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Remittances, Institutions and Growth: A Semiparametric Study

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Abstract

In this article we re-examine the relationship between remittances and economic growth placing special attention to the non-linearity of this relationship. Previous studies have ignored the non-linearity of the relationship between remittances and economic growth or have used a quadratic term to capture non-linearity. We show that the relationship between remittances and growth is neither linear nor quadratic and propose the use of a semiparametric model to avoid the risk of misspecification bias from imposing an arbitrary functional form. We find evidence of a positive relationship between remittances and growth in parametric estimations, however, such relationship disappears when non-linearity is taken into account using nonparametric techniques.

JEL Codes: F22, O11, O15
Key words: Migration, Remittances, Economic Growth

1. Introduction

A great deal of attention is being paid today to worker's remittances, the repatriated earnings of immigrant workers. Remittances have become one of the largest sources of external finance for developing countries. In 1990, worldwide flows of remittances amounted to $68 billion, but this sum increased by about three and a half times to $232 billion by 2005 (World Bank, 2006). The gradual reduction in the cost of transferring money and growth in the migrant stock suggests that these flows will keep increasing during the coming decades.

The impact of worker's remittances on economic growth in receiving countries has been the subject of much debate. On one side the proponents of remittances as a development tool point at the evidence suggesting that remittances are often used for investment purposes (Woodruff and Zenteno, 2001). Also given the lack of credit markets in developing countries remittances can be used to finance investment projects like small businesses (Amuedo-Dorantes and Pozo, 2006a). On the other hand, other authors have argued that remittances may be detrimental to development and economic growth. Some of the arguments are based on empirical evidence showing that remittances have a negative impact on the labor supply of the receiving households (Amuedo-Dorantes and Pozo, 2006b; Hanson, 2005) or may appreciate the receiving country currency (Bourdet and Falck, 2006). However, only a few studies have tested a direct relationship between remittances and economic growth. These studies have typically provided mixed results, while most often find that there is either a positive or no impact of remittances on economic growth.

In this article we re-examine the relationship between remittances and economic growth. The main contribution of the article is the treatment of potential nonlinearities in

the relationship between remittances and economic growth. Even if the impact of remittances on economic growth is positive, it is unlikely to be linear. If the relationship were to be linear, then receiving countries would benefit forever at the same rate as remittances increase. It is more likely that remittances foster growth, but with diminishing returns. That is, there may be a threshold after which the impact of remittances on growth diminishes or disappears. This suggests that the relationship between remittances and growth is non-linear.[1]

Previous studies have ignored non-linearity or have used a quadratic term of remittances in order to account for the impact of remittances on growth. Giuliano and Ruiz-Arranz (2005) study the relationship between remittances and growth using a linear term for remittances. Their results suggest that remittances promote growth in less financially developed countries. They argue that remittances provide an alternative way of financing investment and help overcome liquidity constraints. Similarly using a linear term for remittances, Mundaca (2005) finds that remittances have a positive effect on growth. Mundaca (2005) argues that financial market development may boost the long-run effects of remittances on growth.

However, not all papers have been limited to the use of a linear term. Chami et al. (2005) included a quadratic term of remittances in one of their estimations. While in the estimation the remittances term is not significant, the quadratic term is negative and significant. Catrinescu et al. (2006) also includes a quadratic term for remittances in some of their specifications. In this case the quadratic term was either positively significant or insignificant. While the results in Catrinescu et al. (2006) where inconclusive, they argue that in general, remittances make a positive, but modest, contribution to growth.

[1] It is important to note that we do not argue that the relationship between remittances and all other home

While these papers have provided important and interesting contributions to the remittance literature they have not addressed the non-linearity between remittances and growth properly. Figure 1 is the plot of the point wise regression coefficients (first derivatives) of a semiparametric regression of remittances on growth.[2] If the relationship were to be quadratic, then we should see a straight line. From Figure 1 it is clear that the relationship is neither linear nor quadratic. In this case using a quadratic term to capture the non-linear form will lead to a misspecification bias and misleading econometric conclusions.[3] We propose the use of a semiparametric model to avoid the risk of misspecification bias from imposing an arbitrary functional form. The use of a semiparametric model addresses the non-linearity issue without superimposing any a priori functional form on the relationship between remittances and economic growth. Furthermore, the semiparametric estimations allows us to control for the effect of other important covariates.

[Figure 1]

The results of this article show that remittances impact growth positively in pooled and fixed effects parametric regressions, but that there are no measurable effects when nonlinearities are taken into account using semiparametric techniques. Also, although we find institutions to be an important determinant of growth on their own, we do not find evidence that they help in making remittances more effective.

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country variables is non-linear. Remittances may have a linear relationship with several other variables.

[2] The vertical axis in Figure 1 plots the conditional first derivatives (partial effects) against remittances measure on the horizontal axis.

[3] We also conducted the Ramsey RESET test for non-linearity for the remittances variable. We were able to reject the hypothesis of linearity. Results are available from the authors upon request.

The remainder of the paper is organized as follows. Section 2 introduces the data and methodology. Section 3 presents the results and Section 4 presents some robustness tests. Section 5 summarizes the results and concludes.

2. Methodology and data

According to the previous discussion the relationship between remittances and growth is neither linear nor quadratic. We use a semiparametric estimation technique to address this nonlinearity issue.[4] A nonparametric model imposes no a priori restrictions on the functional form of the regression model. We use a semiparametric or partially linear model because of the large number of observations that would be required to conduct a full nonparametric estimation.[5] In our estimation we allow for non-linearity in our main variable of interest (remittances). The basic model that we consider in the semiparametric estimation is as follows:

$$Y_{it} = \beta X_{it} + m(R_{it}) + U_{it} \qquad (1)$$

In this case Y is the per capita growth rate of GDP, X is the vector of control variables captured through a linear functional form, R is remittances as a fraction of GDP, which affects Y through an unknown functional form $m(.)$ and U is a random i.i.d. error.

The variables in X include controls for home country economic and political conditions. These variables include the initial GDP per capita level (LGDP), an ethnic fractionalization variable (ETHNIC), assassinations per capita (ASSAS), an interaction between ethnic fractionalization and assassinations (ETHASSAS), an institutions quality

[4] See Pagan and Ullah (1999) for details about estimating non-parametric models. Our estimation approach is similar to Li and Stengos (1996) and Robinson (1988).

index (INST) and a policy variable (POLICY). The policy variable is constructed as a linear combination of inflation, the budget surplus and the Sachs-Warner openness index. To control for home country financial conditions we include lag M2 as a fraction of GDP (M2). All these control variables are standard in the growth literature.[6]

Finally, we also include geographic dummies and an interaction between remittances and the institution quality index. This interaction term gives us information about the possibility of remittances being effective in promoting growth only in good institutional environments. This is similar to the idea in Burnside and Dollar (2000) that aid is only effective in promoting growth in good economic environments.

For comparison purposes we also present the results using standard parametric pooled and fixed effects estimations. The functional form of the parametric pooled model is indicated in Equation (2):

$$Y_{it} = \gamma L_{it} + U_{it} . \qquad (2)$$

Where L is similar to X but also includes the remittances series.

The definitions of all the variables are included in the Appendix. Annual data on remittances come from *World Development Indicators*. We use remittances as a share of GDP rather than the level of remittances. The Center for Global Development is the

[5] Nonparametric models suffer from a dimensionality problem. That is, the size of the sample required increases rapidly with the number of regressors that are treated nonparametrically (see Pagan and Ullah, 1999).

[6] We use a set of control variables which is consonance with the literature and similar to the one used in papers such as Burnside and Dollar (2000), Easterly et al. (2004), and Alvi et al. (2008). It can be certainly possible to think about other controls to include in the estimations. However, to keep the main contributions of the paper focused, we abstract from several other issues and do not want to depart from the set of variables used in these previous growth studies. Using a similar set of control variables also allows for better comparisons.

source of all other variables used in our estimations.[7] Our data covers the period 1978 – 2001 and as in most cross-country growth regressions four year averages are used.[8]

3. Results

For comparison purposes, we first present a series of linear parametric estimations. We begin our analysis with a simple pooled parametric least squares estimation of a basic cross-country framework. These results are reported in the first column of Table 1. Looking first at the control variables, it seems that policies and institutions have positive effects on growth. The dummy for Sub-Saharan countries is negative, while the dummy for East Asia is positive. The linear term of remittances is positive, while the interaction term is negative. Both of these terms are significant. Remittances seem to have a positive impact on growth, but it doesn't seem to be the case that institutions help to reinforce that impact. To the contrary, institutions seem to be diminishing the impact of remittances on growth.

Next, we estimate the model using a parametric fixed effects technique to control for unobserved country specific factors. The results of this estimation are reported in the second column of Table 1. In general, results seem to be consistent across estimations. With respect to remittances, we see no changes. The linear coefficient is positive and significant, while the interaction term is negative and significant.

[Table 1]

As we argued above, the relationship between remittances and economic growth is not linear. Hence, just using a linear term of remittances leads to specification bias.

[7] We thank the Center for Global Development, particularly David Roodman, for the data.

Moreover, the use of a quadratic term is not going to solve the problem because the relationship is not necessarily quadratic. In order to address this concern we conduct a semiparametric estimation. In this case we allow our main variable of interest (remittances) to assume a non-linear form while all other control variables are restricted to be linear. We use the Kernel weighted local linear estimation technique. The optimal bandwidth is chosen as to minimize the mean square error.

We start by estimating a pooled semiparametric regression. The results of this estimation are reported in column (3) of Table 1. It seems that the coefficients for the control variables are similar to those of the parametric estimations. This comes at no surprise given the assumption of linearity for those coefficients. The main difference is with respect to the remittances coefficient.[9] In this case, the remittances coefficient is found to be statistically insignificant. In column (4) of Table 1 we report the results when we use a fixed effects semiparametric regression. Again, it seems that the remittances term is not significant.

4. Robustness

As a robustness check and to address the potential endogeneity of remittances in the growth regressions, we also conduct the estimations using the lag of remittances. The results are reported in column (5) for the pooled estimation and in column (6) for the fixed effects estimation. It seems that once again the remittances coefficient is not significant. However, there is a difference in the results. Now it seems that the interaction term is negative and significant.

[8] Countries included are Bolivia, Brazil, Colombia, Dominican Republic, Egypt, El Salvador, Gabon, Ghana, Indonesia, India, Jamaica, Korea, Morocco, Madagascar, Mexico, Nigeria, Pakistan, Philippines, Paraguay, Senegal, Togo, Trinidad and Tobago, Tunisia and Turkey.

In the foreign aid literature it has been documented that institutions can help increase the effectiveness of foreign aid. That does not seem to be the case for remittances. It is possible that having good institutions leads to fewer migrants, which leads to low remittances and therefore a small (and even insignificant) impact on growth. It may also be possible that remittances inflows deteriorate institutional quality and therefore have a detrimental impact on growth (see Abidth, et al. 2008). However, more research on this result, that is certainly not completely robust, is needed before we can reach any definite conclusions. While such an extension is out of the scope of this paper, further work on this issue would be of academic interest.

In sum, remittances are not found to be significant when the semiparametric framework is employed in either pooled or fixed effects estimations. The interaction of a one period lag of remittances with institutions is found to be significant, however. We find that the semiparametric results tend to be very similar to our parametric results for other controls such as institutions, policies and regional dummies.

5. Concluding remarks

Recent literature has emphasized that remittances are an important source of international capital flows for developing countries. A series of studies have analyzed the impact of remittances on growth and development. These studies have assumed that the relationship between remittances and growth is either linear or quadratic.

In this article we argue that the relationship between remittances and growth is neither linear nor quadratic. Assuming that the relationship is linear or quadratic therefore

[9] For remittances we report the average of the point-wise first partial estimates.

results in a misspecification bias. As an alternative we propose a semiparametric estimation to allow more flexibility in analyzing the impact of remittances on growth.

We find evidence of a positive impact of remittances on growth in pooled and fixed effects parametric estimations. On the other hand, the semiparametric results do not support such a link. While there maybe other potential econometric issues related to testing the relationship between remittances and economic growth, our results suggests that the non-linearity of this relationship should not be overlooked. Future studies should take into account the nature of this non-linearity and place extra-effort in modeling the correct functional form of the relationship.

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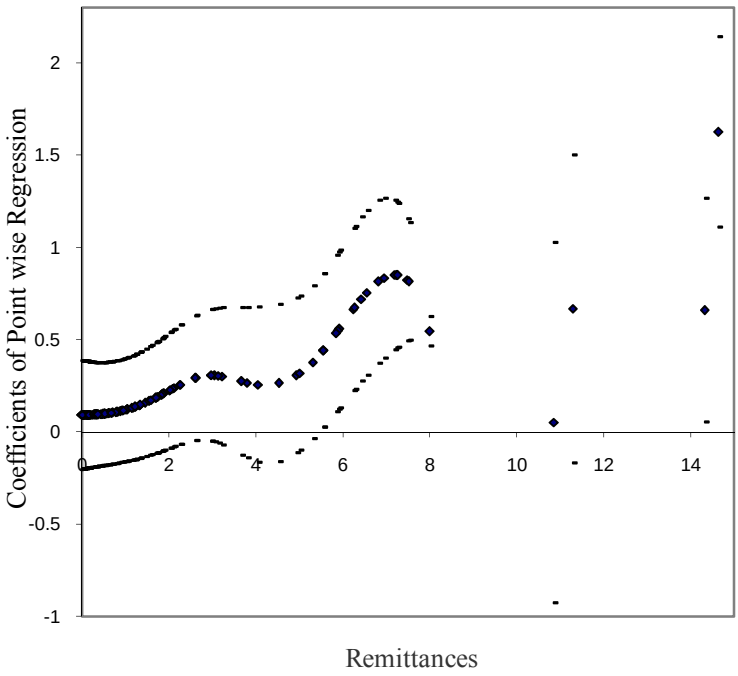
Appendix
Description of the Variables Included in the Estimation

Code	Note
REMIT	Remittances as a fraction of GDP.
GDPG	Per capita GDP growth.
INST	ICRGE (International Country Risk Guide) measure of the quality of government institutions that affect property rights or the ability to conduct business.
REMIT * INST	Interaction of remittances and institutions.
LGDP	Natural logarithm of GDP per capita for first year of period; constant 1985 U.S. dollars.
ETHNF	Ethnic fractionalization variable. Probability that two individuals will belong to different ethnic groups.
ASSAS	Assassinations per capita.
ETHASSAS	Interactions of ethnic fractionalization and assassinations.
M2	M2 as a share of GDP, lagged one period.
LATINO	Dummy for Latin American countries.
SSA	Dummy for Sub-Saharan countries.
EASIA	Dummy East Asian countries.
BB	Budget surplus.
INF	Natural logarithm of 1+inflation rate.
SACW	Sachs-Warner index, updated.
POLICY	This is a linear combination of BB, INF and SACW.

Note: Please refer to Easterly et al. (2004) for more details on data construction.

Figure 1
Remittances and Growth: A Non-linear Relationship



Note: The y-axis reports the point wise regression coefficients of a non-parametric regression of remittances on growth. A ♦ indicates the remittances coefficient, while the bands represent 95% confidence intervals.

Table 1
Remittances and Growth: Parametric and Semiparametric Main Results

	Parametric Results		**Semiparametric Results**			
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LGDP	-0.69 (0.45)	-4.21* (1.39)	-0.72 (0.48)	0.19 (0.35)	-0.71 (0.48)	0.41 (0.46)
ETHNIC	0.70 (0.91)		0.69 (0.91)		0.66 (0.92)	
ASSAS	-0.04 (0.32)	-0.30 (0.26)	-0.02 (0.33)	-0.36 (0.27)	-0.07 (0.34)	-0.26 (0.33)
ETHASSAS	-0.83 (0.94)	-0.03 (0.67)	-0.67 (0.94)	0.49 (0.54)	-0.69 (0.97)	0.69 (0.76)
M2	-0.02 (0.02)	-0.06* (0.03)	-0.03 (0.02)	-0.02 (0.02)	-0.03 (0.02)	0.002 (0.02)
SSA	-2.97*** (0.69)		-3.00*** (0.77)		-2.95*** (0.70)	
EASIA	1.55* (0.83)		1.46* (0.85)		1.62* (0.83)	
POLICY	0.64*** (0.13)	0.68*** (0.14)	0.71*** (0.13)	0.13* (0.06)	0.67*** (0.14)	0.81*** (0.16)
INST	0.69*** (0.15)	0.78*** (0.16)	0.76*** (0.16)	0.39** (0.19)	0.66*** (0.16)	0.47*** (0.17)
REMIT	**0.80*** **(0.23)**	**0.46**** **(0.22)**	**0.22** **(0.17)**	**0.04** **(0.06)**	**0.22** **(0.20)**	**-0.02** **(0.03)**
REMIT*INST	**-0.15*** **(0.054)**	**-0.09*** **(0.04)**	**-0.13** **(0.44)**	**-0.02** **(0.01)**	**-0.14*** **(0.05)**	**-0.14*** **(0.06)**
No. of Observations	144	144	144	144	144	144
R^2	0.27	0.36	0.34	0.29	0.41	0.31

Note: White heteroskedasticity consistent standard errors are in parenthesis. A *, **, *** indicate 10%, 5% and 1% significance level respectively. The Haussmann test favors fixed effect over random effects. (1) Pooled OLS, (2) Fixed effects, (3) Pooled semiparametric regression, (4) Fixed effects semiparametric regression, (5) Pooled semiparametric regression with lag remittances, (6) Fixed effects semiparametric regression with lag remittances.