DISCUSSION PAPER SERIES

IZA DP No. 3393

Remittances and the Brain Drain: Skilled Migrants Do Remit Less

Yoko Niimi
Caglar Ozden
Maurice Schiff

March 2008

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

Remittances and the Brain Drain: Skilled Migrants Do Remit Less

Yoko Niimi
World Bank

Caglar Ozden
World Bank

Maurice Schiff
World Bank and IZA

Discussion Paper No. 3393
March 2008

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

IZA Discussion Paper No. 3393
March 2008

ABSTRACT

Remittances and the Brain Drain: Skilled Migrants Do Remit Less*

It has been argued that the brain drain's negative impact may be offset by the higher remittance levels skilled migrants send home. This paper examines whether remittances actually increase with migrants' education level. The determinants of remittances it considers include migration levels or rates, migrants' education level, and source countries' income, financial sector development and expected growth rate. The estimation takes potential endogeneity into account, an issue not considered in the few studies on this topic. Our main finding is that remittances *decrease* with the share of migrants with tertiary education. This provides an additional reason for which source countries would prefer unskilled to skilled labor migration. Moreover, as predicted by our model, remittances increase with source countries' level and rate of migration, financial sector development and population, and decrease with these countries' income and expected growth rate.

JEL Classification: F22, F24, J61, O15, O16

Keywords: migration, remittances, education level, brain drain

Corresponding author:

Maurice Schiff
DECRG (MC3-303)
World Bank
1818 H Street NW
Washington, DC 20433
USA
E-mail: mschiff@worldbank.org

* The views expressed in this paper are those of the authors and do not necessary represent those of the World Bank, its Board of Executive Directors or the governments they represent.

1. Introduction

Recent years have witnessed a dramatic increase in migrant remittances to developing countries. Officially recorded remittances – measured as the sum of workers' remittances, compensation of employees and migrant transfers – are estimated to have increased from US$58 billion in 1995 to US$167 billion in 2005, with recent estimates putting their level at over $200 billion. This growth rate has outpaced that of private capital flows and official development assistance over the last decade, making remittances the second largest source of external funding for developing countries after foreign direct investment (World Bank, 2005).

The recent increase in formal remittance flows can be explained by the increase in the number and income of migrants, the greater number of remittance providers, wider networks in the global financial services industry, and government policies that improve financial market access, all of which have reduced remittance costs and promoted the use of official remittance channels (Freund and Spatafora, 2005; World Bank, 2005). Whatever the reasons behind this surge, the growing importance of remittances as a source of foreign exchange and their contribution to economic development have attracted increasing attention from policy-makers and academics alike.

One of the issues much discussed in recent years is the impact of migrants' education level on remittance flows. It has been argued in the migration and remittance literature that the negative impact of the brain drain can be offset by the remittances skilled migrants send to their family back home (e.g. Ratha, 2003).[1] Though it is clear that skilled migrants send remittances back home, the question remains as to whether they remit more or less than unskilled migrants. A necessary – though not sufficient – condition for skilled migrants to generate a smaller loss for their home country than unskilled ones is for skilled migrants to remit more than the unskilled

[1] Another argument is that source countries benefit from skilled migrants' contribution to technology transfer to the home country (Burns and Mohapatra, 2008)). On the other hand, Schiff and Wang (2008) show that the brain drain reduces technology absorption and productivity growth in source countries.

ones. To date, however, empirical studies have been unable to establish – at acceptable statistical significance levels – whether remittances increase with migrants' education level or not..

This paper makes several contributions to the literature on remittances and migrants' education by i) presenting a richer model than in previous studies and deriving additional testable hypotheses, ii) showing for the first time (as far as we know) that remittances decrease with migrants' level of education; iii) providing a richer empirical analysis, enabling us to estimate the relationship between remittances and other variables of interest, such as home countries' expected economic growth and their level of financial development; and iv) accounting for the endogeneity of migration and migrants' education level, something previous studies have abstracted from.

The rest of the paper is structured as follows. Section 2 provides a selective review of the existing work on the determinants of remittances. Section 3 introduces a model of the relationship between the brain drain and remittance flows, and derives testable implications from it. Section 4 examines some of the major variables of interest, while Section 5 specifies the econometric model. Section 6 provides a brief description of the data and Section 7 presents the estimation results. Section 8 concludes.

2. Literature on Determinants of Remittances

The existing literature on the determinants of remittances is largely based on micro-econometric analyses. Many of the studies examine migrants' motives to remit, namely altruism and self-interest. Altruism would imply a negative relationship between recipients' income and remittances sent home, as found in McGarry and Shoeni (1995) for the US and Aggarwal and Horowitz (2002) for Guyana, while self-interest might imply a positive relationship.

Similarly, migrants' altruism would imply a negative relationship between remittances and recipients' expected income growth, while self-interest might imply a positive relationship.

The relationship is examined both theoretically and empirically with respect to both actual income and expected income growth. The latter has not been studied before.[2]

Though the literature has focused on microeconomic determinants, a number of country studies have examined the relationship between remittance flows and macroeconomic variables (e.g., Straubhaar, 1986; El-Sakka and McNabb, 1999; Chami, et al. 2003; Freund and Spatafora, 2005; Gupta, 2005). Nonetheless, the empirical evidence regarding the remittance impact of key variables is inconclusive. For instance, using Turkish data, Straubhaar (1986) finds that remittance flows are not affected by changes in exchange rates or in the real rate of return on investment. Gupta (2005) obtains the same results for India but also shows that economic activity in host countries are important determinants of remittances. In contrast, El-Sakka and McNabb (1999) find that exchange rate and interest rate differentials are important in attracting remittances to Egypt.

This paper focuses on migrants' education level, another potentially important determinant of remittances. Skilled migrants tend to earn more than unskilled ones and can thus afford to send more remittances to their families back home. On the other hand, they often come from better-off families whose demand for remittances may be lower than that of poorer ones. Moreover, their greater ability to bring over their family members, and do so more rapidly, also reduces their incentive to remit. Which of these effects dominates is ambiguous a priori.

Given that developed countries' immigration policies increasingly favor skilled migrants, whether they remit more or less than unskilled migrants has important policy implications for migrants' home countries. Unfortunately, the findings obtained are inconclusive. Faini (2007) obtains a negative non-significant impact of migrants' education on remittances,[3] Naufal (2007)

[2] In fact, Rapoport and Docquier (2006) show that altruism and self-interest share many common predictions. They review a set of empirical studies and find that a mixture of self-interested and altruistic motives explains the likelihood and size of remittances.

[3] Moreover, endogeneity of migration and migrants' education level is not taken into account in Faini's analysis, and the education variable used is not necessarily positively related to migrants' education level.

obtains a positive non-significant impact, and Rodriguez and Horton (1994) find no impact for the Philippines.

Another factor that may affect formal remittance flows is home countries' financial sector development. Few studies have looked at this issue. An exception is Freund and Spatafora (2005). They show, first, that home countries' financial development has a significantly positive impact on formal remittance flows, mainly because it reduces the cost of sending remittances through formal channels, and second, that the increase in formal remittances is essentially due to the reduction in informal remittances associated with the decline in formal remitting costs rather than to an increase in the total amount of remittances.

The following section introduces a model in order to examine the issues described above.

3. Model

The model presented in this section simplifies Faini's (2007) model by reducing the number of categories of family members,[4] and extends it by ii) incorporating an analysis of the impact on remittances of source country income, financial development, expected economic growth, and population size.

Migrants enjoy their own consumption as well as that of their family members, and enjoy the latter's presence. Migrants' utility function *U* is:

$$U = u(c_M) + W(Lf_N) + L\left[f_N V(c_N) + (1 - f_N) V(c_S)\right], \qquad (1)$$

where *U* is increasing at a decreasing rate in all its arguments, $0 \leq f_N \leq 1$ is the share of the family migrants bring to the host country in period 1; *L* is family size (exclusive of migrants); c_i is individual consumption in family group i (*i* is equal to migrants (*M*), family members in the

host country (*N*) and in the home country (*S*); and $u(c_M)$, $W(Lf_N)$, $V(c_N)$ and $V(c_S)$ are, respectively, the utility migrants derive from their own consumption, from the presence of family members, and from the consumption by family members in the host and the home countries. Separability is assumed for simplicity and clarity of exposition but has no impact on the qualitative results.

Migrants maximize *U* subject to three budget constraints:

$$c_M = y_M - L[f_N(t+\theta) + (1-f_N)r], c_N = y_N + t, c_S = y_S + r, \quad (2)$$

where y_i is individual income in group *i*, *t* (*r*) = transfer (remittances) per family member in the host (home) country, θ = cost of bringing a family member over, total transfers $T = Lf_N t$ and total remittances $R = L(1-f_N)r$.

Assuming an internal solution, the optimum is given by:

$$u'(c_M^*) = V'(c_N^*) = V'(c_S^*) = \frac{W'(Lf_N^*)}{t^* + \theta - r^*} > 0, \ r^* < t^* + \theta, \ ^{5\,6} \quad (3)$$

---

[4] The reason is that all testable hypotheses can be derived without the "distant family members" category.

[5] Note that if $r^* > t^* + \theta$, $f_N^* = 1$ and $R^* = 0$ because bringing family members over and giving them transfers is cheaper than sending them remittances, and their presence raises migrants' utility. If $r^* < t^* + \theta$ but $W'(Lf_N^*)/(t^* + \theta - r^*) < u'(c_M^*) = V'(c_N^*) = V'(c_S^*)$ for existing values of y_M, y_N, y_S and θ, no family member migrates ($f_N^* = 0$). Then, changes in migrants' education, family members' income in the home country, or financial development either have no impact or, if they do, the impact is qualitatively the same as under the internal equilibrium.

[6] Faini's (2007) solution is different from equation (3) in that $W'(Lf_N^*)$ is divided by θ rather than $t^* + \theta - r^*$. The reason is that the cost migrants consider in determining f_N^* is assumed to be the real resource cost θ of bringing family members over. However, the cost migrants are concerned with is the economic or opportunity cost $t^* + \theta - r^*$, i.e., the real resource cost θ plus the difference between the transfers migrants make to each family member in the host and in the home country $(t^* - r^*)$.

where asterisks denotes optimum values.

Since $V'(c_N^*) = V'(c_S^*)$, $c_N^* = c_S^*$. Under the plausible assumption that $y_N > y_S$, $t^* = c_N^* - y_N < r^* = c_s^* - y_s$, so that $t^* < r^* < t^* + \theta$.

We now turn to the analysis of migrants' education level (Section 3.2), current and expected future income of family members in the home country (Section 3.3), and home country financial development (Section 3.4).

3.1. Migrants' Education Level

Migrants' income y_M tends to increase with their education level E_M. Equation (3) implies that the increase in y_M is spent on migrants' and family members' consumption c_M, c_N, c_S, and on increasing the share f_N of family members brought to the host country. This means that the increase in migrants' education has two opposite effects on remittances. Since part of the increase in income is spent on c_S, per capita remittances r^* increase. On the other hand, the number of remittance recipients $(1 - f_N^*)L$ falls, implying that the sign of $dR^* / dE_M = d\left[L(1 - f_N^*)r^*\right] / dE_M$ is ambiguous.[7] Finally, it can be shown that the sign of dR^* / dE_M is also ambiguous if E_N and E_S are positively correlated with E_M.

3.2. Source Country Family Members' Income

In this section, we examine the impact on the optimum level of remittances R^* of an increase in y_S, the individual income of family members in the home country. Assuming

---

[7] The functional form of *u*, *V* and *W* must be specified in order to determine the sign of dR^* / dE_M.

remittances remain constant initially, we have $dc_S = dy_S > 0$ and $V'(c_S) < V'(c_N) = u'(c_M)$. In order to restore the equality in equation (3), $V'(c_S)$ must increase, i.e., the optimum increase in c_S^* is smaller than the change in y_S, which implies that r^* falls. Second, the reduction in r^* means that spending on c_M^*, c_N^* and f_N^* increases. Since both r^* and (1 - f_N^*) decline, so does $R^* = L(1 - f_N^*)r^*$.

Thus, remittances are negatively related to family members' income in the home country.

3.3. Financial Sector Development in the Source Country

Sections 3.2 and 3.3 assumed zero remittance (transactions) costs, in which case markets for informal remittance channels would not exist. This section assumes positive remittance costs in source countries. It first examines the impact of a change in remitting costs in the absence of parallel remittance channels and then in the presence of such channels.

A positive remittance cost ϕ changes the budget constraint for home-country family members from $c_S^* = y_S + r$ to $c_S^* = y_S + r(1-\phi)$, $0 \le \phi < 1 \le$, and changes the optimum to:

$$u'(c_M^*) = V'(c_N^*) = (1-\phi)V'(c_S^*) = \frac{W'(Lf_N^*)}{t^* + \theta - r^*} > 0,^{8} \qquad (4)$$

A decrease in ϕ implies that $u'(c_M^*) = V'(c_N^*) < (1-\phi)V'(c_S^*)$, i.e., migrants' marginal utility from sending remittances increases and $V'(c_S^*)$ must fall in order to restore the equality. Thus, c_S^* increases. From the budget constraint, if r^* is constant, $dc_S^* = -r^* d\phi$. However,

[8] As one would expect, $V'(c_S)$ is higher – i.e., consumption is lower – in the presence of remitting costs than in their absence.

unless the function V' is specified, it is not possible to know whether dc_S^* is greater or smaller than $-r^* d\phi$, i.e., whether dr^* is positive or negative.

This result can be explained by the fact that a decline in ϕ leads to opposing income and substitution effects on r^*. On the one hand, migrants' budget constraint is relaxed and they can now spend more on c_M, c_N and f_N, leading to a decrease in r^*. On the other hand, the reduction in ϕ means that an increase in remittances leads to a larger increase in c_S^* and thus to a higher marginal utility for migrants, thereby providing an incentive to increase r^*. Consequently, the net effect on r^* is ambiguous.

3.3.1. Informal Remittance Channels

We now add informal remittance channels to the analysis, with costs such that both formal and informal remittance channels coexist. An increase in the level of financial development in the source country – including the degree of competition for, and size of networks of, financial services are provided – reduces remittance costs (Freund and Spatafora, 2005).[9]

The level of remittances *r* per family member in the home country is $r = r_F + r_I$, where r_F (r_I) are the formal (informal) remittance levels. As is implicitly assumed in the debate on ways to reduce formal remitting costs, Freund and Spatafora (2005) find that formal and informal remittance channels are substitutes, with informal remittances $r_I = r_I(\phi), dr_I / d\phi > 0$. The data used in the empirical analysis consist of formal or officially recorded remittances r_F. Since $\frac{dr_F}{d\phi} = \frac{dr}{d\phi} - \frac{dr_I}{d\phi}$ and $\frac{dr_I}{d\phi} < 0$, it follows that the change in r_F^* associated with a decrease in ϕ

[9] These include the explicit fees charged by these institutions, the exchange rate premium they obtain in the conversion of foreign currency remittances into local currency, and the time and other costs incurred by having to go to a different location to obtain the remittances.

is larger and more likely to be positive than the change in r^*. Thus, it is not entirely surprising that Freund and Spatafora (2005) find in their empirical study of informal remittances that "… the cost of sending remittances primarily affects the channel by which money is sent home and not the amount" (p. 9).

From our analysis and Freund and Spatafora's findings, we conclude that formal remittances increase with the level of financial development.

3.4. Increase in Population

With an increase in family size *L*, c_M falls and $L\left[f_N c_N + (1-f_N)c_S\right]$. In other words, migrants spend more on their family. With the decline in c_M, $u'(c_M)$ increases, and thus – by equation (3) – so do $V'(c_N) = V'(c_S)$, i.e., $c_N = c_S$ decline as well. Since y_S and y_N are unchanged, t^* and r^* fall, and since $dc_N^* = dc_S^*$, $dt^* = dr^*$. Thus, $t^* + \theta - r^*$ remains unchanged. With the increase in *L*, $W'(Lf_N)/(t+\theta-r)$. Since $t^* + \theta - r^*$ f_N^* is unchanged and $u'(c_M)$ increases, W' must increase. Thus, Lf_N^*, and thus f_N^*, must fall.

Since total spending on family members increases and the share of family members in the home country, $1-f_N^*$, increases, it would seem that remittances R^* increase as well. The only case where R^* might not increase is if r^* falls proportionately more than t^*, in which case it might be possible for a larger share of expenditures to be spent on family members in the host country (though only if r^* falls sufficiently so that $(1-f_N^*)r^*$ falls). Since $c_N^* = c_S^*$ and $y_N > y_S$, $t^* < r^*$. Moreover, since $dc_N^* = dc_S^*$, $dt^* = dr^*$. Thus, t^* falls proportionately more than r^*. Consequently, a larger share of total expenditures on family members is spent in the home country, and since total expenditures increase, R^* increases.

In conclusion, an increase in home country population results in a decrease in per capita remittances r^* and in an increase in total remittances R^*.

3.5. Expected Economic Growth

Assume now that individuals are risk neutral and live for two periods, with all decisions made in period 1. Thus, individuals migrate, bring family members to the host country, give them transfers and send remittances to those staying in their home country in period 1. For simplicity, the interest rate and migrants' subjective discount rate are assumed equal to zero, though all qualitative results also hold as well under positive values for these two rates.

Migrants' utility function is given by:

$$U = u\left(c_M, c_M^e\right) + W\left(Lf_N\right) + L\left[f_N V(c_N, c_N^e) + \left(1 - f_N\right)V(c_S, c_S^e)\right], \tag{5}$$

with $c_i(y_i)$ = consumption (income) in period 1, and $c^e_i(y^e_i)$ = expected consumption (income) in period 2 ($i = M, N, S$). The budget constraints are:

$$C_M = Y_M - L\left[f_N\left(t + \theta\right) + \left(1 - f_N\right)r\right], C_N = Y_N + t, C_S = Y_S + r\,, \tag{6}$$

where $C_i \equiv c_i + c_i^e, Y_i \equiv y_i + y_i^e$ are the (present value of) lifetime consumption and income, respectively (where period 2 values are expected ones).

For simplicity, and without impact on the qualitative results, u and V are assumed to be symmetric in their arguments, so that $c_i^* = c_i^{e*}$. The optimum is given by:

$$u'\left(c_M^*\right) = V'\left(c_N^*\right) = V'\left(c_S^*\right) = u'\left(c_M^{e*}\right) = V'\left(c_N^{e*}\right) = V'\left(c_S^{e*}\right) = \frac{W'(Lf_N^*)}{t^* + \theta - r^*} \tag{7}$$

What is the impact of an increase in y_S^e? For a given r^*, $d(c_S + c_S^e) = dy_S^e > 0$ and $V'(c_S) = V'(c_S^e)$ fall. In order to restore equality in equation (7), $V'(c_S) = V'(c_S^e)$ must increase, i.e, $c_S = c_S^e$ must fall. Thus, $d(c_S^* + c_S^{e*}) < dy_S^{e*}$, implying that r^* falls. The reduction in r^* means that spending on $c_M^* = c_M^{e*}$, $c_N^* = c_N^{e*}$ and f_N^* increases. Since both r^* and (1 - f_N^*) decline, so does $R^* = L(1 - f_N^*)r^*$.

Thus, both an increase in current income y_S (see Section 3.2) and an increase in expected income y_S^e have a negative impact on remittances.

3.6. Testable Implications

The model leads to predictions on the remittance impact of most of the variables of interest. The main predictions are:

i) An increase in current income in has a negative impact on remittances;

ii) An increase in expected future income has a negative impact on remittances;

iii) An increase in financial development has a positive impact on remittances;

iv) An increase in population has a positive impact on remittances; and

v) An increase in migrants' education level has an ambiguous impact on remittances.

4. Education and Remittances: What Do Regional Aggregates Show?

The mean values of some of the key country-level variables are presented in Table 1 for the year 2000. The first column shows that the ratio of remittances to GDP is equal to 2.95% in Sub-Saharan Africa (SSA), 3.38% in the Middle East and North Africa (MENA) and 2.47% in South Asia. Countries with smaller ratios of remittances to GDP are Latin America and the

Caribbean (LAC) at 1.31%, Eastern and Central Europe at .88%, East Asia and Pacific (EAP) at .58% and Western Europe at .48%. Thus, poorer regions (see last column of Table 1) have higher remittance-to-GDP ratios than the richer ones.

The second column shows a high degree of variation in the migrant-to-population ratio, from a low of .21% in South Asia to a high of 3.56% in Western Europe, with the latter mainly due to intra-European labor flows. It is clear that the size of the regions' population has an important impact on that ratio. For instance, the ratio for Western Europe would be substantially smaller if the region consisted of fewer countries.

Evidence on migrants' education level is from Docquier and Marfouk (2006). It shows that more than half of the migrants from SSA and South Asia have tertiary education, and that migrants are significantly more educated than the rest of the population for all the regions. The ratio of the share of the educated in total migrants divided by their share in the home country population (i.e., the third to the fourth columns), which Docquier and Marfouk (2006) refer to as the "schooling gap", is lowest in Western Europe (34.3/18.63 or about 1.8), followed by Eastern and Central Europe (2.6), MENA and LAC (3.2), and substantially higher schooling gaps for EAP (7.6), South Asia (12.6) and SSA (15.9). Given these figures, it is no wonder that the brain drain has become an issue of great concern in developing regions, especially in South Asia and SSA – the poorest ones – where the problem is particularly acute.

[Table 1 around here]

5. Econometric Specification

We estimate the following equation:

$$\log REM_i = \alpha + \beta_1 MIG_i + \beta_2 FD_i + \beta_3 \log GDP_i + \beta_4 \log PCGDP_i + \beta_5 GDPgrowth_i^e + \beta_6 Edu_i + \varepsilon_i \quad (8)$$

where REM_i denotes remittances (or per capita remittances), MIG_i is the log of migrants or the ratio of migrants to population, FD_i is the level of financial sector development (measured as the ratio of bank deposits to GDP), GDP_i and $PCGDP_i$ (per capita GDP) are measured in PPP terms, $GDPgrowth_i^e$ is the expected growth rate of GDP, Edu_i is the ratio of migrants with tertiary education to the total number of migrants, and ε_i is an error term.

Table 2 provides summary statistics for the variables used in the estimation. A few things stand out. First, log remittances, most instruments, and over fifty percent of the independent variables, exhibit high coefficients of variation, a desirable feature for estimation purposes. Second, the average share of migrants with tertiary education is large at close to 40%, and so is the tertiary school enrollment rate at close to 25%.

The migrants and migrants' education variables are endogenous since sending remittances is a major motivation for migration and a number of micro-econometric studies have shown that remittances have a positive impact on education (Cox-Edwards and Ureta, 2003; Duryea et al., 2005; Yang and Martinez, 2006; Mansuri, 2007).

[Table 2 around here]

The instruments used for migration are: the great-circle distance between home and host countries, the cost of obtaining a passport as a share of per capita GDP, and dummy variables for home countries that are landlocked, islands, officially recognizes dual citizenship, and where English is spoken. Distance raises costs has a significant and robust negative impact on remittances and reduces migration (Mayda, 2006), and similarly for passport costs (McKenzie, 2005) and the two location dummies, while recognition of dual citizenship and English spoken lower migration costs and raise migration.

The migrant' education variable used is the share of tertiary educated migrants in total migrants. As mentioned above, a number of studies have shown that remittances have a positive impact on school attainment in home countries. This reverse causality suggests that accounting for potential endogeneity bias is likely to be important. Instruments used in the IV estimation are the home country's log of public spending on education, the tertiary school enrollment rate, and the number of tertiary educated migrants in the US relative to the population size of their origin country in 1970, all of which should (and actually do) raise migrants' education level.

6. Data

The data covers the eighty two countries for which we have observations on all the variables for the year 2000. Aggregate data on remittances are from the IMF *Balance of Payments* statistics, and consist – according to the standard definition – of the sum of workers' remittances, compensation of employees and migrant transfers. Data on the number of migrants in OECD countries, and on migrants with tertiary education relative to all migrants, are from Docquier and Marfouk (2006). The cost of acquiring a national passport as a percentage of GDP per capita is obtained from McKenzie (2005). The ratio of bank deposits to GDP, our financial sector development variable, is from the IMF *International Financial Statistics*. Most of the other variables are from the *World Development Indicators*. The Appendix provides a description of the variables and their sources in more details.

7. Estimation Results

Equation (8) is estimated by both OLS and instrumental variables (IV) methods.

7.1. OLS Estimation

We estimate three regressions, with remittances measured either as the log of remittances or of remittances per capita. OLS results are shown in columns 1 to 3 of Table 3. As expected,

we obtain positive semi-elasticities of remittances and per capita remittances with respect to the ratio of migration to population in columns (1) and (2), significant at the 1% and 5% level, respectively, and a positive elasticity of remittances with respect to the number of migrants, with a value of .361 and significant at the 10% level (column (3)).

[Table 3 around here]

The impact of migrants' education level on remittances is negative and significant at the 5% level in two of three specifications (columns (1) and (2)). The negative sign of the coefficients implies that migrants with tertiary education remit less than less-educated migrants. The impact of home countries' financial sector development is positive, though not significant. As predicted by the model, the elasticity of remittances with respect to per capita GDP in columns (2) and (3) is negative, with values of -.792 and -.562, respectively, and significant at the 1% level. Interestingly, the elasticity of per capita remittances with respect to per capita GDP is positive in column (1). This might be the case if the variation in $\log L$ is large relative to that of $\log GDP$, which seems to be the case as the coefficient of variation of $\log GDP$ is very small (.09). [10]

The elasticity of remittances with respect to GDP in columns 2 and 3 is .860 and .531, respectively, significant at the 1% level. This may reflect the fact that, for given per capita GDP, a larger economy offers greater investment opportunities, resulting in an increase in remittances.

The 2000 per capita GDP already captures the economic growth during the 1995-1999 period, suggesting that the latter can be interpreted as the expectation in 2000 of the future rate of

[10] Since $\frac{d\log(R/L)}{d\log(GDP/L)} = 1 + \frac{d\log R}{d\log(GDP/L)} + \frac{d\log GDP}{d\log(GDP/L)}$ and $\frac{d\log GDP}{d\log(GDP/L)}$ is positive and small (.15), this may explain the positive elasticity obtained in column (1).

growth. As predicted by the model, the expected growth variable has a negative impact on remittances, significant at the 10% in two of the three regressions.

Finally, the model predicts a positive (negative) impact of population on total (per capita) remittances R^* (r^*). These results are confirmed in the empirical analysis. Keeping GDP constant, the elasticity of remittances with respect to population is found to be .792 in column (2) and .562 in column (3), significant at the 1% level, and the elasticity of per capita remittances with respect to population is -.399, significant at the 5% level (column (1)).

7.2. IV Estimation

Both the migration and migrants' education variables are instrumented in this case, with the instruments described in Section 5. Results are reported in columns (4) to (6) of Table 3. The Hansen J-statistics for overidentification are reported at the bottom of Table 3. The results support the validity of our instruments.

[Table 4 around here]

What are the main differences between the OLS and IV results? First, the ratio of migrants to population is positive but not significant in the regression in column 5.[11] Secondly, as predicted by the model, the positive impact of financial sector development is now significant in the regressions of total remittances. Thirdly, and most importantly, the impact of migrants' education on remittances is now significant in all three regressions. Faini (2007) also found a negative impact of migrants' education on remittances in various regressions but none of them were significant.

[11] However, given our prior that an increase in the number of migrants raises remittance levels, a one-tailed test might be in order, in which case it is significant at the 1% level.

Thus, the claim that the negative impact of the brain drain on migrants' countries of origin is mitigated by the fact that more educated migrants remit more to their families back home than less educated ones is not supported by the evidence.

8. Conclusion

This paper makes several contributions to the literature on remittances and migrants' education. It presents a richer model than in previous studies and derives additional testable hypotheses. Second, it shows that remittances decrease with the share of migrants who possess a tertiary education, a result that had so far not been demonstrated. Third, it accounts for the endogeneity of migration and migrants' education level, something previous studies have abstracted from, and provides a richer empirical analysis that enables us to estimate the relationship between remittances and other variables of interest, including home countries' expected economic growth, income, population, and level of financial development. As predicted by the model, the paper shows that per capita income and expected economic growth have a negative impact on total and per capita remittances, while the size of the population, national income and the level of financial sector development have a positive impact.

The main finding that an increase in the share of migrants with tertiary education has a negative impact on total and per capita remittances contradicts the claim that the negative impact of the brain drain can be mitigated or even offset by the fact that skilled migrants remit more than unskilled ones. These findings thus provide an additional source of concern about the brain drain for countries of origin. This should raise the urgency of finding (non-distortive) ways to reinforce skilled migrants' links with their country of origin. This might possibly be achieved as part of a cooperative arrangement between source and (their principal) host countries, including policies of return and circular migration (Schiff, 2007).

Reference

Aggarwal, R. and A. Horowitz (2002) "Are International Remittances Altruism or Insurance?: Evidence from Guyana Using Multiple-Migrant Households", *World Development*, Vol.30, pp.2033-2044.

Burns, A. and S. Mohapatra (2008) "International Migration and Technological Progress", *Migration and Development Brief*, No. 4 (February 1), DECPG, World Bank.

Chami, R., F. Fullenkamp, and S. Jahjah (2003) "Are Immigrant Remittance Flows a Source of Capital for Development?", IMF Working Paper, WP/03/189, Washington, D.C.: IMF.

Cox-Edwards, A. and M. Ureta (2003) "International Migration, Remittances and Schooling: Evidence from El Salvador", *Journal of Development Economics*, Vol.72, pp.429-461.

Docquier, F. and A. Marfouk (2006) "International Migration by Educational Attainment, 1990-2000." C. Ozden and M. Schiff (eds.). *International Migration, Remittances and the Brain Drain*. Palgrave MacMillan: New York.

Rapoprt, H. and F. Docquier (2006) "The Economics of Migrants' Remittances", in S. C. Kolm and J. Mercier-Ythier (eds.) *Handbook on the Economics of Reciprocity, Giving and Altruism*, Vol.2, Elsevier-North Holland.

Duryea, S., E. Lopez Cordova, and A. Olmedo (2005) "Migrant Remittances and Infant Mortality: Evidence from Mexico", mimeo, Washington, D.C.: Inter-American Development Bank.

El-Sakka, M. I. T. and R. McNabb (1999) "The Macroeconomic Determinants of Emigrant Remittances", *World Development*, Vol.27, No.8, pp.1493-1502.

Faini, R. (2007) "Remittances and the Brain Drain: Do More Skilled Migrants Remit More?", *World Bank Economic Review*, Vol.21, No.2, pp.177-191.

Freund, C. and N. Spatafora (2005) "Remittances: Transaction Costs, Determinants, and Informal Flows", *Policy Research Working Paper* 3704, World Bank, Washington, D.C.

Gupta, P. (2005) "Macroeconomic Determinants of Remittances: Evidence from India", *IMF Working Paper*, WP/05/224, Washington, D.C.: IMF.

Mansuri, G. (2007) "Does Work Migration Spur Investment in Origin Communities? Entrepreneurship, Schooling, and Child Health in Rural Pakistan", in Ozden, C. and M. Schiff (eds.) *International Migration, Economic Development and Policy*, Washington, D.C.: World Bank and Palgrave Macmillan.

Mayda, A. M. (2006) "International Migration: A Panel Data Analysis of the Determinants of Bilateral Flows", mimeo, Washington, D.C.: Georgetown University.

McGarry, K. and R. Schoeni (1995) "Transfer Behaviour in the Health and Retirement Study: Measurement and Redistribution of Resources within the Family", *Journal of Human Resources*, Vol.30 (supplement), pp.S184-S226.

McKenzie, D. (2005) "Paper Walls are Easier to Tear Down: Passport Costs and Legal Barriers to Emigration", *World Bank Policy Research Working Paper*, No.3783 Washington, D.C.: World Bank.

Naufal, G. (2007) "Who Remits? The Case of Nicaragua", *Institute for Study of Labor (IZA) Discussion Paper*, No.3081, Bonn, Germany.

Ozden, C. and M. Schiff (2006) (eds.) *International Migration, Remittances and the Brain Drain*, Washington, D.C.: World Bank and Palgrave Macmillan.

Ratha, D. (2003) "Workers' remittances: An Important and Stable Source of External Development Finance", in World Bank (2003) *Global Development Finance 2003*, Chapter 7, Washington, D.C.: World Bank.

Rodriguez, E. and S. Horton (1994) "International Return Migration and Remittances in the Philippines", in D. O'Connor and L. Farsakh (eds.) *Development Strategy, Employment and Migration. Country Experiences*, Paris: OECD Development Centre.

Schiff, M. 2007. "Optimal Immigration Policy: Permanent, Guest-Worker, or Mode IV?" IZA Discussion Paper 3083 (September). http://ftp.iza.org/dp3083.pdf .

Schiff, M. and Y. Wang. 2008. "Brain Drain and Productivity Growth: Are Small States Different?" Mimeo. DECRG-Trade, World Bank.

Straubhaar, T. (1986) "The Determinants of Workers' Remittances: The Case of Turkey, *Weltwirtschaftliches Archiv*, Vol.122, No.4, pp.728-40.

World Bank (2005) *Global Economic Prospects: Economic Implications of Remittances and Migration*, Washington, D.C.: World Bank.

Yang, D. and C. A. Martinez (2006) "Remittances and Poverty in Migrants' Home Areas: Evidence from the Philippines", in Ozden, C. and M. Schiff (eds.) op. cit.

Table 1: Summary Statistics (mean values) by Geographic Region

	Rem/GDP (%)	Mig/Pop (%)	Ratio of migrants with tertiary edu. (%)	Ratio of population with tertiary edu. in home countries (%)	GDP per capita, ppp (2000 constant, international $)
Latin America and Caribbean	1.31	2.39	37.61	11.69	7,378
Western Europe	0.48	3.56	34.30	18.63	24,569
Eastern and Central Europe	0.88	1.55	44.98	17.45	7,798
Middle East and North Africa	3.38	2.09	30.34	9.37	5,396
Sub-Saharan Africa	2.95	0.39	55.37	3.48	2,282
South Asia	2.47	0.21	55.34	4.38	2,203
East Asia and Pacific	0.58	0.36	49.86	6.59	5,827
Sample average	1.44	0.91	48.26	7.92	6,386

Source: IFS (IMF), WDI (World Bank), Docquier and Marfouk (2006).

Note: Sample size = 82 countries. Figures are weighted by the population. They are based on the mean values for the period 1998-2002 except for the ratio of migrants to population and the ratio of migrants with tertiary education to total migrants, which are the figures for the year 2000.

Table 2: List of Dependent and Explanatory Variables

	Mean	SD
Dependent variables		
Log of remittances	19.53	1.98
Log of remittances per capita	3.23	1.61
Independent variables		
Log of migrants abroad	12.20	1.64
Ratio of migrants abroad to population size (%)	4.59	7.36
Ratio of bank deposit to GDP	0.46	0.28
Log of GDP (in PPP)	24.22	2.25
Log of GDP per capita (in PPP)	8.73	1.09
Expected GDP growth rate [1995-99 annual growth rate (%)]	3.78	2.25
Ratio of migrants with tertiary education to total number of migrants (%)	39.58	14.06
Instrumental variables		
Log of distance (km)	1.17	0.97
Passport cost (% of GDP per capita)	3.04	5.78
Dummy for English language	0.32	
Island dummy	0.16	
Landlock dummy	0.16	
Dummy for dual citizenship	0.43	
Log of public spending on education, ppp	21.82	2.04
Tertiary school enrollment rate (%)	24.67	19.56
Ratio of tertiary educated migrants in the US to the origin country's population in 1970 (%)	0.06	0.09

Note: All the variables are the mean values for the period between 1998-2002 except for the logarithm of migrants abroad, the ratio of migrants to population, and the ratio of migrants with tertiary education which are the figures for the year 2000. The public spending on education and tertiary school enrollment rate are the mean values for the period between 1990-2000. They are unweighted means. As for legal rights and credit information indices, we took the figures for the closet year (2004 or 2005) to the year 2000.

Table 3: OLS and IV Regression Results for Determinants of Remittances

	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
	Log of Rem per capita	Log of Rem	Log of Rem	Log of Rem per capita	Log of Rem	Log of Rem
Migrants/population	0.073***	0.050**		0.129***	0.052	
	[0.020]	[0.022]		[0.035]	[0.038]	
Log of migrants			0.361*			0.463*
			[0.183]			[0.265]
Ratio of migrants with tertiary edu.	-0.022**	-0.024**	-0.012	-0.027*	-0.084**	-0.062*
	[0.010]	[0.011]	[0.012]	[0.016]	[0.035]	[0.037]
Bank deposit/GDP	0.784	1.028	1.110	0.785	1.559*	1.527*
	[0.887]	[0.692]	[0.675]	[0.843]	[0.831]	[0.799]
Log of GDP		0.860***	0.531***		0.980***	0.573***
		[0.121]	[0.113]		[0.176]	[0.182]
Log of GDP per capita	0.399**	-0.792***	-0.562***	0.343*	-1.124***	-0.822***
	[0.183]	[0.223]	[0.203]	[0.181]	[0.316]	[0.298]
Expected GDP growth	-0.128*	-0.107	-0.111*	-0.129**	-0.115	-0.116*
	[0.067]	[0.070]	[0.065]	[0.061]	[0.071]	[0.066]
Constant	0.392	6.274***	7.550***	0.831	8.413***	9.341***
	[1.375]	[2.297]	[1.987]	[1.557]	[3.038]	[2.537]
Observations	82	82	82	82	82	82
R2	0.41	0.62	0.64	0.35	0.45	0.50
F-statistic (p-value)	12.33 (0.00)	18.69 (0.00)	18.30 (0.00)	16.10 (0.00)	14.67 (0.00)	15.46 (0.00)
Overidentification $\chi 2$ (p-value)				5.41 (0.25)	3.22 (0.36)	1.14 (0.77)

Note: Robust standard errors in brackets; *(**)(***) is 10 (5) (1) % significance level; Data is for 2000; Expected growth rate is the average growth rate over the period 1995-1999.

Appendix. Variable Definitions and Sources

Variable name	Description	Source
Remittances (R) to GDP	R/GDP (%), R = workers' remittances + compensation of employees + migrants' transfers (App. A in Freund-Spatafora 2005).	Balance of Payments Statistics (IMF)
Log of remittances	Log of remittances (constant 2000 US$), which are calculated by multiplying the ratio of remittances to GDP by GDP figures.	Remittances: BoP Statistics (IMF), GDP: WDI
Log of remit. per capita	Log of remittances per capita (constant 2000 US$).	Remittances: BoP Statistics (IMF), Population: WDI
Log of migrants	Log of total number of migrants in OECD countries.	Docquier and Marfouk (2006)
Migrants/popul.	Ratio of migrants in OECD to population size of home countries (%).	cf. above
Univ. educated to total migrants	Ratio of tertiary educated to total number of migrants (%).	cf. above
Bank deposits to GDP	Bank deposit to GDP = {(0.5)*[F(t)/Pe(t)+F(t-1)/Pe(t-1)]}/ [GDP(t)/Pa(t)], F = demand + time + saving deposits.	IFS (IMF)
Log GDP	Log of GDP (constant 2000 US$).	WDI
LogGDP per cap	Log of GDP per capita, ppp adjusted (constant 2000 int'l).	WDI
Expected GDP growth	Average GDP growth rates for 1995-1999 (annual %).	WDI
English language dummy	Equal to 1 = countries where English commonly spoken.	Docquier (2006), CIA World Factbook
Log of distance	Log of host to home country great-circle distance. For USA, Canada, EU, Australia, New Zealand: zero distance; Eastern and Central Europe, Middle East, Africa: average distance to EU countries weighted by number of migrants; Central Am., Mex., Caribbean, South Am.: distance to USA; South Asia, East Asia and Pacific: distance to USA/Canada and EU countries weighted by number of migrants.	Authors' calculations based on data from CIA World Factbook
Passport cost to GDP per capita	Passport cost normalized by countries' GDP per capita, in US $, inflation adjusted (%)=(passport cost/(current $ GDP per capita) *100/(1+infl. 90/100)(1+infl. 91/100)…(1+infl. 2004/100).	Passport cost: Mc Kenzie (2005), GDP: WDI
Island dummy	Country being an island (1= home country is an island).	Docquier (2006) and CIA World Factbook
Landlock dummy	Country being landlocked (1 = home country being landlocked).	Cf. above
Dual citizenship	Country legally recognizes dual citizenship (1 indicates that home country recognizes the dual citizenship).	US Office of Personal Mngmt. Investigations Service (2001) *Citizenship Laws of the World*.
Log public expend. on education	Log of public spending on education, ppp adjusted (constant 2000 int'l).	WDI
Tertiary enroll. rate	Rate of tertiary school enrollment (%)	WDI
Tertiary educated migrants in the US to the origin country's population in 1970	Ratio of tertiary educated migrants in the US to the origin country's population in 1970 (%)	Migrants: US Census (2000), Population: WDI