is computed as the residual from the growth accounting exercises for each country. Their averages over ten year panels were used as the dependent variable. Using alternative measures of trade openness he found that they all have significant effects on *TFP*. However, we have reservations on his short lengths of panels.

test, for example, the claims by some economists that countries with higher receipts of remittances grow faster because the *SSGR* depends on remittances.

3. Empirical Results

Our sample consists of 40 countries with a remittances to GDP ratio of 1% or more. The annual data for these countries starts in 1960 and ends in 2007. However, data on some key variables are not available for all the countries and hence our panel data is unbalanced. Further details of the data are in the appendix.

Before we estimate our modified production function we present estimates of the conventional and standard specification of the growth equation used in many empirical works. These estimates are given in Table 1. The dependent variable is the rate of growth of per worker output (ΔLYL). In columns (1) and (2) of Table 1 *OLS* estimates of with 2 definitions of remittances with pooled sample (*OLS* hereafter) are given. Since the sample means are used in the estimation, pooled estimates can be treated as more satisfactory proxies for the long run values of the variables. In column (1) growth rate is assumed to depend only the ratio of remittances to GDP. One would expect that if remittances have any significant long run growth effects the coefficient of remittances will be significant and positive although it will be biased because other growth enhancing variables are excluded and remittances may also depend on growth thus causing an endogenous variable bias.[6]

Two definitions of remittances have been tried. The first is *REMRAT* which includes remittances by all nonresidents and the second is *WRRAT* which includes remittances only by nonresidents who are classified as residents in a foreign country and taxed there. It is hard to say which of these two is better although Barajas et. al., assert that *WRRAT* is better. Estimates of with these 2 measures of remittances are disappointing. While the coefficients of *REMRAT* is positive it is insignificant. The coefficient of *WRRAT* is

[6] A few authors have gone to some lengths to select the instruments to generate the predicted values of remittances. This method of estimation is similar to the indirect least squares estimates but it is well known that a system method of estimation e.g., 2SLSQ etc., are more efficient than the indirect least squares. At this point we will not digress into these refinements because eventually we shall use a system method of estimation.

Table 1

	(1) OLS	*(2) OLS*	*(3) OLS*	*(4) FE*	*(5) RE*	*(6) OLS*	*(7) FE*	*(8) RE*	*(9) OLS*	*(10) OLS*
Intercept	0.012 (2.08)**	0.010 (1.29)	0.077 (2.90)**		0.073 (4.60)**	0.042 (1.75)*		0.016 (0.98)	0.064 (2.75)**	0.025 (1.21)
LREMRAT	$0.584E^{-3}$ (0.36)		$0.742E^{-3}$ (0.58)	$0.476E^{-3}$ (0.21)	$0.776\ E^{-3}$ (0.63)				$-0.497E^{-4}$ (-0.03)	
LWRRAT		$-0.177E^{-3}$ (-0.08)				$0.280E^{-3}$ (0.14)	$0.128\ E^{-2}$ (0.69)	$0.298E^{-3}$ (0.22)		$-0.161E^{-2}$ (-0.63)
LTRAT			-0.016 (-2.64)**	$-0.174E^{-3}$ (-0.01)	-0.012 (-2.40)**	-0.016 (-2.55)**	$0.779\ E^{-2}$ (0.80)	$-0.708E^{-2}$ (-1.27)		
LM2RAT			0.019 (2.19)**	-0.020 (-1.52)	$0.741E^{-2}$ (1.17)	0.024 (2.59)**	-0.012 (-1.07)	0.013 (2.10)**	$-0.242E^{-2}$ (-0.32)	$0.582E^{-2}$ (0.69)
LCRAT1			-0.017 (-4.72)**	-0.014 (-1.58)	-0.016 (-3.84)**	-0.019 (-4.32)**	-0.024 (-3.28)**	-0.022 (-4.99)**		
LIRAT			0.037 (3.18)**	0.033 (2.26)**	0.040 (6.83)**	0.023 (1.98)**	$0.403\ E^{-2}$ (0.27)	0.018 (2.89)**	0.037 (3.12)**	0.020 (1.72)**
LFDIRAT			$0.512\ E^{-2}$ (3.52)**	$0.730\ E^{-2}$ (3.76)**	$0.580\ E^{-2}$ (5.72)**	$0.336\ E^{-2}$ (2.21)**	$0.442\ E^{-2}$ (2.75)**	$0.331\ E^{-2}$ (2.83)**	$0.342\ E^{-2}$ (2.47)**	$0.157E^{-2}$ (1.18)
LGRAT			$-0.962E^{-2}$ (-1.42)	-0.018 (-1.93)**	-0.010 (-1.84)*	-0.012 (-1.77)*	-0.027 (2.41)**	-0.015 (-2.60)**	-0.011 (-1.69)*	-0.013 (2.34)**
DLP			-0.021 (-2.42)**	-0.020 (-3.11)**	-0.019 (-3.33)**	-0.020 (-2.63)**	-0.024 (-3.73)**	-0.020 (-3.83)**	-0.023 (-2.65)**	-0.025 (-3.05)**
SEE	0.048	0.042	0.042	0.040	0.042	0.037	0.034	0.038	0.043	0.038
R-BAR SQ	$-0.60E^{-3}$	$-0.12E^{-2}$	0.17	0.24	0.16	0.14	0.27	0.09	0.12	0.09
DW	1.399	1.240	1.635	1.820	1.594	1.430	1.744	1.337	1.570	1.363
SBIC	-1653.30	-1396.98	-1431.71	-1364.38		-1198.70	-1129.14		-1414.24	-1155.73
Hausman Test					61.461 [0.000]			33.665 [0.000]		

Notes: t-ratios are in the parentheses. 5% and 10% significance is indicated with ** and * respectively.

significant at the 10% level but it is negative. Addition of the lagged dependent variable to these specifications did not yield better estimates. Similarly addition of squared remittances, time trend and a multiplicative variable of remittances and *M2RAT* did not yield a significant positive coefficient for remittances and these are not reported to conserve space.[7]

We have added then some standard control variables to the above specifications. These control variables, in their logs, are: trade openness (*LTRAT*), measured as the ratio of exports plus imports to *GDP*, ratio of *M2* definition of money to *GDP* (*LM2RAT*), ratio of bank credit to private sector to *GDP* (*LCRAT1*), ratio of investment to *GDP* (*LIRAT*), ratio of foreign direct investment to *GDP* (*LFDIRAT*), ratio of current government expenditure to *GDP* (*LGRAT*) and the rate of inflation (ΔLP).[8] The specifications, with the expected signs for the coefficients, are as follows.

[7] We followed here the alternative specifications tried by Barajas et. al.

[8] Some justification for including these variables in the set of the control variables can be found in Barajas et. al. However, note that the number of such potential control variables, as we have noted earlier, exceeds

$$\Delta LYL_{ti} = \alpha_0 + \beta_1 LREMRAT_{it} + \beta_2 LTRAT_{it} + \beta_3 LM2RAT_{it} + \beta_4 LCRAT1_{it} + \beta_5 LIRAT_{it} + \beta_6 LFDIRAT_{it} + \beta_7 LGRAT_{it} + \beta_8 \Delta LP_{it} \quad \text{(xx=7)}$$

$$\Delta LYL_{ti} = \alpha_0 + \beta_1 LWRRAT_{it} + \beta_2 LTRAT_{it} + \beta_3 LM2RAT_{it} + \beta_4 LCRAT1_{it} + \beta_5 LIRAT_{it} + \beta_6 LFDIRAT_{it} + \beta_7 LGRAT_{it} + \beta_8 \Delta LP_{it} \quad \text{(yy=8)}$$

$$\beta_1 \ldots\ldots \beta_6 \geq 0 \text{ and } \beta_7 \text{ and } \beta_8 \leq 0.$$

These 2 equations are estimated with *OLS* and as fixed effects (different intercepts but same slopes, *FE* hereafter) and random effects (*RE* hereafter) models.[9] These 3 estimates for equation (7) are in columns (3), (4) and (5) and for equation (8) in columns (6) to (8). For equation (7) the null in the Hausman test that the *RE* model is preferable to the *FE* model is rejected. The test statistic, with the p-value in the square brackets, is $\chi^2(6) = 33.665\ [0.00]$ and significant at the 5% level. However, the absolute value of SBI of OLS estimate for this equation is higher at -1169.6 than the SBI for the *FE* model which is -1129.1, thus favouring the OLS estimate in column (3). These results are also valid for the estimates of (8) and its *OLS* estimate in column (6) is preferable to those in columns (7) and (8).

In the preferred *OLS* estimate in column (3) out of the 8 slope coefficients 6 are significant. It should be noted that the coefficient of remittances is insignificant although its sign is positive. The signs of the coefficients trade openness and the credit ratio are negative but significant at the 5% level and contrary to prior expectation. The signs of the coefficients of the ratios of M2, investment, foreign direct investment to *GDP* and inflation are as expected and significant. The sign of the ratio of government expenditure has the correct negative sign but significant only at the 16% level. These observations also hold for the *OLS* estimate of equation (8) in column (8) except that the ratio of government expenditure to *GDP* now became significant at the 10% level. Although *OLS*

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100 and if anyone finds the right set of control variables that would be a miracle. Therefore, our selection of these control variables should be treated with the usual caution.

[9] The *FE* estimates with different intercepts and slopes turned out to be inferior to the *FE* model with country specific intercepts and common slope coefficients. For example for (8) the SBI for the former and latter, respectively, are -603.04 and -1129. Similar values held for equation (7) and the *FE* estimates of the former type are not shown to conserve space.

estimates are preferred, the *FE* and *RE* estimates of these two equations are qualitatively similar. *OLS* re-estimates of equations (7) and (8) after deleting the variables with the wrong signs, viz., *LTRAT* and *LCRAT1* are in columns (9) and (10). In neither equation the coefficient of remittances is significant.[10] Thus our estimates imply that the growth effects of remittance seem to be small and insignificant and support the findings in some earlier works like Barajas et. al.

A weakness in the conventional specifications and estimates is that there is no distinction between the short and long run effects of remittances or any other growth enhancing variable. Since several empirical studies claim that they are analyzing the long run growth effects of remittances and/or other growth improving variables, we shall use, as discussed in Section 2, our extended specification in equations (3) and (5) based on the Solow model. Besides the ratio of remittances we have included 7 other variables that may have long run growth effects. These are shown in equations (7) and (8). Therefore, the Z vector consists of 8 variables and an intercept to capture the growth effects of trended but ignored variables. Our modified production function is:

$$y_t = A_0 e^{(g_1 + \sum g_i Z_{it})T} k_t^{\alpha} \qquad (9)$$

the vector Z_{it} consists of the 8 variables from equation (7) or (6).

[10] We have also tried estimates by instrumenting remittances with time trend and 2 and 3 period legged values of remittances. The correlation coefficient between remittances and the instruments was high at 0.88. Although the coefficients of *REMRAT* and *WRRAT* were positive in some estimates, they were insignificant. When a multiplicative term of remittances and *M2RAT* was added to these regressions the coefficient of *WRRAT* in a RE estimate was positive and significant at the 10% level but the coefficient of the multiplicative term was negative and insignificant. Furthermore, the Hausman test rejected the RE estimate in favour of the FE estimate. These results are similar to the findings in Barajas et. al., and not reported to conserve space. However, our results differ from Giuliano and Ruiz-Arranz (2009) who found that the coefficient of this multiplicative term was negative and significant implying that in countries with less developed financial sector remittances are a significant source of funds for investment and growth. More on their results later..

The specification in (9) cannot be easily estimated with the standard panel data methods of *OLS* or *FE* or *RE* because of the nonlinearity of the variables. Generalized Method of Moment (*GMM*) proposed by Arellano and Bond (1991) is the commonly employed estimation procedure to estimate the parameters in a dynamic panel data model with nonlinearities in the variables. In this method first differenced transformed series are used to adjust for the unobserved individual specific heterogeneity in the series. But Blundell and Bond (1998) found that this has poor finite sample properties in terms of bias and precision, when the series are persistent and the instruments are weak predictors of the endogenous changes. Arellano and Bover (1995) and Blundell and Bond (1998) proposed a systems based approach to overcome these limitations in the dynamic panel data models. This method uses extra moment conditions that rely on certain stationarity conditions of the initial observation. The systems *GMM* estimator (*SGMM*) combines the standard set of equations in first differences with suitably lagged levels as instruments, with an additional set of equations in the levels with lagged first differences as instruments; see for further details on the advantages of *SGMM* Arellano, Bond and Temple (2002), Rao, Tamazian and Singh (2009) and Rao, Tamazian and Kumar (2009). We shall use this estimation method to estimate our modified production function (8).

Our empirical results with *SGMM* are in Table 2. Due to the non-balanced nature of our data we have ignored the first 5 years 1960 to 1964 and also the last 3 years 2005, 2006 and 2007. Therefore our sample covers the period 1965 to 2004. Furthermore, we have encountered convergence problems due to high first order serial correlation in the residuals of the levels equation. The estimated first order serial correlation is close to unity. To achieve convergence the levels equations is estimated in a transformed form where the first order serial correlation is fixed at 0.998.

We estimated first a simple version of equation (8) where *TFP* is assumed to be a function of time only to get an understanding of the strength of *TFP* effects on growth and also to check if this specification yields a plausible estimate for the share of profits α. The levels version of the estimated specification is:

$$\ln y_{it} = \pi + gT + \alpha \ln k_{it} \qquad (9)$$

where *T* is time. The estimates are in column (1) of Table 2. It can be seen that all the parameters are significant at the 5% level. The estimate of profit share at 0.311 is highly plausible and close to its stylized value of one third in the growth accounting exercises. The coefficient of time implies that the long run growth rate of per worker income is low in these countries at about 0.56%.

Table 2
SGMM Estimation

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Intercept (A_0)	-3.141 (-13.17)**	-3.304 (-9.90)**	-3.304 (-10.76)	-3.352 (-7.66)**	-3.225 (-14.87)**	-3.098 (-8.83)**	-3.256 (-15.04)**	-3.405 (-8.16)**
Time (G_1)	$0.557E^{-2}$ (3.31)**	$0.731E^{-2}$ (-1.07)						
Profit Share (α)	0.311 (5.43)**	0.179 (2.13)**	0.0179 (2.17)**	0.155 (2.41)**	0.177 (3.05)**	0.207 (2.66)**	0.177 (3.11)**	0.137 (1.22)
REMRAT(G_2)				-0.021 (-0.55)	-0.028 (-1.92)*	-0.032 (-1.21)	$0.351\ E^{-3}$ (0.01)	$-0.679E^{-2}$ (-0.18)
IRAT(G_3)		0.022 (2.52)**	0.022 (3.14)**	0.013 (1.44)				
FDIRAT(G_4)		0.029 (1.35)	0.028 (1.55)	0.081 (2.09)**	0.039 (1.96)**	0.051 (2.02)**	0.031 (1.68)*	
GRAT(G_5)		-0.311 (-0.07)				-0.039 (-1.18)		
DLP(G_6)		-0.131 (-0.65)				$0.121E^{-2}$ (0.45)		
TRAT(G_7)		-0.394 (-0.10)				$0.393E^{-2}$ (1.09)		
M2RAT(G_8)		0.012 (2.76)**	0.012 (4.19)**	0.015 (2.41)**				0.018 (3.25)**
REMRAT×*M2RAT*(G_9)							-0.043 (-0.98)	-0.045 (-0.92)

Notes: t-ratios are in the parentheses. 5% and 10% significance is indicated with ** and * respectively.

To understand on what factors *TFP* may depend it is necessary to estimate our extended specification. We have estimated (8) with the 7 growth inducing variables in the *Z* vector and the specification of this equation analogous to (9) is as follows.

$$\ln y_{ti} = \pi + (g_1 + g_2 TRAT_{it} + g_3 M2RAT_{it} + g_4 CRAT1_{it} + g_5 IRAT_{it} + g_6 FDIRAT_{it} + g_7 GRAT_{it} + g_8 \Delta LP_{it}) \times \mathrm{T} + \alpha \ln k_{it} \qquad (10)$$

$$g_1 \ldots\ldots g_6 \geq 0 \text{ and } g_7 \text{ and } g_8 \leq 0.$$

In the first instance *REMRAT* is excluded from the specification for two reasons. Firstly, variables like *M2RAT, CRAT1* and *IRAT* are important channels through which *REMRAT* is generally considered to have its growth effects. Therefore, adding *REMRAT* may not produce good and reliable results because of multi-colinearity. Secondly, it is necessary to examine if these control variables have any long run growth effects by

affecting adequately *TFP*. If they do have significant growth effects, then it is likely that g_1 will be small or insignificant and remittances may indirectly improve growth through these channels. We have excluded *CRAT1* because its presence made its coefficient and that of *M2RAT* insignificant. Estimates of (10) with the other 6 variables are in column (2) of Table 2. Of these the coefficients only those of *IRAT* and *M2RAT* are significant at the 5% level and they seem to explain adequately the trend in *TFP* because, as expected above, the coefficient of trend g_1 is insignificant. However, the share of profits has decreased to about 0.18 from its earlier estimate of 0.311 but this lower estimate plus 2 of its standard deviations is not far below the stylized value of one third. Removal of trend and 3 other insignificant variables with lower t-ratios viz., *GRAT*, *DLP* and *TRAT* has improved the significance of the coefficient of *FDIRAT* and it is now significant at slightly more than the 10% level. The reestimated equation is in column (3) of Table 2. There are no significant changes in the estimates of the other parameters. These estimates imply that the permanent positive growth effects *IRAT*, *M2RAT* and *FDIRAT* are small. At the sample mean values of these variables of 0.21, 0.41 and 0.02, respectively, their permanent growth effects are 0.44, 0.51 and 0.05 percentage points respectively. If *IRAT, M2RAT* and *FDIRAT* can be increased by 50 percent, this will add about a 1.5 percentage points to the long run growth rate of per worker output. Although this is a difficult target it is not impossible to achieve. It is an attractive policy option because the average growth rate of these countries is low at about one percent and this can be increased to 2.5 percent.

To examine if remittances has any growth effects the above equation is reestimated by adding *REMRAT* and these are in column (4) of Table 2. It can be seen that the coefficient of *REMRAT* has the wrong sign and is insignificant. When *WRRAT* is used in place of *REMRAT* the results are similar and these are not reported to conserve space.

The insignificance of *REMRAT* may be because the growth effects of remittances are indirect through its effects on variables like *IRAT* and *M2RAT*. Since these two are already included in these estimates, *REMRAT* may not have any additional growth effects. To test this we estimated this equation by removing both the channels viz., *IRAT* and *M2RAT* and the results are in column (5) of Table 2. The coefficient of *REMRAT* is negative and significant at slightly higher than the 5% level. The coefficient of *FDIRAT* has decreased and the profit share has increased.

Addition of other non-channel variables *GRAT*, *DLP* and *TRAT* did not change the results but the coefficients of these 3 variables are insignificant. These estimates are in column (6) of Table 2. In this equation only the coefficients of *FDIRAT* and profit share are significant besides the intercept. The coefficient of *REMRAT* is negative and insignificant. When *WRRAT* is used in place of *REMRAT* it made no difference and these are not shown to conserve space.

Recently Giuliano and Ruiz-Arranz (2009) have added a conditional multiplicative term to show that remittances have positive growth effects and this effect is higher in countries with less developed financial sector. This is plausible if remittances are a good substitute for bank finance for funds to investment. In their *SGMM* estimate the coefficient of *REMRAT* was positive (0.406) and the coefficient of the product of *REMRAT* and the ratio of deposits to *GDP* was negative (-0.008) and both are significant at the 5% level. To test if this result holds in our sample with an improved specification to capture the long term growth effects, a multiplicative term *REMRAT*×*M2RAT,* which is similar to the Giuliano and Ruiz-Arranz variable, has been added to the equation in column (5). In this equation *FDIRAT* is the only control variable because the coefficients of 3 additional non-channel variables, viz., *GRAT, FDIRAT* and *DLP* are found to be insignificant; see estimates in column (6). Estimates with the multiplicative term are in column (7) of Table 2. The coefficients of *REMRAT* and *REMRAT*×*M2RAT* have the expected positive and negative signs but are highly insignificant. There is no other significant change in the estimates of other parameters. When *WRRAT* is used in place of *REMRAT* results were worse and the share of profits became insignificant. We have added to this equation *M2RAT* as an additional variable although it is hard to justify because it is a channel for *REMRAT* to affect growth and adding this or similar channels is redundant and biases estimates. Nevertheless, since Giuliano and Ruiz-Arranz's specification includes a similar term and additional channels we estimated in column (8) a specification with both *REMRAT* and *M2RAT*. Although the coefficient of *M2RAT* is positive and significant the coefficients of *REMRAT* and the multiplicative term have remained insignificant. Furthermore, the coefficient of *REMRAT* became negative and the significance of other coefficients has worsened. In our view the standard specification used by Giuliano and Ruiz-Arranz in which the unobservable long term growth rate is proxied with 5 year average growth rate of *GDP* is unsatisfactory. Easterly et. al., (2004) and Demirgüç-Kunt and Levine (2008) have been critical about such specifications. The

5 year average growth rate may be capturing some transient growth effects, whereas our specification is more appropriate to estimate the effects on the long run steady state growth rate. Therefore, it is difficult to accept that Giuliano and Ruiz-Arranz have actually estimated the permanent long run growth effects of *REMRAT* in spite of their elaborate but *ad hoc* specifications with a large number of multiplicative terms. Nevertheless, their contribution is significant in many other respects because their data refinements and use of *SGMM* and threshold effects techniques will encourage others to follow their example, hopefully with improved specifications.

On the basis of these results it is hard to say that remittances have any long run growth effects. However, as Giuliano and Ruiz-Arranz's work reveals remittances may have transient growth effects in the short run. Such effects are better suited for estimation with country specific time series data and time series methods. These transient effects may be significant and persist for a few years. If so, they will have significant permanent level effects on per worker output. Furthermore, remittances may also have indirect and permanent growth effects through its effects on *IRAT* and *M2RAT* etc However, these growth effects are likely to be small because they will be the product of 2 fractions. For example if the coefficient of *REMRAT* in the investment equation is 0.15 and significant in a properly specified investment equation, since the coefficient of *IRAT* in our estimates is 0.022, the indirect growth effect of remittances will be only 0.003. A 20% increase in remittances will add an additional growth rate of only 0.07 percent. If these indirect growth effects exist for *REMRAT*, they may be complex to untangle because as noted by Barajas et. al., some are positive and some are negative. In our reduced form estimates the coefficient of remittances when significant was negative; see column (5) of Table 2.

4. Conclusions

In this paper we have analyzed the direct growth effects of remittances and the growth effects of the channels through which remittances may affect growth by treating as conditioning variables. We have used conventional panel data estimation methods and also the system GMM in which the limitations due to weak instruments and persistence in the variables are minimized if not totally eliminated; see Buny and Windmeijer (2009) for the weak instruments problem in *SGMM*. Our results showed that remittances, measured as *REMRAT* and *WRRAT*, do not seem to have any significant direct growth effects.

However, we found 2 channels through which remittances may have indirect growth effects. These are *IRAT* and *M2RAT* and both have direct growth effects. To estimate the indirect growth effects of *REMRAT* through these channels, it is necessary to use proper specifications for *IRAT* and *M2RAT* instead of arbitrarily regressing them on a single variable such as *REMRAT*. This task is beyond the scope of this paper. We think that such effects will be small in properly specified investment and money supply equations. Therefore the ultimate growth effects of remittances through these channels will be also small. Barajas et. al., offer a reason for this.[11] According to them remittances, however small, may have both positive and negative effects on growth. The negative effects are due to the Dutch Disease and deterioration of the quality of governance and neither of them have been investigated in our paper. Therefore, these two effects may offset each other if reduced form growth equations with remittances as the only explanatory variable are estimated. While adding additional conditional variables it is appropriate to exclude the channels through which remittance have indirect growth effects.

We agree with Easterly et. al., (2004), Rogers (2003) and Demirgüç-Kunt and Levine (2008) on their criticisms of the specifications used in empirical growth models. Therefore, We have suggested and estimated an extended production function, instead of a growth equation, to derive the *SSGR* using the framework of the Solow growth model. In many empirical works there is no awareness that the *SSGR* is an unobservable variable—like the natural rate of unemployment. Both should be derived by estimating a theoretically sound model by imposing the steady state conditions.

Although we found that remittances have no long run growth effects, they may have short to medium term transitory growth effects. These growth effects do not raise the permanent growth rates but they will have permanent level effects. We take the view that cross country and panel data methods are less likely to be useful for estimating the transitory growth effects compared to their estimates with country specific data and time series methods. We hope that some investigators will pay attention to the significance

[11] According to them "This is partially because the multiple paths through which remittances can affect growth include negative as well as positive influences of remittances on long-run economic activity. This result implies that policymakers' high hopes for remittances are likely to be disappointed. It also may suggest, however, that many countries do not yet have the institutions and infrastructure in place that would enable them to channel remittances into growth-enhancing activities."

such level effects of remittances instead of concentrating solely on its long run growth effects because these transitory effects persist for a few years and can permanently increase the level of per worker incomes and living standards.

Data Appendix: *Data definitions and sources*

Variables	**Definition**	**Source**
CRAT1	Domestic credit provided by banking sector (% of GDP)	World Development Indicators (WDI) 2008
FDIRAT	Foreign direct investment to GDP ratio.	World Development Indicators (WDI) 2008
GRAT	General government final consumption expenditure to GDP ratio.	World Development Indicators (WDI) 2008
H	Human capital; An average of the Barro-Lee and Cohen-Soto data set and it incorporates a 7 percent rate of Return to each year of education.	Barro-Lee and Cohen-Soto data set.
IRAT	Gross domestic fixed investment to GDP ratio.	World Development Indicators (WDI) 2008
K	Capital Stock; Derived using perpetual inventory method $K_t = .95 * K_{t-1} + I_t$. I_t is real gross domestic fixed investment	International Financial Statistics, IMF
L	Labour Force	World Development Indicators (WDI) 2008
M2RAT	Money and quasi money (M2) to GDP ratio.	World Development Indicators (WDI) 2008
DLP	Inflation, (GDP deflator) annual percentage	World Development Indicators (WDI) 2008
REMRAT	Workers' remittances and compensation of employees to GDP ratio. Workers' remittances and compensation of employees comprise current transfers by migrant workers and wages and salaries earned by nonresident workers. Workers' remittances are classified as current private transfers from migrant workers who are residents of the host country to recipients in their country of origin. They include only transfers made by workers who have been	World Development Indicators (WDI) 2008

	living in the host country for more than a year, irrespective of their immigration status. Compensation of employees is the income of migrants who have lived in the host country for less than a year.	
TRAT	Sum of export plus import of goods and services to GDP ratio.	World Development Indicators (WDI) 2008
WRRAT	Workers' remittances to GDP ratio. Workers' remittances are current transfers by migrants who are employed or intend to remain employed for more than a year in another economy in which they are considered residents.	World Development Indicators (WDI) 2008
Y	Real Gross Domestic Product	World Development Indicators (WDI) 2008, World Bank

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