Remittances and Public Spending on Education

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Abstract

The aim of the paper is to study the impact of remittances on public education spending in recipient countries. We build a simple theoretical framework where government intervention in education is motivated by the presence of credit constraints. On the one hand, an increase in remittances relaxes liquidity constraints, which implies a shift from public to private spending. On the other hand, remittances may allow households to send children to school rather than to the labor market. This implies an increase in the demand for educational services. In the empirical section we find confirmation of an inverted-U relationship: For small (large) amounts of remittances, an increase in remittances raises (lowers) public spending on education.

1 Introduction

Remittances are an important source of external funding for developing countries. They rank only behind foreign direct investment (FDI), and are much higher than

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total official development assistance and private non-FDI flows (see Ratha, 2005). Remittance flows present several advantages compared to other sources of external financing. First, they are more stable than private capital flows. While these often move pro-cyclically, remittances help to buffer recipient countries from the impact of negative shocks.[1] Second, remittances are directed to households and individuals, while other sources of external financing such as foreign aid goes to public agencies in receiving countries. Its effectiveness may therefore be hindered by corruption of government officials (see Kapur, 2005).

One should therefore expect that remittances have a greater impact on growth and poverty reduction than foreign aid. In a recent paper, Adams and Page (2005) find empirical confirmation of a statistically significant impact of remittances on poverty. Their estimates show that a 10% increase in per capita official remittances has lead to a 3.5% decline in the share of people living in poverty.

One branch of the literature focuses on the impact of remittances on income inequality (see Stark, Taylor and Yitzhaki, 1986; Barham and Boucher, 1998; Taylor, Mora, Adams and Lopez-Feldman, 2005). The distributional impact of remittances seems to differ according to the type of migration (remittances from migrants abroad versus remittances from internal migrants) and the degree to which migration opportunities are diffused across households (high versus low-migration areas).

Another branch of the literature studies the impact of remittances on labour supply (Funkhouser, 1992; Rodriguez and Tiongson, 2001; Amuedo-Dorantes and Pozo, 2005). In particular, using data from a nationally representative survey carried out by the Mexican statistical institute, Amuedo-Dorantes and Pozo (2005) find that the relationship between remittances and labour supply depends on the

[1] See for instance Yang (2005) who studies the impact of hurricane damages on international financial flows to affected countries.

gender of the recipient, the location of the household, and the type of work.

In this paper we study an aspect of remittances that has found only little attention in the literature: the impact of remittances on public education spending in recipient countries. Investment in education is a key driver of future development. There is empirical evidence that public education expenditure is positively associated with future economic growth (see Sylwester, 2000). The importance of government intervention in education on growth has been stressed in theoretical frameworks as well (see Glomm and Ravikumar, 1992, Eckstein and Zilcha, 1994). Migration is likely to play an important part in enhancing educational attainments of the young. Remittances may help families to alleviate economic constraints, and provide resources to keep children longer at school. On the other side, improving economic conditions through remittances may lead governments to shift financing of education from the public to the private sector. Remittances may therefore affect public educational spending in two ways: first, by increasing the demand for educational services, as it may allow households to send children to school rather than the labour market. Second, by shifting educational spending from the public to the private sector.

Some previous work suggests that remittances may indeed affect the demand for educational services. Work by Cox, Edwards and Ureta (2003) examines the effect of remittances on households'schooling decisions using data for El Salvador. They find that remittances have a significant and large effect on school retention (the hazard of leaving school). Hanson and Woodruff (2003) examine the relationship between household migration behavior and educational attainment in Mexico. They find that children in migrant households complete significantly more years of schooling. Their results are therefore consistent with the idea that households who send a migrant abroad generate remittances that help relax household credit constraints on the financing of education.

Moreover, there is some empirical evidence that remittances may increase private education expenditure. Yang (2005) exploits the 1997 Asian financial crisis as an experiment to identify the impact of migrant income shocks on educational choices of Philippine households. The appreciation of a migrant's currency against the Philippine peso implied an increase in household's remittances received from overseas and an increase in educational expenditure for origin households.

We set up a theoretical framework where government intervention in education is motivated by the presence of credit constraints. We present two countervailing effects of remittances on public education spending. On the one hand, an increase in remittances relaxes liquidity constraints. Because of this effect, remittances may be a substitute for educational subsidies. On the other hand, an increase in remittances raises the demand for school services, which will positively impact on educational subsidies. We show that these two effects may imply an inverted-U relationship between educational spending and remittances: For small (large) amounts of remittances, an increase in remittances raises (lowers) public education spending.

We then test the implications of our model. We find empirical confirmation of an inverted-U relationship between the per capita level of remittances and educational spending. This finding is robust to the inclusion of several control variables, time and country effects. When estimating difference equations or fixed effects equations to eliminate common country effects, we need to assume that remittances are strictly exogenous. This assumption is violated when for instance a shock to educational spending at time period $t-1$ affects remittances at time t. We address this problem in our empirical analysis by employing the difference GMM estimator and using past levels of remittances as instruments for the endogenous variables in first difference.

Finally, we propose an estimation strategy that attempts to overcome one ma-

jor problem that has hindered the analysis of data on international remittances. In fact, the available data on remittances does not include the large sum of remittances that are transmitted through unofficial channels.

The remainder of the paper is organised as follows. Section 2 presents an overview of the differences in public expenditure on education and remittances among different groups of countries. Section 3 presents the theoretical framework and its empirical implications. Estimation results are presented in section 4. Finally, in the last section we discuss policy implications and we conclude the paper.

2 Background, Data and Descriptive Information

2.1 Remittances

Remittances from international migrants have been increasing substantially over the past three decades. Figure 1 shows the overall development of remittance flows over the period between 1968 and 2001. Figures are in constant 1995 international dollars. Remittances constitute an important resource, not only for the receiving households, but for the receiving economy as a whole.

But what exactly are remittances? Reinke and Patterson (2005) in a recent report define remittances as "certain transactions that are initiated by individuals living or working outside their country of birth or origin and related to their migration". The IMF collects data on migrants'remittances in the "Balance of Payments Statistics Yearbook" (our data source: IMF BOPS CD-ROM). In particular, "workers'remittances" is defined as current transfers by migrants who are employed in new economies and considered residents there. In the IMF BOPS migrants differ from border workers or seasonal workers because they come to an

economy and stay there, or are expected to stay, for a year or more. We transform the component "workers'remittances" in real terms to take into account differences in purchasing power among countries. We divide real remittances by the population to obtain a per capita measure. One remark is worth mentioning. Another component of balance of payments statistics is related to migrants'remittances: "migrants capital transfers". This refers to the capital account changes caused by the change of residence of a household, at the time this takes place. While this component has been used by other authors, we do not use it since we are interested in the amount of remittances that can be targeted to "buy" education.

The registered amount of remittances is largely underestimated and the proportion of those sent by informal channels (through friends or family, hand-carried or through the hawala/hundi system)[2] can be high (see Ritzema and Puri, 1999 for discussion).

Remittances need not always be in cash: They can be in-kind, for instance in form of jewelry, clothes and other consumer goods (Ratha, 2005).

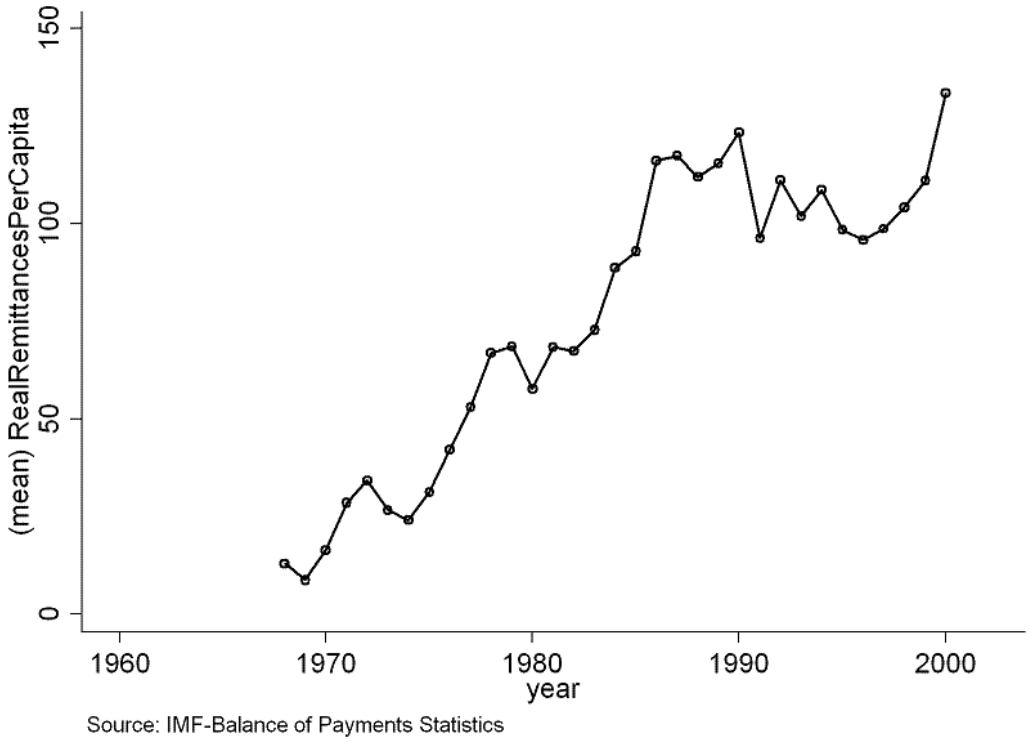
Puri and Ritzema (1999) summarize estimates of unrecorded remittances (as a percentage of total remittances) from various sources. The use of informal channels is a dominant aspect of migrant remittances behaviour in some countries like Pakistan (43%), Philippines (50%), India (40%; this estimate represents remittance behaviour of migrant workers from Kerala only) and Egypt (33%) but less in others like Sri Lanka (13%), Thailand (18%), Korea (8%) and Bangladesh (20%).

The studies summarized by Puri and Ritzema (1999) use information from

[2]The "Hawala" or "hundi" remittance system is an alternative to the traditional banking channels of transmission. Initially developed in India, before Western banking practices were introduced, it is now worldwide used. The system is based on trust and the extensive use of connections between "hawalanders" in home and host country. See Jost P.M., Singh Sandhu H., 2000 for details and discussion. See De Luna Martinez (2005) for other examples of informal channels.

household surveys. Using aggregate data on remittances from the IMF's Balance of Payments Statistics for 104 countries over the period 1995-2003, Freund and Spatafora (2005) quantify the magnitude of informal flows through a tought experiment on the cross-section and panel estimates of the determinants of recorded remittances. Their results show that informal remittances may amount to about 35-75 percent of official flows to developing countries. Moreover, they find that informal remittances to Sub-Saharan Africa and Eastern Europe and Central Asia are relatively high, while unofficial flows to East Asia and the Pacific are relatively low.

Figure 1: Real remittances per capita



In the empirical section we deal with this measurement issue and, in particular, we exploit the fact that migrants may have incentives to shift from informal to formal channels and viceversa.

Remittances can vary a lot according to geographical areas. To illustrate differences in remittances per capita among different groups of countries, we follow the World Bank's country classification and distinguish between a "developing country" (a low or middle-income country) and "developed countries" (high-income countries). The World Bank also makes a distinction of developing countries according to six geographical areas: East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia and Subsaharan Africa. In table 1 we illustrate the differences in remittance receipt per capita for different groups of countries. The first column of the table reports the average receipt of remittances per capita over the last three decades. Columns 2-4 break these numbers down by decade; column 2 reports number for the 1970s, column 3 for the 1980s and col 4 for the 1990s. Finally the last column reports the average growth rate in per capita remittances over this period.

Table 1: Average real remittances per capita

Group of countries	From 1970 onwards	1970s	1980s	1990s	growth rate
All developing countries	94.73	51.47	93.22	104.43	0.09
East Asia and Pacific	12.81	17.55	9.92	13.86	0.11
Transition	94.73			92.51	0.21
Latin America and the Caribbean	131.15	72.61	142.79	134.86	0.09
Middle East and North Africa	245.46	146.9	226.75	294.1	0.04
South Asia	59.45	16.49	61.21	70.34	0.13
Sub-Saharan Africa	34.2	10.17	23.11	48.52	0.09

Values in constant international dollars. Growth rate is average annual growth rate

Source: IMF - Balance of Payments Statistics

As we discussed above these numbers may not reflect accurately the relative

magnitude of remittance receipt across regions, due to the different degree of usage of unofficial channels as we pointed out above.

On average, countries in Middle East and North Africa and Latin America and the Caribbean received more remittances than countries in other regions. Small amounts of remittances are received by countries in Sub-Saharan Africa and East Asia and Pacific (see table 1).

Remittances did respond to dramatic economic and political changes in recipient countries. Macroeconomic instability is likely to have an ambiguous impact on remittances. On the one hand, a more (less) stable macroeconomic environment creates (dis)incentives to remit. In just one year remittances per capita received by Bolivians decreased by 40% after the hyper-inflation of 1985. On the other hand, remittances are often viewed as a self-insurance mechanism for developing countries. In the late 1990s, Ecuador suffered a tremendous economic crisis and remittances sharply increased (see also Jokisch and Pribilsky, 2002).

Table 1 also shows that in most developing areas remittances rose sharply in the 1990s, after developing countries eliminated foreign exchange restrictions and liberalised their capital and current accounts. However, as pointed out by Kapur (2005), this increase in officially recorded remittances may simply reflect a shift from informal to formal channels.

2.2 Educational Spending

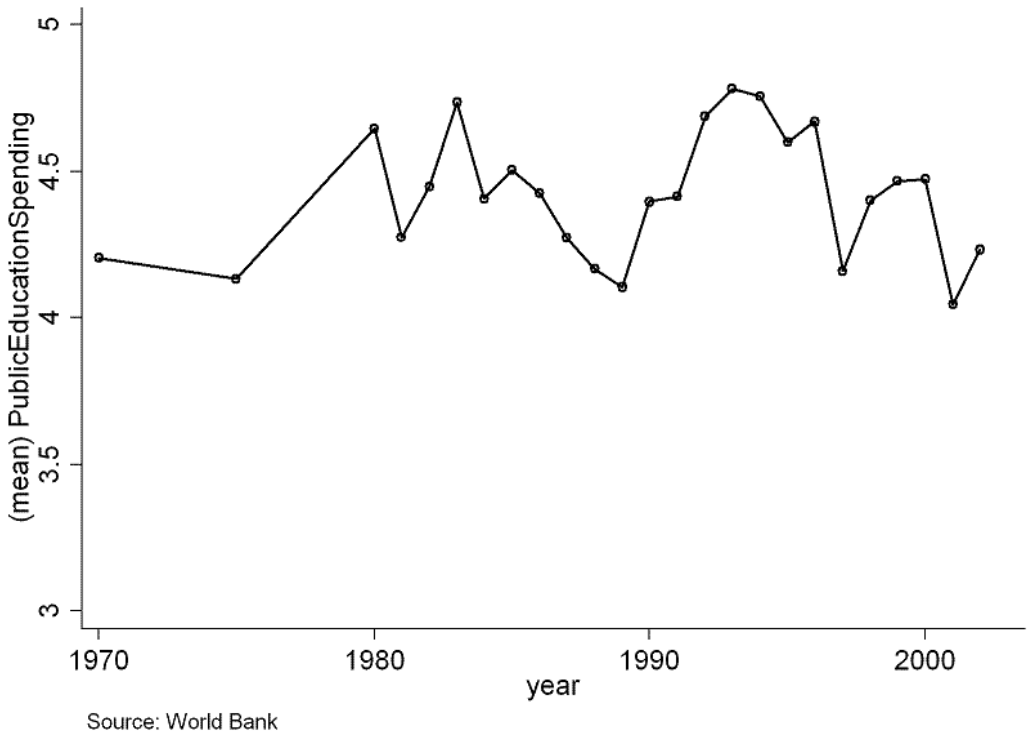
Figure 2 illustrates the trend in public educational spending as a percentage of GDP for the period 1970-2000. Data is from World Bank (World Development Indicators).

Table 2 breaks this down according to geographical areas and group of countries.

High levels of public education spending are observed in Middle East and North

Africa and Europe and Central Asia, while low levels in East Asia and Pacific and South Asia (see table 2).

Figure 2: Public Education Spending (% GDP)



Government intervention in education usually shrinks after events such as wars or civil riots. Congo is an interesting example in this context. In the early 1980s the government financed large-scale reform projects thanks to huge oil revenues and the financial support of international organisations. In those years the average GDP annual growth was around 5%. In June 1997 the civil war started and the economic progress stopped. Before the civil war, average public education spending was around 6% of GDP. In 1998 and 1999 was less than 0.5%.

Table 2: Average public education spending as a % of GDP

Group of countries	From 1970 onwards	1970s	1980s	1990s	growth rate
All countries	4.35	3.99	4.23	4.55	0.006
Developing countries	4.12	3.67	3.93	4.37	0.008
Developed countries	5.07	4.83	5.03	5.17	0.002
East Asia and Pacific	3.79	3.6	3.71	3.79	0.02
Transition	4.77	2.48	4.17	5.23	0.02
Latin America and the Caribbean	3.97	3.83	4	3.86	0.01
Middle East and North Africa	5.21	4.72	5.29	5.11	−0.004
South Asia	2.71	2.07	2.44	3.12	0.02
Sub-Saharan Africa	4.17	3.74	3.93	4.56	−0.008

Growth rate is average annual growth rate. Source: World Bank

3 The theoretical framework

We now turn to our theoretical model. We develop a framework that illustrates the two mechanisms by which remittances may affect educational spending. We then develop the empirical implications.

There are N identical households in the economy. Each family has one child and one adult. The model consists of two periods, $t = 1, 2$. There is no discounting of the future.

Parents live and work for both periods. Every parent supplies in each period one unit of labour, which has value of A efficiency units ($A \geq 1$).

At time $t = 1$ children may also work. Time not spent working is spent in school. The time children spend at work has a value of 1 (in efficiency units). The child has a unit time endowment. In the first period parents decide how to allocate their children's unit time endowment between labour (l) or schooling

$(1-l)$. The only cost to acquire education is an opportunity cost. In the second period, children become adults and they supply one unit of labour, which has value $h(1-l)$. Following Baland and Robinson (2000) and Rogers and Swinnerton (2004), the function $h(1-l)$ has the following properties: $h(0)=1$, $h'(1-l)>0$, $h''(1-l)<0$.

Let c_1 and c_2 be the household consumption in the first and second period, respectively. The household utility function is assumed to be separable: $V = U(c_1)+U(c_2)$. The function U is twice continuously differentiable, strictly increasing and strictly concave.

3.1 First Best

In the first best situation, households can borrow and lend freely in the credit market. To simplify notation, let the interest rate be equal to zero. Parents decide the optimal allocation of their children's unit time endowment between labour (l) or schooling $(1-l)$ and the optimal value of saving (s) :

$$\begin{aligned} & \max_{l,s} U(c_1)+U(c_2) && (1)\\ s.t.\ c_1 &= A+l-s \\ c_2 &= A+h(1-l)+s \end{aligned}$$

The first order conditions with respect to l and s are respectively:

$$U'(c_1) = U'(c_2)h'(1-l) \quad (2)$$

$$U'(c_1) = U'(c_2) \quad (3)$$

We assume that an interior optimal level of l exists. The following result holds:

The first-best children's time allocation between labour and schooling is such that: $h'(1-l^*)=1$. Furthermore, $s^*<0$ (in the first period households choose optimally to borrow).

3.2 No credit market case

We now assume that individuals cannot lend and borrow in the credit market ($s=0$).

The maximization problem is written as follows:

$$\begin{aligned} & \max_{l} U(c_1)+U(c_2) \qquad (4)\\ s.t.\ c_1 &= A+l \\ c_2 &= A+h(1-l) \end{aligned}$$

The FOC with respect to l can be written as:

$$\frac{U'(c_1)}{U'(c_2)}=h'(1-l) \qquad (5)$$

The concavity of the utility function U and the properties $h(0)=1$ and $h'(1-l)>0$ imply that $\frac{U'(c_1)}{U'(c_2)}>1$. It is straightforward to show the following result:

In the first-best case the level of schooling is higher than in the no credit market case.

3.3 Government intervention in education

The impossibility to borrow for investing in human capital[3] is one of the reason that justifies government intervention in education. As explained before, in the first period parents decide how to allocate their children's unit time endowment between labour (l) or schooling ($1-l$). The opportunity cost of acquiring education is thus equal to $1-l$. We now assume that the government bears a fraction τ of this cost. The educational subsidy is financed by a proportional income tax at the rate of T.

In the presence of an educational subsidy, the household maximizes:

$$\begin{aligned} & \max_{l} U(c_1) + U(c_2) \qquad (6) \\ s.t.\ c_1 &= (1-T)(A+l) + \tau(1-l) \\ c_2 &= A + h(1-l) \end{aligned}$$

For given level of τ, the optimal l is given by:

$$U'(c_1)(1-T-\tau) = U'(c_2)h'(1-l)$$

The government's objective is to choose τ in order to induce the first-best level of schooling[4]. Since the budget constraint of the government is $T(A+l) = \tau(1-l)$, the optimal τ is:

[3] This is due to the fact that human capital provides poor collateral and credit markets work poorly in developing countries.

[4] An alternative objective might be to induce $l = 0$. In April 2000, participants at the World Education Forum in Dakar (Senegal) reaffirmed their commitment to achieve quality basic education for all by 2015.

$$\tau^* = \frac{(A+l)[U'(c_1) - U'(c_2)]}{(1+A)U'(c_1)}$$

where l solves $h'(1-l) = 1$.

3.4 Introducing remittances in the model

We now introduce remittances in the model. There are two countervailing effects at work. On the one hand, remittances relax liquidity constraints, which implies that remittances might reduce public education spending. On the other hand, more remittances might imply a demand-driven increase in educational subsidies, since more young people may go to school rather than to work. We proceed as follows. First, we consider an exogenous level of remittances in the framework and we provide a comparative statics analysis. In the appendix we make remittances endogenous and we close the model (in the empirical section we address the issue of endogeneity of remittances).

3.4.1 Exogenous remittances and comparative statics analysis

The household receives an exogenous level of remittances r, which is targeted to "buy" children's education (more precisely, to cover a fraction r of the opportunity cost of schooling, where $0 \leq r \leq 1$). In the first-best situation, households can borrow and lend freely in the credit market. The optimal allocation of children's time between labour (l) and schooling ($1-l$) and the optimal value of saving (s) can be found by solving the following maximization problem:

$$\begin{aligned} & \max_{l,s} U(c_1) + U(c_2) \qquad (7) \\ s.t.\ c_1 &= A + l + r(1-l) - s \\ c_2 &= A + h(1-l) + s \end{aligned}$$

From the first order conditions of (7) we get:

$$U'(c_1)(1-r) = U'(c_2)h'(1-l) \quad (8)$$

$$U'(c_1) = U'(c_2) \quad (9)$$

In the presence of remittances the first-best children's time allocation between labour and schooling is such that: $h'(1-l) = (1-r)$. Thus, in the presence of remittances parents decide more schooling for their children than in the situation described in 3.1 (first best without remittances, where $h'(1-l) = 1$. This result depends on the concavity of the function h).

By implicit function theorem on $h'(1-l) - (1-r) = 0$, we can analyze the impact of remittances on children's labour:

$$\frac{dl}{dr} = \frac{1}{h''(1-l)} < 0 \quad (10)$$

An increase in remittances thus reduces child labour and consequently raises time allocated to schooling. This result is consistent with empirical findings of Cox Edwards and Ureta (2003) and Hanson and Woodruff (2003).

In case of credit market imperfections ($s = 0$), the first-best level of children'schooling can only be reached through educational subsidies.

In the presence of an educational subsidy, for a given level of r the household sets the optimal children's labour given by maximization of (11)[5]:

[5]In our model remittances are not taxed. This in line with de Luna Martinez (2005), who presents the findings of a survey of central banks in 40 developing countries across different regions in the world. Only 5 of the 40 countries that participated in this survey tax remittances.

$$\begin{aligned} & \max_{l} U(c_1) + U(c_2) \qquad (11) \\ s.t.\ c_1 &= (1-T)(A+l) + \tau(1-l) + r(1-l) \\ c_2 &= A + h(1-l) \end{aligned}$$

The first order condition of (11) yields:

$$U'(c_1)(1-T-\tau-r) = U'(c_2)h'(1-l)$$

The government chooses the level of educational subsidies that induces the first-best level of schooling ($h'(1-l) = (1-r)$), subject to the government budget constraint ($T(A+l) = \tau(1-l)$).

The optimal τ satisfies the system of equations in (12):

$$\begin{aligned} U'(c_1)(1-T-\tau-r) &= U'(c_2)h'(1-l) \qquad (12) \\ h'(1-l) &= (1-r) \\ T(A+l) &= \tau(1-l) \end{aligned}$$

The optimal educational subsidy is given in (13):

$$\tau^* = \frac{(A+l)[U'(c_1) - U'(c_2)]}{(1+A)U'(c_1)}(1-r) \qquad (13)$$

where l solves $h'(1-l) = 1-r$.

3.5 Empirical implications

In the previous subsection we have computed the optimal fraction τ of the opportunity cost of acquiring education that is subsidized by the government.

The public educational subsidies is thus:

$$e^* = \tau^*(1 - l^*)$$

where τ^* is given in (13) and the optimal l is such that $h'(1 - l^*) = (1 - r)$.

The impact of remittances on public education spending is given by the following derivative:

$$\frac{de^*}{dr} = \frac{d\tau^*}{dr}(1 - l^*) - \tau^* \frac{dl^*}{dr} \tag{14}$$

This shows the two main countervailing forces at work. On the one hand, the term $\frac{d\tau^*}{dr}(1 - l^*)$ implies that an increase in remittances may relax liquidity constraints. Because of this effect, remittances may be a substitute for the optimal educational subsidies. On the other hand, an increase in remittances raises the time allocated to schooling and, consequently, educational subsidies ($-\tau^* \frac{dl^*}{dr} > 0$).

In an economy in which individuals cannot lend and borrow in the credit market ($s = 0$), all household's income is devoted to consumption. Once we condition on household's income, in the regression analysis our coefficients of interest do not capture the indirect effect of remittances on public education spending through the consumption channel. In this case it is possible to show that the theoretical framework predicts an inverted-U relationship between remittances and public education expenditure. For amounts of remittances smaller (larger) than $h''(\cdot)\frac{(A+l^*)(1-l^*)}{(A+l^*)-(1-l^*)} + 1$, an increase in remittances raises (lowers) public education spending.

4 Empirical Analysis

4.1 Estimation strategy

The previous section suggests the following relationship between educational spending and remittances:

$$E_{it} = \alpha_0 + \alpha_1 R_{it} + X'_{it}\beta + u_{it} + e_i + f_t \,, \tag{15}$$

where i and t are indices for time and country, X'_{it} is a vector of observables which we discuss below, β is a parameter vector, u_{it} is an idiosyncratic error term, f_t are time effects and e_i a country specific (unobserved) fixed effect. Our dependent variable E_{it} is public education spending as a percentage of GDP. R_{it} represents the logarithm of real remittances per capita, and our parameter of interest is α_1.[6] OLS estimation of equation 15 will lead to unbiased estimates if $E(R_{it}|X_{it}, u_{it}, e_i) = 0$. To eliminate country specific effects, we estimate equation 15 in differences:

$$\Delta\, E_{it} = \alpha_1 \,\Delta\, R_{it} + \Delta\, X'_{it}\beta + \Delta\, u_{it} + \Delta\, f_t \,, \tag{16}$$

where Δ is a difference operator. Estimates of α_1 will be consistent if $E(\Delta R_{it}|\Delta\, X_{it}, \Delta\, u_{it}) = 0$. One assumption for this to hold is that the variable R_{it} is strictly exogenous in the level equation 15. This is violated if for instance shocks to educational spending in period $t-1$ affect remittance behaviour in period t. Below we address this problem by employing the difference GMM estimator. We use suitable lagged levels of

[6] For simplicity we consider only a linear term here. To capture non-linearities, we will estimate a quadratic specification below.

remittances as instruments for the variables in first differences. Strictly exogenous regressors instead enter the instrument matrix in the conventional instrumental variables way.

4.2 Explanatory Variables

In this subsection we describe the explanatory variables of vector X. $Under15$ and $Over65$ are the percentage of population under 15 years old and over 65 years old, respectively. They are included in the regression to control for the effects of the age structure of the population on public education spending. In fact, groups of people with different age may have a higher demand for those components of public spending for which they are the main beneficiaries (for instance, elderly people may prefer public health expenditure to education spending). $Over65$ may also be a proxy for life expectancy, since higher life expectancy at birth implies that individuals enjoy the benefits of education over a longer period. *populationdensity* is the logarithm of population density (people per square kilometer). There are fixed costs of providing public education (for instance, related to the building of education infrastructure). These costs may be prohibitive for countries with very low population density. For this reason, an increase in population density is expected to raise public education spending.

The dummy *democracy* is equal 1 if the country has strictly positive values of the indicator POLITY2 in the POLITY 4 database. This is the same definition of democracy as in Giavazzi and Tabellini, 2005. It is a time-variant variable and it controls for the impact of democratization on education expenditure. In a cross-section regression, Sylwester (2000) finds that more resources are targeted to public education in democratic countries. Countries that become democracies are thus expected to raise public spending on education.

gdppercapita is the logarithm of real (PPP-adjusted) GDP per capita. This

variable is used as a proxy for household's income (see the theoretical framework). It is also added to capture the effects of dramatic economic changes in recipient countries.

inf *lationrate* is computed as the annual growth rate of the GDP deflator. We include this variable to control for the general increase in prices, for distortional macroeconomic policies and for the degree of macroeconomic instability.

We have also tried to include several variables related to the educational attainment of the population (from the Barro-Lee database) and the number of migrants. These variables are not statistically significant. Their inclusion considerably reduces the number of observations since yearly data for these variables is not available.

Data sources and summary statistics for all the variables are in the appendix.

4.3 Results

Table 3 and 4 present the estimation results. In table 3 we only consider developing countries, while in table 4 we present estimates using data on both developing and developed countries. In the first column we present results from fixed-effect estimates with country and time dummies. In the second column we report estimates from the First difference estimator. Finally, in the last column we report results from the Difference GMM estimator and use lagged levels of remittances as instruments for the endogenous variables in first differences.

In all columns we include all the control variables we describe above. We find empirical confirmation of an inverted-U relationship between remittances and public expenditure on education. For small (large) amounts of remittances, an increase in remittances raises (lowers) public education spending. In particular, result from the GMM estimator show that the turning point is obtained for real remittances per capita equal to 28.14 international dollars.

An increase in population density is found to raise public spending on education. Countries that become democracies increase public expenditure on education. Finally, the general increase in prices (this is also a proxy for distortional macroeconomic policies and for the degree of macroeconomic instability) has reduced public expenditure on education.

From the coefficients of the variables of interest and from the turning point it is also possible to show that the marginal effects at the mean and at the median of remittances per capita are negative.

Table 3: Estimation results (Developing countries only)

	FE	FD	GMM
dependent variable	$EducSpending$	$EducSpending$	$EducSpend.$
$remittancespc$	0.468 (0.129)	0.484 (0.163)	0.287 (0.107)
$remit \tan cespc^2$	−0.07 (0.0218)	−0.088 (0.029)	−0.043 (0.016)
$Under15$	−0.063 (0.0349)	−0.065 (0.09)	−0.063 (0.024)
$Over65$	−0.379 (0.204)	−0.234 (0.459)	0.058 (0.177)
$populationdensity$	0.271 (1.384)	−1.144 (3.512)	2.717 (1.028)
$democracy$	0.14 (0.141)	−0.079 (0.184)	0.324 (0.106)
$gdppercapita$	0.115 (0.185)	0.297 (0.229)	0.19 (0.13)
$\inf lationrate$	−0.014 (0.003)	−0.003 (0.001)	−0.003 (0.001)
Turning point	28.3	15.64	28.14
Time dummies	*yes*	*yes*	*yes*
# of Observations	461	461	461

Standard errors are in parantheses

Table 4: Estimation results (All countries)

	FE	FD	GMM
dependent variable	$EducSpending$	$EducSpending$	$EducSpend.$
$remittancespc$	0.455 (0.113)	0.465 (0.141)	0.182 (0.092)
$remit\tan cespc^2$	−0.076 (0.019)	−0.087 (0.024)	−0.04 (0.014)
$Under15$	−0.038 (0.027)	−0.064 (0.071)	−0.052 (0.01)
$Over65$	−0.125 (0.098)	−0.312 (0.228)	−0.01 (0.078)
$populationdensity$	−0.465 (0.847)	−2.147 (2.259)	0.311 (0.06)
$democracy$	−0.012 (0.122)	−0.14 (0.159)	0.061 (0.089)
$gdppercapita$	−0.068 (0.163)	0.274 (0.229)	−0.085 (0.115)
$\inf lationrate$	−0.015 (0.003)	−0.003 (0.001)	−0.004 (0.001)
Turning point	19.95	14.47	9.73
Time dummies	*yes*	*yes*	*yes*
# of Observations	618	618	618

Standard errors are in parentheses

4.4 Remittances through unofficial channels

As we discussed in section 2, our measure of remittances is restricted to remittances which go through official banking channels. For some countries, this is only a fraction of overall remittances.

Suppose that the true level of remittances is R^*, which is related to measured remittances R_{it} as

$$R^*_{it} = R_{it} + \gamma_{it} \tag{17}$$

We assume that γ_{it} decomposes into a time specific effect g_t, a country specific effect m_i, and a country- and time specific term l_{it}: $\gamma_{it} = g_t + m_i + l_{it}$. The time- and country specific effects are absorbed by time dummies and differencing. We assume that the remaining time varying component l_{it} is absorbed by observed changes in the black market premium ((black market xrate-official xrate)/official xrate). El-Sakka and McNabb (1999) find that the black market premium is a significant determinant of emigrant remittances which go through official channels. A similar result is found by Freund and Spatafora (2005).

The more significant is the black market premium the larger the share of remittances diverted toward the black market. A strictly positive black market premium implies an implicit tax on migrants who remit money through official channels. Thus the time varying component l_{it} captures the incentive to remit through private channels. We thus include the black market premium as additional control variable. This variable reduces the number of observations to 316 and lowers the adjusted R-squared value. Its coefficient is highly insignicant. More importantly, even if we hold constant the incentive to remit through informal channels, we still find empirical evidence of an inverted-U relationship. The coefficients of interest from the Difference GMM estimator are 0.6204 (StdE: 0.15) and -0.1435 (StdE: 0.025). The turning point is equal to 8.7 international dollars.

5 Concluding remarks

In this paper we have studied the impact of remittances on public education expenditure in recipient countries. We have built a simple theoretical framework where government intervention in education is motivated by the presence of credit constraints. We have presented two countervailing effects of remittances on public education spending. On the one hand, an increase in remittances relaxes private

liquidity constraints, which implies a shift from public to private spending. On the other hand, remittances may allow households to send children to school rather than to the labor market. This implies an increase in the demand for educational services. Using data on developing countries, we have found empirical confirmation of an inverted-U relationship: for small (large) amounts of remittances, an increase in remittances raises (lowers) public spending on education. We have proposed an estimation strategy that deals with the possible endogeneity of remittances and that attempts to overcome one major problem that has hindered the analysis of data on international remittances: the available data on remittances does not include the large sum of remittances that are transmitted through unofficial channels.

Our results imply that countries that receive an amount of remittances smaller than the turning point have higher public education expenditure than they had in the absence of remittances. Large amounts of remittances that are targeted to "buy" education may imply an increase in the number of educated people at a lower cost for the government. This is an additional reason for the government of recipient countries to promote remittance inflows through the reduction of remittance fees. As suggested by de Luna Martinez (2005) this can also be achieved through the establishment of a more competitive environment between institutions involved in remittance transactions, the reduction of information asymmetries concerning costs of using different instruments to remit, improving regulation of money transfer companies or fostering cooperation between financial authorities in recipient and sending countries.

6 Appendix

6.1 Solving for the optimal level of remittances

We now solve for the optimal level of remittances. In the empirical section of the paper we address the issue of endogeneity of remittances.

In the home country each household consists of one adult and one child. We assume that some of these households have one adult in the host country[7]. This migrant supplies in the destination country one unit of labor, which has value of B efficiency units ($B > A$). We assume that the utility of the migrant depends on his own level of consumption in the host country and on his children's level of schooling in the home country. Thus, the utility of the migrant (denoted as R) includes both material and symbolic consumption. The latter is related to the pride in having children who are well educated (see Banerjee (2004) for an analysis of educational policies in the presence of similar preferences). R is assumed to be separable: $R = U(c) + \delta V(1 - l)$, where $0 \leq \delta \leq 1$. The functions U and V are twice continuously differentiable, strictly increasing and strictly concave. Sending remittances that are targeted for children's education in the home country has two effects. On the one hand, it implies a reduction of consumption for the migrant. On the other hand, it increases migrant's utility since his children can acquire more human capital in the home country. We assume that the migrant anticipates the effect his remittances will have on the optimal children's time allocation between labour and schooling (thus we solve by backward induction, using results on the optimal l from the previous subsection). The maximization problem is written as

[7]Individuals may differ in terms of migration costs. This may imply that only some households have a relative in the host country. However, for simplicity the migration decision is not modelled in an explicit way.

follows[8]:

$$\begin{aligned} & \max_{r} U(c) + \delta V(1-l^*) \\ s.t. c &= B - r(1-l^*) \end{aligned} \tag{18}$$

where, from the previous section, l^* is such that $h'(1-l^*) = 1-r$.

Thus, the optimal level of remittances is given by:

$$\begin{aligned} U'(c)(-1+l^*+r\frac{dl^*}{dr}) - \delta V'(1-l^*)\frac{dl^*}{dr} &= 0 \Longleftrightarrow \\ \frac{U'(c)}{\delta V'(1-l^*)} &= \frac{1}{r - h''(1-l^*)(1-l^*)} \end{aligned} \tag{19}$$

Using the implicit function theorem on 19, we can analyze the impact of an increase in B on r^*: $\frac{dr^*}{dB} > 0$. An increase in the migrant's earnings in the host country raises remittances.

6.2 Descriptive statistics

Table 4: Descriptive statistics (Developing countries)

Variable	Source	Mean	SD
educspending	World Bank-WDI	4.12	2.02
$remit\tan cespc$	IMF-BOPS	94.73	155.35
$Under15$	United Nations-WPP	38.84	8.53
$Over65$	United Nations-WPP	4.9	2.98
populationdensity	United Nations-WPP	83.48	120.62
democracy	Polity IV Project	0.39	0.49
gdppercapita	World Bank-WDI	3678.8	2866.76

[8] A sufficient assumption for the SOC to hold is $[U'(c)r - \delta V'(1-l)]h'''(1-l) > 0$

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