

# Forthcoming: Applied Economics

## The influence of remittances on education and health outcomes: a cross-country study

Maria Cristina Zhunio  
Department of Economics  
Florida Atlantic University  
Boca Raton, FL 33431 USA

Sharmila Vishwasrao  
Department of Economics  
Florida Atlantic University  
Boca Raton, FL 33431 USA

and

Eric P. Chiang\*  
Department of Economics  
Florida Atlantic University  
Boca Raton, FL 33431 USA

**Abstract:** We study the effect of international remittances on aggregate educational and health outcomes using a sample of 69 low and middle-income countries. We find that remittances play an important role in improving primary and secondary school attainment, increasing life expectancy, and reducing infant mortality. Our results suggest that as migration laws continue to support greater emigration and remittances, policies should be enacted to facilitate the flow of remittances as they represent a significant source for economic development.

Key words: Remittances, Education, Health, Migration, Cross-Country

*JEL classification:* O11, O15, I10, I20

\*corresponding author: Eric P. Chiang, Ph.D.; Department of Economics, Florida Atlantic University; 777 Glades Road; Boca Raton, FL 33431. Tel: 1-561-297-2947. E-mail: [chiang@fau.edu](mailto:chiang@fau.edu).

## **I. Introduction**

It is estimated that over 200 million people in the world are currently living in a country in which they were not born, a number that is increasing each year (World Bank, 2008). While high-income economies are the most popular destinations, migration between developing economies accounts for nearly half the migrants from developing economies. The money these migrants send to their families and friends in their home country, known as remittances, has increased significantly over the past decade. In 2007, US \$251 billion flowed into developing countries in the form of international remittances, representing 5% of total GDP for low-income countries and 1.8% of total GDP for middle-income countries, a significant rise from approximately US \$116 billion in 2002 (Ratha, 2007). Figure 1 shows how remittances per capita have increased over the last 20 years. Since 1995, countries in Latin America have been the largest recipients of remittances.

<Figure 1 here>

Remittances represent the second largest source of foreign income for developing countries after foreign direct investment (World Bank, 2006). For most developing countries, remittances exceed the inflows of official foreign aid. In addition, they are considered a more stable source of money during financial crises (Ratha, 2007). Consequently, there has been an increased interest in remittances and their role in promoting economic development.

The United States continues to be the largest source of remittances, sending a total of US \$47.2 billion in 2008. India was the top recipient of remittance inflows in 2008, receiving US \$51.9 billion, while Tajikistan received the highest remittances as a percentage of GDP (45.5%). Table 1 shows the top 10 recipients of remittances in absolute terms and as a percentage of GDP.

<Table 1 here>

While data generally show the pattern of high-income countries representing remittance-sending countries and developing countries representing remittance-receiving countries, migration also occurs between developing countries. In fact, nearly half the migrants from developing countries migrate to other developing countries. The remittances from these South-South migrations make up between 30 and 45 percent of total remittances received by developing countries (World Bank, 2006).

Remittances affect households in a number of ways. By increasing the disposable income available for consumption and investment, they can increase a household's ability to pay for education and health and improve those outcomes. However migration also changes the composition of the household. This may have negative consequences if the departure of a family member impacts the educational attainment or ability to stay in school for the children.

Remittances can have both a direct and indirect effect on educational and health outcomes. At the individual level, remittances affect education and health directly if they are used to buy education and health inputs. Alternatively, the effect can be indirect if remittances help families buy better housing and clothing which may have a complementary effect on health and education. These effects can be translated into benefits to the community as a whole (Kanaipuni and Donato, 1999). For example, remittances can be used to build schools and hospitals as a private initiative (direct effect), or can be used to create businesses that create jobs and reduces the burden of the government to provide welfare which allows for greater investment in other projects that serve the whole population (indirect effect).

Despite the growing interest on this subject, the existing literature is still limited, and its link to development through other variables is uncertain. Theory suggests that remittances lead to higher incomes which facilitate development by way of increased consumption of goods related

to education and health. In general, these ideas have been mostly supported by empirical evidence on migrant-sending countries. Yet, most existing studies use surveys of households, and focus predominately on Latin American countries.

The purpose of this paper is to study the relationship between remittances and development indicators, specifically the effect of remittances on education and health at the aggregate country-level. This study examines whether countries exhibit an improvement in educational and health outcomes as they receive a higher level of remittances. We focus on education and health, two key indicators that measure economic development and are a component of the Human Development Index (HDI) and the Physical Quality of Life Index (PQLI). They also are crucial in the formation of human capital.

The rest of the paper is organized as follows. Section 2 reviews the existing literature on remittances and their effect on education and health. Section 3 presents the econometric model and the relationships that are expected among the variables, while Section 4 describes the data and their limitations. Section 5 summarizes the empirical results, and Section 6 concludes.

## **II. A Review of the Literature**

The literature on remittances focuses on two basic questions: how does migration influence the level of remittances (i.e., who remits, how much, and why), and how do remittances affect variables measuring economic development? This paper focuses on the latter question. Although a number of papers have studied the economic effect of remittances on the development of low-income nations, the literature is still evolving. While there is agreement in some areas such as poverty, other issues such as the effect of remittances on inequality and growth are still in debate.

Early studies on remittances in the 1970s had a pessimistic view of remittances, as it was believed that money sent by migrants was mainly used in consumption and not investment. Studies by Bohning (1975) and Rempel and Lobdell (1978), among others, supported this belief. However, this view has changed; more recent studies by Yang (2004) and Adams (2006) have found remittances to be a substantial source of investment spending, particularly in small microenterprises that form the entrepreneurial foundation of many developing countries (Woodruff and Zenteno, 2001). In a similar shift in views on inequality, studies have shown that remittances have contributed to a reduction in income inequality (Stark et al., 1986; 1988).

Economic growth and development are driven by investment in physical and human capital. Although remittances can be used to finance investments in both types of capital, this paper focuses on the effect of remittances on human capital in the source country. Recent studies by Rapoport and Docquier (2005) and Bertoli (2006) explain how remittances affect the long-term dynamics of human capital by alleviating liquidity constraints in recipient households, allowing them to invest in education. Both studies focus on developing countries, which is consistent with most household level studies (using survey data) on remittances that focus on Latin America (especially Mexico due to its proximity to the U.S.) and Asia. The general consensus is that remittances positively affect development measures such as education and health, though with varying results.

### *Remittances and education*

When analyzing the influence of remittances on education, two kinds of relationships emerge. The first describes education as a determinant of migration and remittances. In other words, a person's educational level influences their decision to migrate. In such cases, remittances are determined by the level of education of a previous generation. Studies that focus

on the ‘brain drain’ as well as the ‘brain gain’ have attracted a lot of interest. The second relationship between remittances and education refers to the idea that remittances affect the educational level of a future generation. This latter approach is adopted in this paper.

Although there are some mixed results in empirical studies of the influence of remittances on education, the majority finds that this source of income has a positive effect on the migrant-sending country. Edwards and Ureta (2003) applied the Cox proportional hazard model in a cross-section of 14,286 individuals aged 6 to 24 in El Salvador to conclude that, after controlling for gender, parental schooling, income, and access to basic services, remittances reduce the hazard of leaving school in both urban and rural areas. Moreover, the authors find that income from remittances has a significantly greater effect of reducing the hazard of leaving school than income from other sources, with urban areas having a larger impact relative to rural areas.

Related studies on Mexico emphasize the relationship between emigration and education, with the underlying assumption that emigration has a positive effect on schooling through remittances. In their study on educational inequality in rural Mexico, McKenzie and Rapoport (2006) found no correlation between emigration and school attendance. Their model estimated schooling completed based on whether the child lived in a household that had a migrant member, controlling for the level of education of the mother and a set of child-specific and state-level controls. Their results showed a negative relationship between emigration and educational inequality. However, the authors argued that this reduction in education inequality was the result of disincentives for individuals who are at the top of the education distribution to seek schooling over migration opportunities. Specifically, the study showed that males and children between the ages of 16 and 18 of highly educated mothers faced a stronger disincentive to go to school.

In contrast, a study by Hanson and Woodruff (2003) reports a better educational outcome for migrant households (a household with at least one member who has emigrated). Their study showed that girls who have mothers with less than 3 years of education and belong to a migrant household complete an extra 0.23 years of schooling. This finding coincides with a study by López-Córdova (2004), who found a positive correlation between remittances and education using a cross-section of Mexican municipalities. His study showed that an increase in the fraction of households that received remittances led to a decrease in illiteracy and an increase in school attendance for children between 6 and 14 years old.

### *Remittances and health*

Recent studies focusing on Mexico have generally found a positive effect of remittances on health. López-Córdova (2004) used a cross-section of all Mexican municipalities and showed a correlation between remittances and a reduction in infant mortality (after controlling for distance from the municipality to the U.S.-Mexican border along with typical demographic variables). This contrasts with an earlier study by Kanaiaupuni and Donato (1999) which presented evidence that Mexican communities with higher levels of emigration face higher rates of infant mortality, though higher remittances are associated with lower risks of mortality. Using a hierarchical linear model at the individual and community levels over time, the authors considered emigration as a cumulative process with varying health effects at different stages of its progression. The results showed that as emigration increased in a community, infant mortality increased as well. However, this effect was reversed as communities were exposed to emigration for longer periods of time. Communities with persistent emigration for at least 20 years and those that received at least US \$10,000 in annual remittances exhibited lower infant mortality rates.

Hildebrandt and McKenzie (2005) also found a positive effect of migration on the reduction in child mortality and an increase in birth weight. Using the Grossman model that treats the demand for health care as an investment and consumption good, the authors used survey data to determine that positive health outcomes are the result of an increase in 1) income, which allows households to consume more health-improving goods and medical care, and 2) health knowledge, which is transferred from migrants to household members and improves health practices. Lastly, a study by Duryea et al. (2005) found that remittances have a positive effect on infant survival through improvements in living conditions, while Frank and Hummer (2002) showed that membership in a migrant household reduces the risk of low birth weight.

### **III. Model and Methodology**

We are interested in analyzing the effect of remittances on specific education and health outcomes at the aggregate country level. We use a panel data approach using an unbalanced panel of developing countries. Our basic econometric specification is as follows:

$$\text{Outcome}_{it} = \alpha + \beta_r \text{REM}_{it} + \beta_x X_{it} + \Phi_i + T_t + \upsilon_i + \varepsilon_{it} \quad (1)$$

where  $\text{REM}_{it}$  represents the real flows of remittances per capita received by country  $i$  in year  $t$ ;  $X_{it}$  represents the characteristics of country  $i$  in year  $t$  such as GDP per capita, unemployment rate, outward migration rate, rural population, distance to nearest high-income country, and public expenditures on education and health;  $\Phi_i$  represents the regional dummies of America (North and South), Africa, and Asia/Oceania to control for geographic characteristics that are not controlled by other variables;  $T_t$  represents a time trend variable;  $\upsilon_i$  represents the country specific random error; and  $\varepsilon_{it}$  represents the standard error term.

One of the primary concerns regarding empirical studies of this sort is the potential endogeneity issue with respect to remittances. A common critique is that such studies capture correlations between remittances and education and health variables rather than revealing a causal relationship between increased remittances and improved education or health. To address this concern, we employ three econometric models to estimate equation (1) above. We start with a random effects generalized least squares estimation with an unbalanced data panel in order to maximize the use of available observations. This is because not all countries have complete data available for each of the variables for each year from 1987 to 2006, and hence the use of balanced panel data would leave out a considerable number of countries. We also use the random effects specification as it allows us to use time invariant country level explanatory variables.

However, a random effects model suffers from biased estimates when some explanatory variables are correlated with the country specific error term. This problem can be addressed by using a country level fixed effect, but that does not allow for the use of country level time invariant explanatory variables. Another ‘fix’ is to use the Hausman-Taylor random effects error components model<sup>1</sup> based on the instrumental variable approach which assumes that some of the explanatory variables are correlated with the country level error  $v_i$ . This allows us to address potential endogeneity issues between explanatory variables such as per capita income which could be correlated with both education and remittances resulting in biased estimates.

Lastly, we use an instrumental variables, two stage least squares model with our key variable, remittances, estimated using net outward migration rates, age dependency ratio, and dummies for colonial histories as instruments in the first stage estimation. This allows us to address issues of causality, namely whether increased remittances are indeed leading to

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<sup>1</sup> Estimation was performed using the `xthtaylor` model in Stata 11.

improvements in education and health parameters in these countries<sup>2</sup>. We would expect greater outward migration and higher dependency ratios to drive the flow of remittances (and other capital) into the country. Because these variables do not appear to be significantly related to health and education outcomes, they are useful instruments in the first stage estimation to predict remittance flows.

Our empirical model includes three educational indicators and three health indicators as dependent variables. For education, we use 1) Gross Primary Enrollment Ratio, 2) Gross Secondary Enrollment Ratio, and 3) Primary Completion Rate. All the measures are cohort specific for the appropriate age group. For health, we use 1) Life Expectancy at Birth, 2) Infant Mortality (number before age one), and 3) Fertility Rate (number of children per mother through child-bearing years). In general we chose to include age specific variables (as opposed to population literacy rates, for instance) as they are most likely to accurately reflect changes occurring over a short period of time.

For each of the dependent variables to be estimated, we include a common set of independent and control variables. These include 1) Official Real Flows of Remittances Per Capita, 2) Net Outward Migration, 3) Real GDP per capita (in 2000 \$US), 4) Unemployment Rate, 5) Rural Population, 6) Minimum Distance to a High-Income Country, and 7) Infant Mortality Rate (for the education estimates). Further, we include educational and health specific determinants for each respective variable, including 1) Public Education Expenditures (% of GDP), 2) Public Health Expenditures (% of GDP), and 3) Number of Physicians (per 1,000 population). For all estimations, we include the regional binary variables AMERICA (North and South America), AFRICA, and ASIAOCEAN (Asia and Oceania) to represent the countries

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<sup>2</sup> Estimation was performed using the xtivreg estimator in Stata 11 with the G2SLS model.

within each respective region, with Europe as the control region; further, we include an annual time variable to capture trends not explained with country-specific factors.

In general, since increased incomes and an increase in remittances are expected to improve educational and health outcomes, we expect the signs on real GDP per capita and real remittances per capita to be positive, and the signs on unemployment rate to be negative. We also expect the sign on rural population (which typically has limited access to educational or health inputs (e.g., potable water, sanitation, or health clinics) to be negative. Next, we do not have an *a priori* expectation on the effect of net outward migration, since higher levels of outward migration can worsen the ability of communities to fund educational or health facilities, while remittances resulting from outward migration might have the opposite effect. Dustmann and Mestres (2010) suggest the latter is true in their study on the effect of temporary versus permanent migration on remittances. Lastly, we expect each of the education-specific and health-specific determinants (expenditures and number of physicians) to exhibit positive signs in explaining the respective educational and health indicators.

Analyzing the effect of remittances on educational and health outcomes in more detail, one can argue that remittances help alleviate household income constraints that often force children to work at a younger age. Therefore, remittances would improve school enrollment and completion rates, especially at the secondary level when schooling is less likely to be compulsory. Further, remittances allow households to buy medicines, nutritious food, and health care that lead to higher life expectancies and lower infant mortality rates. A similar effect should be seen at the aggregate level since remittances also can finance the construction of hospitals and the costs of hiring (or educating) more doctors. Lastly, as work opportunities improve and as urbanization rises with economic development, we expect fertility rates to decrease.

Yet, there remains the possibility that as educational outcomes improve, skilled outmigration will increase and lead to greater remittances. Thus there remains some doubt as to whether a causal relationship between remittances and improved education (and health) exists. We address this issue using an instrumental variables approach. We expect the positive effects of remittances to persist, especially since there is a time lag between educational changes and the quality of migrants, while higher levels of remittances would be expected to affect school enrollments and health parameters much quicker.

#### **IV. Data**

The data for our empirical model include a total of 69 countries for 20 years from 1987 to 2006. For consistency, data for the educational and health dependent variables were obtained using the World Bank's *World Development Indicators*. Data on the real flows of official remittances (used in the calculation of the per capita remittance variable similar to Adams and Page, 2005) were obtained using the *Migration and Remittances Factbook 2008* from the World Bank. Regional and colony variables were obtained from the CIA's *World Factbook*, distance data were obtained from Rose (2004), and all remaining control variables were obtained from *World Development Indicators*. Table 2 shows the complete list of variables along with their definitions and summary statistics. The complete list of countries used in the analysis is shown in the Appendix.

<Table 2 here>

For educational indicators, we choose primary and secondary enrollment rates along with primary completion rates as dependent variables in order to capture the potential effects that remittances may have on families in the recipient country. For this reason, we do not include educational indicators such as the literacy rate, as such variables are typically measured only on

those over 15 years of age, and therefore would not capture the immediate effect of remittances on educational attainment (though the long-term impact may clearly be affected).

There are two main limitations with the data used in this study: underreporting of the actual level of remittances, and sporadic or missing data. First, some countries do not report remittances, while others do so in an inconsistent manner. For example, some countries report only workers' remittances or compensation of employees, while others report these variables along with migrant transfers. In addition, there is a significant amount of remittances that are transferred through informal channels (e.g., bringing the money themselves when they visit). While the reported official remittances may be underestimated by at least 50% (World Bank, 2006), they are effective in their comparative power across countries and regions.

The other limitation is sporadic or missing data with respect to three variables: net outward migration, infant mortality, and school enrollment. With respect to the first two variables, the data is reported in five year intervals. In our paper, to retain the maximum number of observations for the model, we annualize the data for these two variables by imputing each five year average into the prior and subsequent two years (i.e., data for 1990 are used for years 1988 to 1992 in the model). With respect to school enrollment, we include the primary completion rate, which has fewer missing observations, as a related dependent variable.

Despite these limitations, the results from the regressions remain robust from a descriptive and policy standpoint. The only consequence is that the marginal effects of remittances on health and educational outcomes may need to be interpreted with caution until improved data become available.

## V. Results

Summary statistics for each of the dependent and independent variables are provided in Table 2. Estimation results for each of the three educational and three health variables are provided in Tables 3 to 5. Table 3 presents the random effects GLS estimates, Table 4 presents the Hausman–Taylor estimates and Table 5 presents the estimates from the two stage least squares instrumental variables approach.

<Tables 3, 4, and 5 here>

The results mostly conform to expectations, though with varying level of significance. Comparing coefficients across the three models for the educational dependent variables, the key variable remittances was found to be most influential in explaining secondary school enrollment and to a lesser extent primary school completion. With respect to the health indicators, remittances were a strong determinant in life expectancy and infant mortality rates.

The results suggest remittances are more likely to have a greater effect on secondary education, when there is greater tendency for older children to leave school to work. This finding may reflect the fact that primary school enrollment in most countries is compulsory and less likely to be dictated by the usual variables. We expect that remittances are more likely to affect educational outcomes for older children where opportunity costs in terms of labor effort are higher. Further, our overall findings suggest that a higher level of remittances increases life expectancy and reduces infant mortality rates fertility.

One of the challenges working with data of this sort is the likely endogeneity inherent in the remittances variable. One sign providing such evidence is the strong correlation between remittances and infant mortality. For this reason, we focus on the results from the Hausman–Taylor estimates in Table 4 and IV estimates in Table 5. For the latter, first-stage estimates on

the instrumented variable (remittances) are provided in Table 6 for three key equations of interest: secondary enrollment, life expectancy, and infant mortality.

<Table 6 here>

A majority of estimates in the Hausman-Taylor and G2SLS models are consistent and reflect the underlying predictions, suggesting that the findings are fairly robust to the various specifications. For the Hausman-Taylor estimates in Table 4, values of  $\sigma_{\mu}$ ,  $\sigma_{\epsilon}$ , and  $\rho$  are reported to indicate the fraction of the total error variance that can be attributed to within country correlation. In our six equations, this fraction ranged from 82 to 98%. In the case of the instrumental variable estimates in Table 5, the Hausman test for endogeneity on the pooled data supports the endogeneity assumption in the case of primary completion rates, life expectancy, and fertility.

Besides the important role of remittances in explaining education and health outcomes, higher GDP per capita and smaller rural population led to improved educational outcomes at the secondary level. Further, the regional variables and time trend all confirm to expectations. Using the coefficients from the instrumental variables estimates in Table 5 to estimate some elasticities, we find that a 1% increase in real remittances per capita results in a 0.12% increase in the proportion of children enrolled in secondary school and an increase of 0.09% in the primary completion rate. These marginal effects from remittances are in fact stronger than for those traditionally expected to improve educational outcomes, namely public education expenditures. In our estimates, public education expenditures have a somewhat weaker effect on secondary enrollment and primary completion rates relative to remittances. These findings support the argument that the role of remittances in improving educational outcomes in recipient countries is important as a means for development.

Turning to health outcomes, the effect of remittances is positive and significant for life expectancy and negative and significant on infant mortality<sup>3</sup>, as expected. Using estimates from Table 5, we find that a 1% increase in real remittances per capita results in a 0.03% increase in life expectancy and a 0.15% reduction in infant mortality. Further, a greater rural population results in lower life expectancy, but the results are insignificant for infant mortality. Similar to our findings for educational outcomes, our results suggest that private spending through remittances is more effective than public spending on health outcomes. Increased remittances also have a role to play in reducing fertility, with a 1% increase in remittances per capita leading to a 0.09% reduction in the fertility rate. This may be due to a difference in the composition of the household after migration as well as a reduced demand for children as sources of labor or old age security. Thus, remittances play a very real and significant role in improving the health outcomes of countries that receive them, arguably surpassing the benefit from direct foreign aid.

## **VI. Conclusion**

Using a sample of 69 low and middle income countries, our analysis concludes that the results from household studies on the relationship between remittances and development outcomes such as education and health are robust at the aggregate level after controlling for economic and geographic differences and time trends. A higher level of real remittances per capita is correlated with higher secondary enrollment rates, primary completion rates, higher life expectancy, lower infant mortality, and lower fertility. These results help to confirm the important role that remittances play in the process of economic development, and should encourage governments to find ways to facilitate greater flows of remittances from their citizens residing abroad.

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<sup>3</sup> Results for under-five mortality rates were similar albeit with a larger coefficient.

Opportunities for future research depend largely on improvements in the quality of comparative aggregate data on remittances. Specifically, the ability to acquire accurate data on actual flows of remittances would be beneficial, as data on reported flows are subject to differences in how governments report such flows. Reducing the variations in the ratio of reported to actual remittances between countries will provide a stronger analysis into the role of remittances on economic development.

## References

- Adams, Richard H. (2006) Remittances and poverty in Ghana, World Bank Policy Research Working Paper No. 3838. Washington, DC: World Bank.
- Adams, Richard H., and John Page (2005) Do international migration and remittances reduce poverty in developing countries? *World Development*, **33**, 1645-1669.
- Bertoli, Simone (2006) Remittances and the dynamics of human capital in the recipient country, Working Paper, S. Cagnetti de Martiis, Department of Economics.
- Bohning, W. R. (1975) Some thoughts on emigration from the Mediterranean Basin, *International Labour Review*, **3**, 251-277.
- Duryea, Suzanne, Ernesto López-Córdova, and Alexandra Olmedo (2005) Migrant remittances and infant mortality: Evidence from Mexico, Mimeo. Washington DC: IADB.
- Dustmann, Christian, and Josep Mestres (2010) Remittances and temporary migration, *Journal of Development Economics*, **92**, 62-70.
- Edwards, Alejandra Cox, and Manuelita Ureta (2003) International migration, remittances and schooling: Evidence from El Salvador, *Journal of Development Economics*, **72**, 429-461.
- Frank, Reanne, and Robert A. Hummer (2002) The other side of the paradox: The risk of low birth weight among infants of migrant households within Mexico, *International Migration Review*, **36**, 746-765.
- Hanson, Gordon, and Christopher Woodruff (2003) *Emigration and Educational Attainment in Mexico*, Cambridge: National Bureau of Economic Research.
- Hildebrandt, Nicole, and David J. McKenzie (2005) The effects of migration on child health in Mexico, *Economia*, **6**, 257-289.

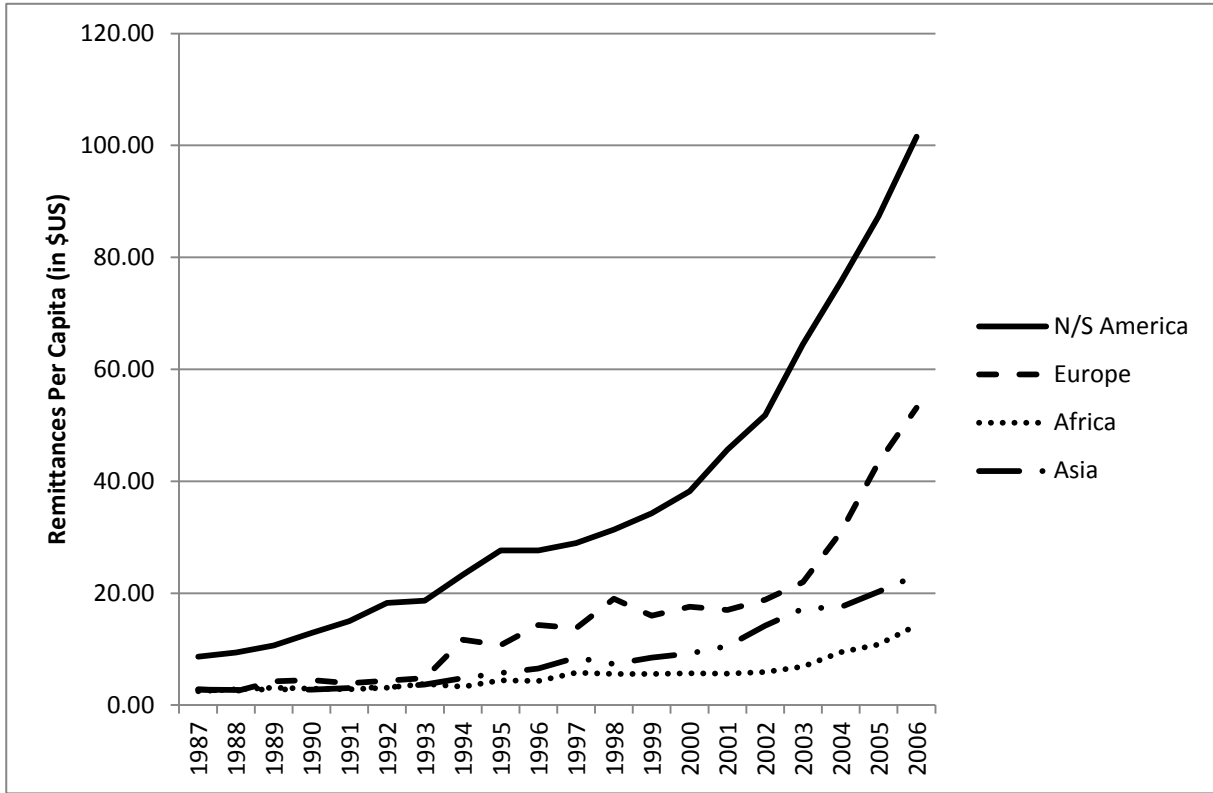
- Kanaiaupuni, Shawn Malia, and Katharine M. Donato (1999) Migradollars and mortality: The effects of migration on infant survival in Mexico, *Demography*, **36**, 339-352.
- López-Córdova, Ernesto (2004) Globalization, migration and development: The role of Mexican migrant remittances, INTAL-ITD, Working Paper 20, Washington DC: Inter-American Development Bank.
- McKenzie, David J., and Hillel Rapoport (2006) Migration and education inequality in rural Mexico, INTAL-ITD, Working Paper 23, Washington DC: Inter-American Development Bank.
- Rapoport, Hillel, and Frederic Docquier (2005) The economics of migrants' remittances, Discussion Paper Series IZA DP No. 1531, Bonn, Germany: IZA.
- Ratha, Dilip (2007) *Leveraging Remittances for Development*, Washington DC: Migration Policy Institute.
- Rempel, Henry, and Richard A. Lobdell (1978) The role of urban-rural remittances in rural development, *Journal of Development Studies*, **14**, 324-341.
- Rose, Andrew K. (2004) Do we really know that the WTO increases trade? *American Economic Review*, **94**, 98-114.
- Stark, Oded, Edward J. Taylor, and Shlomo Yitzhaki (1986) Remittances and inequality, *Economic Journal*, **96**, 722-740.
- Stark, Oded, Edward J. Taylor, and Shlomo Yitzhaki (1988) Migration, remittances and inequality: A sensitivity analysis using the extended Gini index, *Journal of Development Economics*, **28**, 309-322.
- Woodruff, Christopher, and Rene Zenteno (2001) Remittances and microenterprises in Mexico. Mimeo, University of California San Diego.

World Bank (2008), *Migration and Remittances Factbook 2008*, Washington DC: World Bank.

World Bank (2006), *Global Economic Prospects: Economic Implications of Remittances and Migration*, Washington DC: World Bank.

Yang, Dean (2004) International migration, human capital, and entrepreneurship: Evidence from Philippine migrants' exchange rate shocks, Policy Research Working Paper 3578, Washington DC: World Bank.

**Fig. 1. Per Capita Remittance Inflows by Region (1987 – 2006)**



**Table 1. Top 10 Remittance-Receiving Countries, 2008**

Ranked by Absolute Value			Ranked by Relative Value		
No.	Country	Remittances (\$US billions)	No.	Country	Remittances (% of GDP)
1	India	51.9	1	Tajikistan	45.5
2	China	40.6	2	Tonga	39.4
3	Mexico	26.3	3	Moldova	34.1
4	Philippines	18.6	4	Lesotho	27.7
5	France	15.1	5	Guyana	25.8
6	Spain	11.8	6	Lebanon	23.7
7	Germany	11.1	7	Samoa	22.8
8	Poland	10.7	8	Jordan	21.7
9	Nigeria	10.0	9	Honduras	21.5
10	Egypt	9.5	10	Kyrgyz Republic	19.1

*Source:* Migration and Remittances Factbook, Development Prospects Group, World Bank.

**Table 2. Descriptive statistics of the variables used**

<b>Variables</b>	<b>Definition</b>	<b>N</b>	<b>Mean (S.D.)</b>	<b>Min</b>	<b>Max</b>
<b>Dependent variables</b>					
Primary School Total	Gross enrollment ratio (total) of the corresponding age group	878	100.42 (19.06)	16.90	155.06
Secondary School Tot.	Gross enrollment ratio (total) of the corresponding age group	815	61.74 (28.26)	5.19	113.30
Primary Comp. Total	Percentage of total in relative age group completing primary school	1146	76.53 (26.23)	10.47	143.67
Life Expectancy Total	Number of years from birth if prevailing patterns of mortality remain constant	1139	65.02 (10.65)	23.68	81.78
Infant Mortality	Number of infants dying before reaching one year of age, per 1,000 live births	2142	54.29 (40.15)	4.00	191.00
Fertility Rate	Number of children born to a mother if she lives to the end of her childbearing years	1195	3.53 (1.72)	0.90	8.30
<b>Independent variables</b>					
Real Remittances	Per capita (in real US\$) current transfers by migrants employed for more than one year	1770	47.82 (75.88)	0.00	777.28
Net Out Migration	Net outward migration annualized from five year interval data (in thousands)	2248	22.13 (80.43)	-395.4	522.14
Public Educ. Spending	Total public spending on education as percentage of GDP	2124	1.13 (2.20)	0.00	13.35
Health Spending	Total health expenditure as percentage of GDP	2195	1.43 (2.61)	0.00	12.90
Physicians	Number of physicians per 1,000 people	2384	0.33 (0.75)	0.00	5.90
GDP per capita	PPP-adjusted in constant 2000 US\$	1983	7836.6 (8355.6)	459.6	59852.5
Unemployment Rate	By percentage of labor force in the source country	1890	4.27 (6.39)	0.00	39.30
Rural Population	Percentage of population	2384	50.65 (23.03)	0.00	94.78
Age Dependency Ratio	Ratio of dependents (age < 15 and > 65) to the working age population	2049	0.72 (0.19)	0.30	1.16
Distance to High Inc.	Minimum distance to the nearest high-income country	1857	7.64 (0.87)	4.13	9.26

**Regional variables**

America	= 1 if country is in N. or S. America	2484	0.28 (0.45)	0.00	1.00
Africa	= 1 if country is in Africa	2484	0.32 (0.46)	0.00	1.00
AsiaOcean	= 1 if country is in Asia or Oceania	2484	0.32 (0.46)	0.00	1.00

**Colony variables**

England_Colony	= 1 if country was ever colonized by England	2424	0.37 (0.48)	0.00	1.00
France_Colony	= 1 if country was ever colonized by France	2424	0.27 (0.44)	0.00	1.00
Spain_Colony	= 1 if country was ever colonized by Spain	2424	0.18 (0.38)	0.00	1.00

**Time variable**

Year	Year of Observation	2492		1987	2006
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**Table 3. Random Effects GLS estimates of the effects of remittances on education and health**

Dependent Variable	Educational Indicators			Health Indicators		
	Primary Enrollment (1)	Secondary Enrollment (2)	Primary Completion (3)	Life Expectancy (4)	Infant Mortality (5)	Fertility Rate (6)
Real Remittances Per Capita	0.183 (2.13)	2.392** (1.24)	2.424 (2.24)	1.622* (0.94)	-3.335 (2.32)	0.008 (0.06)
Net Outward Migration	-0.436 (1.01)	-0.500 (0.82)	1.682 (1.26)	-0.703*** (0.26)	-0.106 (0.39)	-0.011 (0.01)
Public Education Expenditures	0.332 (0.29)	0.214 (0.20)	0.377** (0.19)	---	---	---
Public Health Expenditures	---	---	---	-0.047 (0.03)	0.144 (0.09)	0.005 (0.01)
Physicians Per 1000 Population	---	---	---	0.007 (0.10)	-0.295 (0.28)	-0.044*** (0.01)
GDP Per Capita (constant 2000 \$)	-1.461*** (0.53)	1.409*** (0.50)	-0.213 (0.48)	-0.111 (0.33)	0.371 (1.05)	0.036 (0.02)
Unemployment Rate	-0.077 (0.06)	0.168*** (0.06)	0.023 (0.05)	0.011 (0.03)	-0.069 (0.07)	-0.006** (0.003)
Rural Population	-0.266* (0.15)	-0.381*** (0.09)	-0.283*** (0.10)	-0.157** (0.07)	0.295* (0.19)	0.016** (0.01)
Distance to High-Income Country	3.352 (2.62)	4.105** (1.89)	3.605* (1.95)	-0.262 (1.05)	-0.054 (4.25)	-0.055 (0.17)
Infant Mortality	-0.098 (0.09)	-0.138*** (0.05)	-0.317*** (0.08)	---	---	---
America	1.829 (10.00)	-12.353** (6.33)	-3.950 (6.11)	-2.960 (3.42)	21.673* (12.82)	1.000** (0.50)
Africa	-5.187 (9.04)	-27.707*** (7.59)	-12.707* (6.85)	-14.309*** (3.75)	53.252*** (12.57)	2.433*** (0.62)
AsiaOcean	0.109 (6.23)	-15.968*** (4.45)	-0.930 (4.59)	-4.231* (2.63)	20.735** (9.31)	1.055** (0.45)
Year	0.779*** (0.22)	1.005*** (0.13)	0.454*** (0.16)	0.125* (0.07)	-0.978*** (0.22)	-0.066*** (0.01)
Constant	-1453.98*** (428.37)	-1948.43*** (268.75)	-819.90*** (312.20)	-169.31 (130.98)	1963.77*** (440.04)	133.077*** (11.85)
Observations	495	465	656	1081	1085	554
Groups	69	69	69	69	69	69
R-squared	0.1709	0.7679	0.7578	0.6439	0.5203	0.5360

Notes: Standard errors in parentheses. Significance of coefficients at the 10%, 5%, and 1% levels are shown by \*, \*\*, and \*\*\*, respectively.

**Table 4. Hausman-Taylor estimates of the effects of remittances on education and health**

Dependent Variable	Educational Indicators			Health Indicators		
	Primary Enrollment (1)	Secondary Enrollment (2)	Primary Completion (3)	Life Expectancy (4)	Infant Mortality (5)	Fertility Rate (6)
<b>Endogenous Variables</b>						
Real Remittances Per Capita	0.413 (1.16)	2.352*** (0.86)	2.931*** (0.89)	1.556*** (0.24)	-3.120*** (0.78)	0.010 (0.03)
Net Outward Migration	-0.299 (0.89)	-0.789 (0.68)	1.714*** (0.65)	-0.715*** (0.11)	-0.031 (0.34)	-0.006 (0.02)
GDP Per Capita (constant 2000 \$)	-2.356*** (0.61)	1.300*** (0.46)	-0.425 (0.44)	-0.348*** (0.11)	1.588*** (0.37)	0.079*** (0.01)
<b>Exogenous Variables</b>						
<i>Time Varying</i>						
Public Education Expenditures	0.361** (0.17)	0.210* (0.13)	0.380*** (0.12)	---	---	---
Public Health Expenditures	---	---	---	-0.048* (0.03)	0.157* (0.09)	0.005 (0.003)
Physicians Per 1000 Population	---	---	---	-0.032 (0.12)	-0.111 (0.40)	-0.039*** (0.01)
Unemployment Rate	-0.094 (0.07)	0.156*** (0.05)	0.023 (0.05)	0.005 (0.01)	-0.045 (0.04)	-0.005*** (0.02)
Rural Population	-0.362*** (0.12)	-0.350*** (0.10)	-0.338*** (0.09)	-0.144*** (0.03)	-0.029 (0.11)	0.010** (0.004)
Infant Mortality	0.056 (0.05)	-0.087** (0.04)	-0.277*** (0.04)	---	---	0.002** (0.001)
Year	0.864*** (0.11)	1.082*** (0.09)	0.469*** (0.08)	0.154*** (0.02)	-1.241*** (0.08)	-0.076*** (0.003)
<i>Time Invariant</i>						
Distance to High-Income Country	2.376 (3.21)	3.834 (3.15)	4.392* (2.54)	-0.539 (1.20)	2.729 (6.01)	0.101 (0.25)
America	2.313 (13.98)	-13.433 (13.74)	-3.641 (10.94)	-3.203 (5.44)	20.748 (27.44)	1.036 (1.10)
Africa	-9.134 (14.01)	-31.506** (13.59)	-17.283* (10.94)	-15.296*** (5.34)	57.254** (26.94)	2.564** (1.08)
AsiaOcean	-0.252 (12.30)	-17.706 (12.04)	-1.033 (9.64)	-4.955 (4.85)	23.156 (24.48)	1.127 (0.98)
Constant	-1607.47*** (223.32)	-2102.50*** (175.37)	-851.80*** (159.76)	223.09*** (46.71)	2477.37*** (164.59)	153.18*** (6.99)
Observations	495	465	656	1081	1085	554
Groups	69	69	69	69	69	69
Sigma_μ	16.985	17.134	13.378	6.844	34.631	1.387
Sigma_ε	6.602	4.891	6.307	2.067	6.673	0.192
Rho	0.869	0.925	0.818	0.916	0.964	0.981

Notes: Standard errors in parentheses. Significance of coefficients at the 10%, 5%, and 1% levels are shown by \*, \*\*, and \*\*\*, respectively.

**Table 5. 2SLS estimates of the effects of remittances (instrumented) on education and health**

Dependent Variable	Educational Indicators			Health Indicators		
	Primary Enrollment (1)	Secondary Enrollment (2)	Primary Completion (3)	Life Expectancy (4)	Infant Mortality (5)	Fertility Rate (6)
<b>Instrumented Variable</b>						
Real Remittances Per Capita	14.057 (11.00)	16.217* (10.75)	-4.731 (11.73)	8.156** (3.32)	-42.785*** (11.89)	-1.122* (0.66)
<b>Independent Variables</b>						
GDP Per Capita (constant 2000 \$)	-0.759* (0.45)	1.814*** (0.47)	-0.035 (0.32)	0.229* (0.13)	-1.970*** (0.44)	-0.030 (0.02)
Public Education Expenditures	0.281 (0.24)	0.237 (0.20)	0.319** (0.16)	---	---	---
Public Health Expenditures	---	---	---	-0.086* (0.05)	0.373* (0.23)	0.005 (0.01)
Physicians Per 1000 Population	---	---	---	0.317 (0.24)	-1.883* (1.05)	-0.118** (0.05)
Unemployment Rate	-0.018 (0.10)	0.231*** (0.08)	0.021 (0.09)	0.046* (0.02)	-0.313*** (0.10)	-0.014** (0.006)
Rural Population	-0.140* (0.08)	-0.325*** (0.09)	-0.183*** (0.07)	-0.092** (0.04)	0.164* (0.10)	0.005 (0.01)
Infant Mortality	-0.007 (0.11)	-0.002 (0.11)	-0.427*** (0.12)	---	---	0.004 (0.005)
Distance to High-Income Country	4.980* (2.88)	9.716*** (3.23)	5.720** (2.48)	0.638 (0.81)	-8.273*** (2.34)	-0.324** (0.16)
Year	0.537** (0.25)	0.749*** (0.24)	0.579*** (0.22)	-0.001 (0.05)	-0.113 (0.19)	-0.046*** (0.008)
Constant	-1002.59** (484.33)	-1484.81*** (452.17)	-1078.56*** (419.74)	66.386 (98.27)	334.84 (375.47)	96.963*** (16.01)
Observations	428	401	561	915	919	465
Groups	66	66	67	68	69	68
Wald Chi2	85.31	490.29	470.14	282.68	414.57	382.83

Notes: Standard errors in parentheses. Significance of coefficients at the 10%, 5%, and 1% levels are shown by \*, \*\*, and \*\*\*, respectively. Regional variable coefficients not reported in second stage results.

**Table 6. First stage instrument variable estimates on remittances (select equations)**

Dependent Variable	Remittances (Secondary Enrollment)	Remittances (Life Expectancy)	Remittances (Infant Mortality)
<b>Instruments</b>			
GDP Per Capita (constant 2000 \$)	-0.022 (0.02)	-0.019 (0.01)	-0.002 (0.01)
Net Outward Migration	-0.018 (0.04)	-0.011 (0.02)	-0.006 (0.02)
Public Education Expenditures	-0.011 (0.01)	---	---
Public Health Expenditures	---	0.005 (0.01)	0.005 (0.004)
Physicians Per 1000 Population	---	-0.054*** (0.02)	-0.046** (0.02)
Unemployment Rate	-0.005* (0.003)	-0.005** (0.002)	-0.002 (0.002)
Rural Population	-0.001 (0.005)	-0.009*** (0.003)	-0.006*** (0.002)
Infant Mortality	-0.009*** (0.002)	---	---
Age Dependency Ratio	-0.140 (0.53)	-0.445* (0.28)	-0.326 (0.24)
Distance to High-Income Country	-0.179 (0.14)	-0.144* (0.08)	-0.144*** (0.05)
Year	0.018*** (0.006)	0.008** (0.003)	0.007** (0.003)
America	-0.004 (0.59)	-0.123 (0.35)	-0.070 (0.21)
Africa	0.207 (0.59)	-0.070 (0.35)	-0.056 (0.22)
AsiaOcean	-0.124 (0.50)	-0.170 (0.31)	-0.139 (0.19)
England_Colony	0.277 (0.23)	0.304** (0.14)	0.270*** (0.08)
France_Colony	0.118 (0.27)	-0.016 (0.17)	-0.013 (0.10)
Spain_Colony	0.166 (0.36)	0.032 (0.21)	0.024 (0.12)
Other_Colony	0.055 (0.27)	-0.048 (0.17)	-0.048 (0.10)
Constant	-34.05** (13.93)	-14.003* (7.90)	-13.481* (7.56)
Observations	401	915	919

Notes: Standard errors in parentheses. Significance of coefficients at the 10%, 5%, and 1% levels are shown by \*, \*\*, and \*\*\*, respectively.

## Appendix

Middle and low income countries used in regression analysis by region

### Africa

Algeria	Kenya	Nigeria
Botswana	Lesotho	Rwanda
Burkina Faso	Madagascar	South Africa
Cameroon	Malawi	Swaziland
Egypt	Mali	Tanzania
Ethiopia	Mauritius	Tunisia
Gabon	Morocco	Uganda
Guinea		

### Americas

Argentina	Ecuador	Nicaragua
Belize	El Salvador	Panama
Bolivia	Guatemala	Paraguay
Brazil	Guyana	Peru
Chile	Haiti	St. Lucia
Colombia	Honduras	Suriname
Costa Rica	Jamaica	Trinidad and Tobago
Dominican Republic	Mexico	Uruguay

### Asia/Ocean

Bangladesh	Israel	Pakistan
Cambodia	Jordan	Papua New Guinea
China	Laos	Philippines
Fiji	Malaysia	Sri Lanka
India	Mongolia	Syria
Indonesia	Nepal	Thailand
Iran		

### Europe

Albania	Cyprus	Hungary
Bulgaria		