I Z A Institute of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 10772

The Education Motive for Migrant Remittances: Theory and Evidence from India

Matthieu Delpierre
Arnaud Dupuy
Michel Tenikue
Bertrand Verheyden

MAY 2017

I Z A Institute
of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 10772

The Education Motive for Migrant Remittances: Theory and Evidence from India

Matthieu Delpierre
IWEPS

Arnaud Dupuy
CREA, University of Luxembourg and IZA

Michel Tenikue
LISER

Bertrand Verheyden
LISER

MAY 2017

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

The Education Motive for Migrant Remittances: Theory and Evidence from India*

This paper analyzes the impact of anticipated old age support, provided by children to parents, on intra-family transfers and education. We highlight an education motive for remittances, according to which migrants have an incentive to invest in their siblings' education via transfers to parents, in order to better share the burden of old age support. Our theory shows that in rich families, selfish parents invest optimally in children education, while in poor families, liquidity constraints are binding and education is fostered by migrant remittances. We test these hypotheses on Indian panel data. Identification is based on within variation in household composition. We find that remittances received from migrants significantly increase with the number of school age children in the household. Retrieving the effects of household characteristics shows that more remittances tend to be sent to poorer and older household heads, confirming the old age support hypothesis.

JEL Classification: D13

Keywords: migration, remittances, education, old age support

Corresponding author:
Matthieu Delpierre
Institut Wallon de l'Evaluation, de la Prospective et de la Statistique (IWEPS)
Route de Louvain-la-Neuve 2
5001 Belgrade
Belgium
E-mail: m.delpierre@iweps.be

* The present project has been supported by the core funding of LISER from the Ministry of Higher Education and Research of Luxembourg and the National Research Fund, Luxembourg, under the AFR PDR scheme (cofunded by the Marie Curie Actions of the European Commission (FP7-COFUND)).

1 Introduction

Remittances constitute a non trivial source of revenue for many households and have become the second largest inflow of resources after FDI in developing countries, with 431 US$ billions for remittances against 662 US$ billions for FDI in 2014, according to the World Bank (World-Bank (2016)). In 2014, remittances flows were also more than three times as large as official development assistance (World-Bank (2016)). Although migrants' motives to remit are numerous (Rapoport & Docquier (2006)), most of them can conveniently be classified into three general classes depending on their nature. Motives in the first class are related to payments made by migrants to recipients in home country for investments. These payments are meant either to prepare return migration (Delpierre & Verheyden (2014)), settle risk-sharing arrangements (Stark & Levhari (1982), de la Briere et al. (2002)) or simply remunerate the services provided by the recipient (Cox (1987)). In the second class, which is related to the strategic bequest setting, remittances are motivated by the migrant's expectation regarding the family's future bequest. In this context, remittances serve either of two purposes: increase the future bequest or increase the migrant's share of the bequest (Hoddinott (1994), de la Briere et al. (2002), Goetghebuer & Platteau (2010)). Motives in the last class, are deeply rooted in the migrant's preferences either intrinsically through altruism or extrinsically through social obligation. These preferences lead migrants to remit with the aim of helping family members left behind, for instance (anticipated) parents old age care or ensure siblings' access to education.

While substantial empirical evidence has been accumulated in support of motives in all three categories (Lucas & Stark (1985), Hoddinott (1994), de la Briere et al. (2002), Goetghebuer & Platteau (2010)), interestingly enough, to the extent of our knowledge, the possible interaction between the various motives has not been studied either theoretically or empirically. This paper aims at filling this gap by exploring both theoretically and empirically the possible trade-off between altruism and bequest motives. Intuitively, this trade-off arises very naturally in an economy with imperfect capital markets for old age care and for education. To see this, consider a migrant who has school age siblings in his/her household of origin. This altruistic migrant anticipates that, in the absence of a formal pension system, together with his/her altruistic siblings, he/she will contribute to their parents' old age support on a voluntary basis. Since better educated siblings will have higher earnings and will therefore contribute higher amounts, it benefits the migrant to send remittances to finance school age siblings' education. However, since better educated siblings are tougher competitors, migrants who are competing with siblings for inheritance should be reluctant to finance their education. A migrant who cannot monitor the allocation of remittances, which is left to parental decision, therefore faces a trade-off between remitting more to lower his future parents' old age care burden and remitting less to increase his future bequest.

We study this trade-off both theoretically and empirically. To this aim, we first develop a two-period theoretical model, which captures the situation just described: We consider a migrant with school age siblings in his/her household of origin. In period 1, the migrant sends remittances to parents and/or saves. Parents then decide on their allocation between own consumption, savings and investment in education. In period 2, parents, who are old and inactive, must rely on own savings and transfers from children, including siblings, who have become active on the labor market. Children then simultaneously and non-cooperatively contribute to old age support. Because the parents' wellbeing is a club good for altruistic children, standard results on this setup apply. In particular, the neutrality result (Bergstrom et al. (1986)), which states that, provided that all children make strictly positive transfers, the parents' consumption level only depends on aggregate family resources and not on its distribution, holds. Therefore, higher children earnings, which positively depend on their education, translate into higher parental consumption at old age. This gives an incentives to parents to invest in education, even in the absence of descending altruism. Indeed, better educated siblings contribute higher amounts to old age support, which also benefits the migrant. In this setting, we obtain the following results, depending on family wealth. If family wealth is high enough, parents will save before old age and invest optimally in the education of their children. If the family is poor and faces liquidity constraints, investments in education will be fostered by migrant remittances. Notice that even if the parents have full discretion over the use of remittance, the parents and the migrant have aligned incentives, so that a binding contract between them, which would be difficult to set up in practice, is not required.

The empirical analysis aims at highlighting the tradeoff between ascending altruism, as described in the model, and bequest motives. To this end, we make use of panel data collected in the state of Jharkhand, India. This data provides details on remittances and on the age structure of the household in 2006 and 2009. Our empirical strategy is based on the following two predictions: (1) remittances sent for education motives should increase when families are relatively poor and when younger siblings left behind are of school-age and (2) the trade-off faced by migrants should be prominent for relatively richer households where bequest is more attractive and where siblings may be considered as future competitors. Empirically, we rely on a within variation in household composition to identify these effects. We find that remittances received significantly increase with the number of school age children in the household for all levels of household wealth. This tends to indicates that the education motive prevails and dominates the bequest motive in our sample. Random effect estimation also suggests that remittances tend to be increasing in the age of the household head and decreasing in family wealth, thereby providing direct evidence of old age support.

The paper is structured as follows: In Section 2, we discuss the related empirical and theoretical literature. Attention is paid to the link between remittances and education and to the comparison with other relevant motives for migrant remittances that appear in the existing literature. Relevant theoretical papers on intra-family transfers and education are also briefly discussed and we highlight their similarities and dissimilarities with our own model. Section 3 is devoted to the model. We successively present the first best allocation, the equilibrium contribution to old age support and the incentives faced by the parent when deciding on education and by the migrant when sending remittances. The possible equilibria are then analyzed. Section 4 presents the empirical analysis. It contains the description of our identification strategy and of our econometric approach and present the estimation results. Section 5 concludes.

2 Related literature

2.1 Old age care, education and migration

In developing countries, children are expected to help old parents (Hoddinott (1992), Lillard & Willis (1997), Cameron & Cobb-Clark (2001)). Lillard & Willis (1997) documents that children provide financial support to old parents in Malaysia and that this support positively relates to their income. They argue that old age support acts as a repayment for the educational investment.

Within families where one or more family members are involved in migration, support to old parents requires coordination between siblings. According to Stohr (2015), migration decision themselves may be affected by the prospect of providing parents with old age care. More precisely, some children may stay and specialize in old age care provision. Our standpoint in this paper is to look at the earlier stage where educational decisions are taken, by analyzing how the anticipation of old age support impacts remittances and education.

2.2 Remittances, investment and education

Under imperfect capital markets, liquidity constraints may prevent households in developing countries from seizing profitable investment opportunities. In this context, migrant remittances may constitute an important source of liquidity, which has a significant impact on investment. Different kinds of investments are affected by the reception of remittances. First, based on data from rural Pakistan, Adams (1998) shows that the path of physical asset accumulation is significantly faster for households with a migrant member. Second, it has been shown that remittances are also invested in social capital, or social prestige (Stark & Falk (1998), Gallego & Mendola (2009)). Third, as several studies illustrate, investment in human capital tends to increase with migrant remittances. Edwards & Ureta (2003) highlight a significant impact of remittances on school retention rates in El Salvador. For the Philippines, Yang (2008) points out a positive effect on human capital accumulation and a concomitant reduction in child labor. Adams Jr. & Cuecuecha (2010) and Medina & Cardona (2010) present similar findings for Guatemala and Colombia, respectively. Finally, migrants finance investments that benefit them more directly in case of return migration, such as housing, as demonstrated by Osili (2004) in Nigeria. However, the strong impact of remittances on siblings' education suggests that the latter may serve their interest as well, be it for selfish or for altruistic reasons. Remittances allow the household to overcome liquidity constraints and to enhance investment in human capital, which is otherwise inefficiently low.

Notice that it remains unclear whether the allocation of funds is influenced by the migrant's wishes or whether the parents have a complete discretionary power over it. If one could argue that the migrant is able to set monitoring and enforcement devices to control the use of remittances, there would be a strong case for the education motive. By means of experiments, De Arcangelis et al. (2015) show that migrants would tend to remit higher amounts, if they were able to direct remittances to education expenses. However, even under the alternative assumption that he/she cannot influence the household investment decisions, remittances sent remain an indication than the education choices made by the parents suit the migrant. Our model adopts this assumption and shows that the education motive, namely the migrant's willingness to send remittances for the purpose of educating siblings, prevails, thanks to aligned incentives between the migrant and parents. This discussion pertains to migrants' motivations for sending remittances to their families, which we tackle in the next subsection.

2.3 Motives for migrant remittances: strategic bequest versus education

As mentioned in the introduction, the existing literature has highlighted a series of motives for migrant remittances, we intend to highlight that the migrant's willingness to contribute to siblings' education may constitute an important motive that has not been considered so far. To do so, we need to discuss how the education motive compares to others and in particular to the strategic bequest motive.

In the strategic bequest setting, it is considered that migrants compete with siblings and send remittances in order to receive a higher share of inheritance. This argument is inspired by the paper by Bernheim et al. (1985), according to which parents are able to attract care and transfers by designing the sharing rule that governs the division of the family estate between heirs. The noticeable difference between Bernheim et al. (1985)'s paper and its application to the case of migrant remittances is that the former considers transfers in kind from children to parents, while the latter considers cash transfers. Transfers in kind in Bernheim et al. (1985)'s paper are non-tradable in the sense that parents are assumed to derive utility from the care they receive from their own children. Parents are then ready to pay for this specific type of care, as opposed to care from the market. They may do so by holding their wealth in illiquid form, thereby credibly committing to refrain from consuming their capital. This capital serves as a reward for children who offer their time. Provided the parents' willingness to pay is high enough and the opportunity cost of children's time is low enough, a surplus is created in this transaction. Regarding the application to migrant remittances, it is not so obvious that the transaction that involves remittances and bequest is profitable to both the migrant and the parents. Indeed, migrants have alternative savings or investment options, which may produce higher returns than remittances do with the promised inheritance. Parents should also prefer not to consume their wealth. Intuitively, two conditions need to be met for the strategic bequest argument to hold in the case of migrant remittances. On the one hand, it should be illiquid. This condition, common to both contexts, ensures that the parents cannot consume it easily and at the same time prevents the migrant from acquiring it easily on the market. This is typically the case of land where the land market is imperfect and when migrants want to keep agriculture as a fallback option.[1] Family reputation could also be considered as illiquid. One can also imagine that the extend to which children inherit family reputation is manipulable by parents. On the other hand, family assets should be sufficiently attractive, so that the strategic bequest motive is unlikely to take place in poor families. This discussion suggests that the strategic bequest motive appears to hold under very restrictive conditions. In contrast, the education motive should precisely appear in poor families, where parents will be in need of support at old age. Household wealth therefore offers a way to distinguish between both motives. Importantly, migrants who are competing with siblings for inheritance should be reluctant to finance their education, as educated siblings are tougher competitors. Our empirical analysis exploits this opposition of predictions with the education motive. We do find support for the education motive in our data, for all wealth levels. However, evidence of the presence of the strategic bequest motive is lacking, even in relatively wealthy households.

2.4 Intra-family transfers and education

Before turning to the exposition of the model, let us briefly discuss how it relates to existing theory.

Baland & Robinson (2000) study educational decisions by parents under descending altruism and imperfect capital markets. In particular, parents cannot borrow to compensate for the loss incurred when children's time devoted to education increases at the expense of child labor time. Under liquidity constraints, investment in education is suboptimally low. Interior savings are therefore a necessary condition for optimality, while not sufficient. Indeed, because descending altruism does not imply that parents fully internalize returns to education, they show that the bequest left to children also needs to be interior. In this case, parents can reap the benefits of an investment in education by reducing the bequest. The first difference with our setting is that we assume ascending altruism only, namely altruistic children and selfish parents.[2] The way parents

[1] Land is indeed considered as the typical inheritable asset by Hoddinott (1994) and Goetghebuer & Platteau (2010).

[2] We do not make this assumption for the sake of realism. Indeed, children altruism in the model could be interpreted as the willingness to abide by social obligations. Regarding parental altruism, it could easily be added as it would reinforce the parents' incentives to invest in education.

internalize returns to education in our model in through their effect on support received at old age. Nevertheless, even in an apparently different setting, the conditions we obtain for parents to invest optimally in children's education resemble the conditions highlighted by Baland & Robinson (2000). Indeed, we also show that parental savings and intra-family transfers need to be interior, the only difference being that transfers from children to parents at old age take the role played by bequest in Baland & Robinson (2000)'s paper. Old age support could as well be interpreted as a negative bequest, which our model would allow. Ascending altruism or social obligations make children's commitment to accept a negative bequest, or to provide parents with old age support, credible.

Our results on optimal investment in education can also be linked to Becker (1974)'s rotten kid theorem. This theorem states that selfish children make decisions that maximize total family income if they expect a strictly positive bequest from parents. More precisely, suppose they can affect parental income, they will maximize the sum of parental income and their own income. Our model is the mirror image of the rotten kid theorem. Indeed, first the decision-maker is the parent and not the child. Second, the direction of the transfer is reversed as we consider old age support instead of bequest. Third, parents are selfish and children altruistic. In this reversed setting, we show that the result is maintained in the sense that the parent makes a decision on education that maximizes the present value of the aggregate flow of income of family members. In other words, they invest optimally.

3 The model

3.1 Assumptions

In this model, we study a family whose demographic structure may allow the education/old age support motive to take place. To this end, we assume a family $F = \{p, m, b\}$ composed of three members: one parent p and two children, m and b, with m older than b. Moreover, the age gap between the children, m and b, and former migration decisions are such that m has migrated while b was still of school age. We consider two periods in the model. The first period covers the situation just described where m has migrated and b is of school age. The second extends over the old age of the parent. We assume that b has already entered the labor market end earns a wage at the starting date of this second period. Due to the imperfection of capital markets, migrants cannot borrow to finance remittances and parents cannot borrow to finance education. The following decisions are made by the players. In period 1, the migrant m decides on savings and remittances $(s_m, r) \in \mathbb{R}^2_+$. Then, the parent p observes (s_m, r) and makes his/her decisions on savings and investment in the sibling's education $(s_p, e) \in \mathbb{R}^2_+$. In period 2, the children $\{m, b\}$ make non-negative transfers to old parent $(t_m, t_b) \in \mathbb{R}^2_+$. Second period transfer decisions are simultaneously made. Transfers to parent at old age are motivated by ascending altruism.[3] However, in order to rule out any direct motive to educate the sibling, we exclude any other form of altruism. More precisely, there is neither descending altruism, namely from the parent to the sibling, nor horizontal altruism, namely from the migrant to the sibling. The parent

[3]Notice that the assumption of ascending altruism could be replaced by the assumption of a strong social norm requiring that children take care of old parents. The second stage of our model would be unaffected by this change if it results in similar qualitative predictions, namely that the marginal utility of consumption is equalized between the parent and the children, up to a multiplicative parameter. It could be so if the social norm imposes more pressure on wealthy children. In other words, if transfers from children to parent are increasing in the income gap between them.

and the migrant's preferences are defined over the two periods of consumption and are respectively given by

$$\begin{aligned} U_p &= u(c_{p1}) + \delta u(c_{p2}), \\ U_m &= u(c_{m1}) + \delta u(c_{m2}) + \gamma U_p, \end{aligned}$$

when evaluated in period 1, where $\delta \in (0,1]$ is a discount factor and where $\gamma \in (0,1]$ is the coefficient of ascending altruism. The sibling does not make any decision in period 1. As a consequence, his/her utility level is evaluated in period 2 only, and writes

$$U_b = u(c_b) + \gamma u(c_{p2}).$$

For simplicity, we assume that agents have constant elasticity of substitution (CES) preferences, i.e. $u(c) = c^{1-a}/(1-a)$, where a is the parameter of elasticity of substitution.

Let us now describe the budget constraints.

First, the migrant earns an exogenous wage of w_m, which is assumed constant over the two periods. His/her consumption levels in periods 1 and 2 are therefore respectively given by

$$\begin{aligned} c_{m1} &= w_m - r - s_m, \\ c_{m2} &= w_m + \tau_m s_m - t_m, \end{aligned}$$

where τ_m denotes the interest rate on savings at the migrant's host location.

Second, the consumption levels of the parent write

$$\begin{aligned} c_{p1} &= w_p + r - e - s_p, \\ c_{p2} &= \tau_p s_p + t_m + t_b, \end{aligned}$$

where w_p is the sum of the parent's earnings and his/her initial wealth and where τ_m denotes the interest rate on savings at the parent's location. The migrant and the parent cannot borrow. Notice also that, while e can be considered as the direct cost of the sibling's education, it can equivalently be interpreted as an opportunity cost if one assumes that child labor is a possibility.

Finally, returns to the sibling's investment in education are given by the function $w_b(e)$. The shape of this function depends on the quality of education and of the sibling's intrinsic ability. It is assumed that $w_b'(0) \longrightarrow +\infty$, $w_b'(e) > 0$, $w_b''(e) < 0$. Therefore, the sibling's consumption level in period 2 writes

$$c_b = w_b(e) - t_b.$$

For the ease of exposition, we will make use of specific notations representing the agents' endowments in each period:

$$\begin{aligned} y_{m1} &= w_m, \\ y_{p1} &= w_p + r, \\ y_{m2} &= w_m + \tau_m s_m, \\ y_{p2} &= \tau_p s_p, \\ y_b &= w_b(e). \end{aligned} \tag{1}$$

Also, Y_1 and Y_2 will stand for the household aggregate income in period 1 and 2 respectively, with

$$\begin{aligned} Y_1 &= w_m + w_p - e - s_m - s_p, \\ Y_2 &= y_{m2} + y_b + y_{p2} = w_m + \tau_m s_m + \tau_p s_p + w_b(e). \end{aligned}$$

3.2 The first best

Before turning to the resolution of the game, we briefly discuss the first best allocation. Let $(\lambda_p, \lambda_m, \lambda_b)$ denote the vector of Pareto weights attributed to the parent, the migrant and the sibling, respectively.

Proposition 1 *At the First Best,*

1. *Agents consume a fixed share of aggregate family income in each period:*

$$c_{p1}^{FB} = \alpha_{p1} Y_1, \tag{2}$$

$$c_{m1}^{FB} = \alpha_{m1} Y_1, \tag{3}$$

where

$$\alpha_{p1} = \frac{\phi_m}{1+\phi_m}, \qquad \alpha_{m1} = \frac{1}{1+\phi_m},$$

and

$$c_{p2}^{FB} = \alpha_{p2} Y_2, \tag{4}$$

$$c_{m2}^{FB} = \alpha_{m2} Y_2, \tag{5}$$

$$c_{b}^{FB} = \alpha_{b} Y_2, \tag{6}$$

where

$$\alpha_{p2} = \frac{\phi_m \phi_b}{\phi_m \phi_b + \phi_m + \phi_b}, \qquad \alpha_{m2} = \frac{\phi_b}{\phi_m \phi_b + \phi_m + \phi_b}, \qquad \alpha_{b} = \frac{\phi_m}{\phi_m \phi_b + \phi_m + \phi_b},$$

with

$$\phi_m = \left(\frac{\lambda_p}{\lambda_m} + \gamma\right)^{\frac{1}{a}}, \qquad \phi_b = \left(\frac{\lambda_p}{\lambda_b} + \gamma\right)^{\frac{1}{a}}.$$

2. *The investment strategy is as follows: Either parental and migrant savings are at a corner and* $w_b'\left(e^{CFB}\right) \geq Max\left\{\tau_p, \tau_m\right\}$*, with* e^{CFB} *such that*

$$w_b'\left(e^{CFB}\right) = \frac{\chi_1}{\delta \chi_2} \frac{u'(Y_1)}{u'(Y_2)},$$

or

$$w_b'\left(e^{FB}\right) = Max\left\{\tau_p, \tau_m\right\},$$

and the family only saves on the account that yields the highest interest rate, so as to satisfy

$$Max\left\{\tau_p, \tau_m\right\} = \frac{\chi_1}{\delta \chi_2} \frac{u'(Y_1)}{u'(Y_2)},$$

where

$$\chi_1 = \lambda_m \alpha_{m1}^{1-a} + (\lambda_p + \gamma\lambda_m)\,\alpha_{p1}^{1-a}, \tag{7}$$

$$\chi_2 = \lambda_m \alpha_{m2}^{1-a} + \lambda_b \alpha_b^{1-a} + (\lambda_p + \gamma\lambda_m + \gamma\lambda_b)\,\alpha_{p2}^{1-a}. \tag{8}$$

Proof. Provided in Appendix 1. ■

The first point of Proposition 1 pertains to intra period transfers (r, t_m, t_b). It tells us that agents consume a fixed share of aggregate resources. One can see that we would have obtained a qualitatively similar result in the absence of altruism ($\gamma = 0$). At the first best, every agent should thus aim at maximizing the present value of aggregate family income. In particular, family investment strategies (s_m, s_p, e) are such that each monetary unit that is sacrificed in period 1 is invested in the strategy that yields the highest marginal return. Notice that the assumption that $w_b'(0) \to +\infty$ ensures that the family invests a strictly positive amount in sibling's education $e > 0$, whatever the agents' intertemporal preferences and whatever their endowment in both periods (w_m, w_p). Therefore, the family invests in education first. Then, depending on the agents intertemporal preferences and on their endowment (w_m, w_p), either the family has corner savings $(s_m = s_p = 0)$, or it has interior savings. In the former case, the education level e^{CFB} is constraint in the sense that it is limited by the lack of access to credit, hence the superscript CFB, which stands for *constrained first best*. In the latter case, the first best education level is such that marginal returns to education are equal to the highest interest rate available to family members $Max\{\tau_p, \tau_m\}$. Indeed, as already mentioned, because $w_b'(0) \to +\infty$, education always yields the highest marginal returns for small amounts invested. Then, because of decreasing marginal returns to education, there exists a level of investment noted e^{FB}, above which marginal returns to education become smaller than the highest interest rate $Max\{\tau_p, \tau_m\}$.

3.3 Voluntary contribution to old age care

Solving the model backwards, we first analyze the subgame of voluntary contribution to old age care between children in period 2, taking the levels of education of the sibling and savings of the migrant and the parent as given. In the following proposition, we analyze the solution to the subgame of voluntary contribution with a focus on the endowment of the younger sibling. We show that if the endowment of this sibling is insufficient, he/she will not contribute to old age care. In contrast, in order to focus on the set of relevant cases, we assume that the migrant is sufficiently endowed and always provides strictly positive support at parent's old age. Formally, this means that the migrant's first order condition with respect to his/her second period transfer t_m is always satisfied with equality:

$$\frac{\partial U}{\partial t_m} = -u'(c_{m2}) + \gamma u'(c_{p2}) = 0.$$

Making use of CES preferences, one can rewrite this first order condition as $c_{p2} = \omega c_{m2}$, where $\omega \equiv \gamma^{\frac{1}{a}} \in (0, 1]$. Let us now present the proposition characterizing the subscription subgame equilibrium.

Proposition 2 ***Voluntary contribution to old age care:***

- *If the endowment of the young sibling is insufficient, that is if*

$$\frac{y_b}{y_b + y_{m2} + y_{p2}} < \frac{1}{2+\omega} \iff e < \tilde{e}_b \equiv w_b^{-1}\left(\frac{y_{m2} + y_{p2}}{1+\omega}\right), \tag{9}$$

then the contribution subgame has the following corner solution:

$$\begin{aligned} t_b^* &= 0, \\ t_m^* &= y_{m2} - \frac{1}{1+\omega}\left(y_{m2}+y_{p2}\right) > 0. \end{aligned} \tag{10}$$

In this case, equilibrium levels of consumption are given by

$$\begin{aligned} c_b\left(t_m^*, t_b^*\right) &= w_b\left(e\right), \\ c_{m2}\left(t_m^*, t_b^*\right) &= \frac{1}{1+\omega}\left(y_{m2}+y_{p2}\right), \\ c_{p2}\left(t_m^*, t_b^*\right) &= \frac{\omega}{1+\omega}\left(y_{m2}+y_{p2}\right). \end{aligned}$$

- *If the endowment of the young sibling is large enough, that is, if* $e \geq \tilde{e}_b$*, then the contribution subgame has the following interior solution:*

$$t_b^* = y_b - \frac{1}{2+\omega}\left(y_{m2}+y_b+y_{p2}\right) > 0, \tag{11}$$

$$t_m^* = y_{m2} - \frac{1}{2+\omega}\left(y_{m2}+y_b+y_{p2}\right) > 0. \tag{12}$$

In this case, equilibrium levels of consumption are given by

$$\begin{aligned} c_b\left(t_m^*, t_b^*\right) &= \frac{1}{2+\omega}\left(y_{m2}+y_b+y_{p2}\right), \\ c_{m2}\left(t_m^*, t_b^*\right) &= \frac{1}{2+\omega}\left(y_{m2}+y_b+y_{p2}\right), \\ c_{p2}\left(t_m^*, t_b^*\right) &= \frac{\omega}{2+\omega}\left(y_{m2}+y_b+y_{p2}\right). \end{aligned}$$

Proof. Provided in Appendix 2. ■

Proposition 2 highlights that two cases need to be considered, depending on the sibling's education level. On the one hand, if the sibling's education is too low, namely lower than $\tilde{e}_b$, as defined in equation (9), then the sibling is too poor to contribute to old age support. More precisely, given his/her level of altruism γ, he/she finds it optimal to free ride on the migrant's transfer. On the other hand, if his/her education level is high enough ($e_b \geq \tilde{e}_b$), then the sibling provides an interior transfer. Note that the condition under which an interior solution prevails has an appealing interpretation. It simply states that the sibling's relative endowment must be larger than the share of resources he/she intends to consume. In this case, the migrant's and the sibling's consumption levels are equalized. We also obtain the well-known neutrality result that the consumption of the parent only depends on aggregate family income in period 2 (Bergstrom et al. (1986)). Indeed, the parent's utility is here a public good from the migrant's and the sibling's point of view. Note that the parameter ω is directly interpretable as the weight attributed by children to the parent in terms of resource sharing. Given their level of altruism, children allocate a fraction $1/\left(2+\omega\right) \in [1/3, 1/2]$ of aggregate family resources to their own consumption and a share $\omega/\left(2+\omega\right) \in [0, 1/3]$ to the parent's consumption.

Finally, it is important to point out that the parent only reaps the benefits of the sibling's education if e is at least equal to $\tilde{e}_b$. Below this threshold, education is costly to the parent but does not translate into transfers at old age. Therefore, in equilibrium, either the sibling receives an education level of at least $\tilde{e}_b$, or he/she does not receive any education. In the next subsection, we explore the parent's investment strategy in savings and/or education in more details.

3.4 The parent's investment strategy

We now turn to period 1 and analyze the parent's investment strategy, given his/her receipt of remittances r and his/her observation of migrant savings s_m. The parent has two degrees of freedom in his/her choice of investment since he/she has to determine the amount of savings s_p and the level of education e. We analyze these decisions on (s_p, e) in two steps, which translate these two degrees of freedom into an aggregate amount invested and its allocation between savings and education: In a first step, we determine the optimal vector of investment (s_p, e) for any given level of aggregate investment $S = s_p + e$. Taking account of the impact on equilibrium transfers in period 2, this first step gives us the parent's possibility frontier in the space (c_{p1}, c_{p2}). In a second step, we determine the optimal aggregate investment S from the parent's point of view.

Lemma 1 *For a given amount of aggregate investment S, the parent's optimal allocation between savings and education is given by*

$$\begin{aligned} e^*(S) &= 0,\ \textit{if}\ S \in [0, \tilde{e}_p), \\ &= S,\ \textit{if}\ S \in \left[\tilde{e}_p, e_p^*\right), \\ &= e_p^*,\ \textit{if}\ S \in \left[e_p^*, +\infty\right), \end{aligned}$$

and

$$\begin{aligned} s_p^*(S) &= S,\ \textit{if}\ S \in [0, \tilde{e}_p), \\ &= 0,\ \textit{if}\ S \in \left[\tilde{e}_p, e_p^*\right), \\ &= S - e_p^*,\ \textit{if}\ S \in \left[e_p^*, +\infty\right), \end{aligned}$$

where e_p^* and $\tilde{e}_p$ are respectively such that

$$\begin{aligned} w_b'\left(e_p^*\right) - \tau_p &= 0, \\ (1+\omega)\, w_b(\tilde{e}_p) - (2+\omega)\, \tau_p \tilde{e}_p - y_m &= 0, \end{aligned}$$

with $\tilde{e}_p > \tilde{e}_b$.

Proof. Provided in Appendix 3. ■

For any given amount of aggregate investment S, the parent opts for the strategy that yields the highest total return. We know from Proposition 2 that the sibling does not contribute to old age support if his/her education level is too low. For this reason, if the parent were to invest small amounts, he/she would opt for savings only, even if the prevailing interest rate τ_p is low and even though social marginal returns to education are very large. Moreover, the parent only starts investing in education for $S \geq \tilde{e}_p > \tilde{e}_b$. In other words, he/she does not invest in education for S in the neighborhood of $\tilde{e}_b$, which is the education level that leads the sibling to make interior transfers. The reason thereof is that at $S = \tilde{e}_b$, the transfer is interior but just equal to zero. The investment in education becomes profitable to the parent at a point where the transfer received yields a total return which is higher than that of savings. This result is led by the absence of descending altruism in the model. For the sake of realism, we will focus on cases where the parent makes an interior investment in education, namely when $S \geq \tilde{e}_p$. Notice that this automatically implies that $e > \tilde{e}_b$, which means that the sibling makes a strictly positive contribution in period 2. Education then increases with S as long as $w_b'(e) > \tau_p$. The parent stops increasing his/her investment in education once marginal returns to education and the interest rate at the parent's location are equalized. Additional amounts are then saved. Figure 1 depicts the parent's possibility frontier in the space (c_{p1}, c_{p2}).[4]

FIGURE 1 HERE: The possibility frontier

Let us define $c^*_{p2}(S)$ as the function that maps the parent's total investment in education and savings S into his/her second period consumption level c_{p2}, taking account of both the contribution equilibrium described in Proposition 2 and his/her optimal allocation between education and savings given by Lemma 1. Positive education in equilibrium implies that the parent is willing to invest in education, which entails that his/her aggregate willingness to invest S is at least equal to $\tilde{e}_p$ and hence strictly higher than $\tilde{e}_b$. As a result, the sibling always makes an interior transfer. Therefore, only considering cases where $S \geq \tilde{e}_p$, $c^*_{p2}(S)$ writes

$$\begin{aligned} c^*_{p2}(S) &= \frac{\omega}{2+\omega}\left(y_{m2} + w_b(S)\right), \text{ if } S \in \left[\tilde{e}_p, e^*_p\right), \\ &= \frac{\omega}{2+\omega}\left(y_{m2} + w_b\left(e^*_p\right) + \tau_p\left(S - e^*_p\right)\right), \text{ if } S \in \left[e^*_p, +\infty\right). \end{aligned} \tag{13}$$

Lemma 2 *The optimal amount of parental investment S^* is given by*

$$\begin{aligned} S^* &= S^*_e(y_{p1}) < e^*_p, \text{ if } y_{p1} < \tilde{y}_{p1}, \\ &= S^*_{es}(y_{p1}) \geq e^*_p, \text{ otherwise,} \end{aligned}$$

where S^*_e and S^*_{es} are respectively such that

$$-u'\left(c_{p1}\left(S^*_e\right)\right) + \delta u'\left(c^*_{p2}\left(S^*_e\right)\right)\frac{\omega}{2+\omega}w'_b\left(S^*_e\right) = 0, \tag{14}$$

$$-u'\left(c_{p1}\left(S^*_{es}\right)\right) + \delta u'\left(c^*_{p2}\left(S^*_{es}\right)\right)\frac{\omega}{2+\omega}\tau_p = 0, \tag{15}$$

Proof. Provided in Appendix 4. ■

Lemma 2 indicates that cases of positive investment in education can be of two types: (1) The parent has corner savings and invests S in education only. In this case, which takes place when $y_{p1} < \tilde{y}_{p1}$, the investment level is suboptimal. In other words, the parent would be willing to borrow at the prevailing interest rate τ_p in order to increase his/her investment in education, if possible. In these cases, the liquidity constraint is thus binding. (2) The parent has interior savings and invests in education up to the point where marginal returns to education are equalized to the interest rate at his/her location.

The education level thus depends on remittances through parent's first period income. However, as we show below, the migrant's level of savings also influences the parent's decision. The following proposition describes the parent's reaction to changes in the migrant's decision variables, namely his/her level of savings s_m and remittances r.

[4] As can be seen from Figure 1, the optimal allocation between savings and education from the parent's viewpoint yields a non-convex feasibility set. However, we will restrict our attention to cases where the sibling receives some education: $e > 0$. The portion of the possibility frontier that leads to these cases is concave and hence the problem (at least locally) well-behaved.

Proposition 3 ***Parent's best response:***

1. *The aggregate amount of parental investment S^* increases with remittances. However, a fraction of each unit of remittance is consumed by the parent in period 1:*

$$\frac{\partial S^*}{\partial r} = \frac{\partial e^*}{\partial r} = \frac{u''_{p1}}{u''_{p1} + \delta \left[u''_{p2} \left(\frac{\omega}{2+\omega} w'_b(e^*) \right)^2 + u'_{p2} \frac{\omega}{2+\omega} w''_b(e^*) \right]} \in [0,1], \ \textit{if } S^*(r, s_m) \in \left[\tilde{e}_p, e^*_p \right), \quad (16)$$

$$= \frac{\partial s^*_p}{\partial r} = \frac{u''_{p1}}{u''_{p1} + \delta u''_{p2} \left(\frac{\omega}{2+\omega} \tau_p \right)^2} \in [0,1], \ \textit{if } S^*(r, s_m) \in \left[e^*_p, +\infty \right), \quad (17)$$

2. *The aggregate amount of parental investment S^* decreases with migrant savings:*

$$\frac{\partial S^*}{\partial s_m} = \frac{\partial e^*}{\partial s_m} = -\frac{\delta u''_{p2} \left(\frac{\omega}{2+\omega} \right)^2 w'_b(e^*) \tau_m}{u''_{p1} + \delta \left[u''_{p2} \left(\frac{\omega}{2+\omega} w'_b(e^*) \right)^2 + u'_{p2} \frac{\omega}{2+\omega} w''_b(e^*) \right]} < 0, \ \textit{if } S^*(r, s_m) \in \left[\tilde{e}_p, e^*_p \right), \quad (18)$$

$$= \frac{\partial s^*_p}{\partial s_m} = -\frac{\delta u''_{p2} \left(\frac{\omega}{2+\omega} \right)^2 \tau_p \tau_m}{u''_{p1} + \delta u''_{p2} \left(\frac{\omega}{2+\omega} \tau_p \right)^2} < 0, \ \textit{if } S^*(r, s_m) \in \left[e^*_p, +\infty \right). \quad (19)$$

Proof. We obtain these results by applying the implicit function theorem to equations (14) and (15). ■

Corollary 1 *In cases where the education level is suboptimal, education increases with remittances and decreases with migrant savings.*

Proposition 3 describes two effects of the migrant's decisions on the parent's investment behavior.

First, the parent's investment level is positively influenced by remittances. This is expected as a higher first period income increases the parent's willingness to transfer income to period 2 for consumption smoothing purposes. In particular, when education is impeded by liquidity constraints, remittances provide the parent with liquidities that allow him/her to increase his/her investment level. However, each unit of remittance is only partly invested, because the parent's marginal propensity to consume is strictly positive.

Second, S, and thus e under liquidity constraints, decrease with migrant savings. This eviction effect is due to the fact that the parent benefits from migrant savings through transfers in period 2, which reduces his/her willingness to transfer resources to period 2 by means of investment in education or savings.

3.5 The migrant's incentives to remit and save

As shown above, while migrant remittances foster parental investment, migrant savings have a disincentive effect on it. The migrant takes both effects into account when deciding on his/her remittance and savings behavior. Let us define c^*_{m2} as the level of c_{m2} which takes account of equilibrium family transfers (Proposition 2) and of the parental investment strategy (Lemma 1 and Lemma 2):

$$c^*_{m2}(r, s_m) = \frac{1}{2+\omega} \left(y_{m2}(s_m) + w_b(S^*(r, s_m)) \right), \text{ if } S^*(r, s_m) \in \left[\tilde{e}_p, e^*_p \right),$$

$$= \frac{1}{2+\omega} \left(y_{m2}(s_m) + w_b\left(e^*_p\right) + \tau_p \left(S^*(r, s_m) - e^*_p \right) \right), \text{ if } S^*(r, s_m) \in \left[e^*_p, +\infty \right).$$

The migrant's marginal utility of remittances is given by

$$\frac{\partial U_m}{\partial r} = -u'(c_{m1}) + \delta u'(c^*_{m2}) \frac{\partial c^*_{m2}}{\partial r} + \gamma \left(\frac{\partial U^*_p}{\partial r} + \frac{\partial U^*_p}{\partial e} \frac{\partial e^*}{\partial r} + \frac{\partial U^*_p}{\partial s_p} \frac{\partial s^*_p}{\partial r} \right).$$

Making use of the envelope theorem, the equilibrium transfers and the parental investment strategy, this expression boils down to

$$\begin{aligned} \frac{\partial U_m}{\partial r} &= -u'(c_{m1}) + \delta u'(c^*_{m2}) \frac{1}{2+\omega} \left(\frac{\partial e^*}{\partial r} + \omega \right) w'_b(e^*), \text{ if } S^*(r, s_m) \in \left[\tilde{e}_p, e^*_p\right), \\ &= -u'(c_{m1}) + \delta u'(c^*_{m2}) \frac{1}{2+\omega} \left(\frac{\partial s^*_p}{\partial r} + \omega \right) \tau_p, \text{ if } S^*(r, s_m) \in \left[e^*_p, +\infty\right). \end{aligned} \quad (20)$$

Similarly, the marginal utility of savings writes

$$\begin{aligned} \frac{\partial U_m}{\partial s_m} &= -u'(c_{m1}) + \delta u'_2(c^*_{m2}) \frac{1}{2+\omega} \left(1 + \frac{w'_b(e^*)}{\tau_m} \frac{\partial e^*}{\partial s_m} + \omega \right) \tau_m, \text{ if } S^*(r, s_m) \in \left[\tilde{e}_p, e^*_p\right), \\ &= -u'(c_{m1}) + \delta u'(c^*_{m2}) \frac{1}{2+\omega} \left(1 + \frac{\tau_p}{\tau_m} \frac{\partial s^*_p}{\partial s_m} + \omega \right) \tau_m, \text{ if } S^*(r, s_m) \in \left[e^*_p, +\infty\right). \end{aligned} \quad (21)$$

What should be retained from these expressions is that: (1) As for any kind of investment, each unit of remittance or saving entails a disutility of $u'(c_{m1})$ in period 1 in exchange of a higher level of consumption in period 2. Because of this similarity between both decisions, the migrant simply aims at maximizing total returns to his/her investment. (2) Because of ascending altruism, the migrant does not only care about his/her own consumption, but also about the parent's consumption in period 2. For this reason, the term ω, which gives the share of family income devoted to parent's consumption, appears in the migrant's subjective marginal return to remittances and savings. (3) Finally, as already noted, the parent only invests a fraction of remittances received and reduces his/her investment if migrant savings increase. Therefore, one unit of remittance does not translate into one unit of investment at the family level, nor does one unit of migrant saving. Interestingly, these effects are of exactly the same magnitude if the parent has interior savings. In other words, one unit of remittance or one unit of migrant saving result in the same amount invested at the family level net of all eviction effects. The only difference is the rate of return, which depends on the location where this amount is saved, namely τ_p at the parent's location and τ_m at the migrant's place of residence. This equivalence does not hold under corner parental savings, as we show in the next proposition.

Proposition 4 ***Aggregate family investment:***

1. *Under interior parental savings, one unit of migrant saving and one unit of remittance yield the same amount of investment at the family level:*

$$1 + \frac{\tau_p}{\tau_m} \frac{\partial s^*_p}{\partial s_m} = \frac{\partial s^*_p}{\partial r}. \quad (22)$$

2. *Under corner parental savings, one unit of migrant saving yields a higher amount of investment at the family level than one unit of remittance:*

$$1 + \frac{w'_b(e^*)}{\tau_m} \frac{\partial e^*}{\partial s_m} = \frac{\partial e^*}{\partial r} + \phi > \frac{\partial e^*}{\partial r}, \quad (23)$$

where

$$\phi = \frac{\delta u'_{p2} \frac{\omega}{2+\omega} w''_b(e^*)}{u''_{p1} + \delta u''_{p2} \left(\frac{\omega}{2+\omega} w'_b(e^*) \right)^2 + \delta u'_{p2} \frac{\omega}{2+\omega} w''_b(e^*)} \in [0, 1].$$

Proof. These results can be obtained by substituting expressions (19), (17), (18), and (16) into equations (22) and (23). ■

Corollary 2 *Under interior parental savings, the migrant has interior (corner) remittances and corner (interior) savings if and only* $\tau_p \geq (<) \tau_m$.

Proof. Indeed, in light of equations (20) and (21) and of Proposition 4, it can be seen that marginal returns to remittances are higher than that of savings if and only if $\tau_p \geq \tau_m$. ■

Before discussing Proposition 4, it should be noted that the terms τ_p/τ_m and $w_b'(e^*)/\tau_m$, which appear respectively in equations (22) and (23), indicate that an investment made by the migrant at a constant rate of return of τ_m generates a change in the parent's investment, which yields a marginal return of τ_p or $w_b'(e^*)$, depending on whether the parent has interior or corner savings. Once this effect is taken into account, Proposition 4 states that, under interior parental savings, remittances and migrant savings result in the same amount of investment at the family level. Remittances are (partly) invested in savings at the parent's location, where they yield τ_p, while migrants savings yield τ_m for the same amount invested. As a consequence, the migrant opts for the strategy which yields the highest marginal return and remits if and only if $\tau_p \geq \tau_m$, and saves otherwise. Under corner parental savings, another distortion appears. Because the parent is liquidity constrained, his/her marginal propensity to consume is higher. As a result, the family investment is higher if the migrant saves than if he/she remits in order to have the parent invest on his/her behalf. Therefore, if the migrant anticipates that in equilibrium the parent will end up with corner savings, then his/her perceived returns to remittances are lower, which reduces the incentive to invest in the sibling's education. Still, because returns to education are initially very high, the migrant is likely to have interior remittances when parental savings are at a corner in equilibrium.[5]

In the next subsection, we summarize the possible equilibria.

3.6 The equilibrium level of education

In the absence of borrowing in the model, the equilibrium level of education depends on the parent and the migrant's initial endowments w_p and w_m, which determine their willingness to transfer resources to period 2.

On the one hand, if the parent is poor, and more precisely if w_p is lower than $\tilde{y}_{p1}$, then, in the absence of remittances, the level of education is suboptimally low, according to Lemma 2. Moreover, in this case, the first unit of migrant remittance increase the parent's investment in education, by Proposition 3. The migrant remits if and only if, for the first unit of remittance, marginal returns to remittances $\left(\frac{\partial e^*}{\partial r} + \omega\right) w_b'(e^*)$ are higher than that of savings $\left(\frac{\partial e^*}{\partial r} + \phi + \omega\right) \tau_m$. Because marginal returns to education are initially very high, this condition is likely to be satisfied when the parent is very poor. Indeed, in this case the investment in education in the absence of remittances is low and hence marginal returns are high. Then depending on the migrant's income w_m, the parent may end up with corner or interior savings. In any case, when w_p is lower than $\tilde{y}_{p1}$ and interior remittances are observed, we now that the migrant sends remittances for the purpose of investing in education.

On the other hand, if parental wealth w_p is higher than $\tilde{y}_{p1}$, then he/she has interior savings and the migrant remits if and only if $\tau_p \geq \tau_m$, by Corollary 2.

[5] This point is discussed in the next subsection.

We can now provide a normative assessment of the education level in the different potential equilibria. As a reminder, the first best level of education is such that $w_b'\left(e^{FB}\right) = Max\left\{\tau_p, \tau_m\right\}$.

Proposition 5 ***The equilibrium level of education:***

1. *Under corner parental savings, the education level is always inefficiently low.*

2. *Under interior parental savings, the education level is efficient if and only if $\tau_p \geq \tau_m$, otherwise it is too high.*

Proof.

1. **Case 1: corner parental savings:** $s_p^* = 0$: In this case, we know that $w_b'(e^*) > \tau_p$. Two cases can then be encountered. Either $\tau_p > \tau_m$, which implies that the education level is inefficiently low because $w_b'(e^*) > w_b'\left(e^{FB}\right) = \tau_p$; or $\tau_p \leq \tau_m$. In the latter situation, the first best level is such that $w_b'\left(e^{FB}\right) = \tau_m$. In this case also, we can show that the education level is too low. Indeed, if the migrant has corner savings, then in equilibrium returns to remittances $\left(\frac{\partial e^*}{\partial r} + \omega\right) w_b'(e^*)$ are higher than that of savings $\left(\frac{\partial e^*}{\partial r} + \phi + \omega\right) \tau_m$. If instead migrant savings are interior, then marginal returns are equalized. Because $\phi > 0$, we always have that $w_b'(e^*) > w_b'\left(e^{FB}\right) = \tau_m$.

2. **Case 2: interior parental savings:** $s_p^* > 0$: In this case, we know that $w_b'(e^*) = \tau_p$. Either $\tau_p \geq \tau_m$, which leads to efficient education since $w_b'\left(e^{FB}\right) = \tau_p$; or $\tau_p < \tau_m$, in which case the level of education is too high because $w_b'(e^*) = \tau_p < \tau_m = w_b'\left(e^{FB}\right)$.

■

Proposition 5 implies first that interior parental savings are a necessary condition for efficient education. It should be noted that, when parental savings are at a corner, the education level never approaches the first best level in the sense that if $e^*$is lower than e^{FB}, then it cannot be in the neighborhood of e^{FB}. Indeed, we have seen that, in this case, the migrant anticipates that the parent will divert a larger share of remittances sent for his/her immediate consumption. As a result, either the migrant sends more and makes the parent have interior savings, which leads to first best education (provided $\tau_p \geq \tau_m$), or he/she sends less and saves instead. Second, we see that interior savings are not sufficient to reach the first best level of education. In cases where $\tau_p < \tau_m$, it would be socially preferable to save at the migrant's place instead of saving at the parent's place and investing in education for the monetary units whose marginal return $w_b'(e)$ falls in the interval $[\tau_p, \tau_m]$

The two main lessons we draw from the model are the following. First, we see that migrant remittances increase the family investment in education in poor families where $w_p < \tilde{y}_{p1}$. The migrant should anticipate this effect and hence send remittances for that purpose. We have indeed shown that the migrant and the parent have aligned incentives as they both benefit from investing in the sibling's education when marginal returns are high. Therefore, the education motive for migrant remittances takes place in poor families, where liquidity constraints are binding (in the absence of remittances) and where children support is needed at parent's old age. Second, if the parent and/or the migrant's income (or wealth) is high enough, then the education level is efficient (provided $\tau_p \geq \tau_m$). This result is interesting per se because on the one hand the parent is selfish and on the other hand different eviction effects take place in the model. This includes the fact that the parent, who serves as an agent for the family investment in education, allocates part of the remittances received to immediate consumption. This effect is indeed compensated by another eviction effect, according to which the parent disinvests when the migrant saves.

4 Empirical analysis

We now turn to a first empirical exploration of the education/old age care motive that we have highlighted in the model.

4.1 Data

The data requirement are important. We need details on transfers made to parents by children currently living abroad. This information is not easily available. Most existing household surveys collect data on transfers received by a household over a period, but do not identify precisely who had made the transfer. These surveys sometimes collect only the total amount received, say from people living abroad, but not the amount per transfer. Such data do not allow to distinguish whether the transfer was made by a child or by any other relatives.

We use data extracted from a three-wave households panel data survey conducted in the State of Jharkhand, India, between 2004 and 2009 by the NGO PRADAN (Professional Assistance for Development Action) and the University of Namur. The survey, designed to study the effect of being member of a self-help group, collected an extensive list of indicators on the household and individuals including relevant information on age of individuals, schooling, remittances and household assets. The panel covers about 1000 households and has a dropout rate of less than 10% (Baland et al. (2011)). Only the last two waves provide relevant information, for instance a small set of characteristics of people who had made transfers to households, for this analysis. We thus use the two waves of the panel collected in 2006 and in 2009. We restrict the data to households that have at least one child who had migrated to a different State in India or abroad by 2006 or by 2009. A household member is defined as migrant if he/she resides abroad or in another Indian State. We put together between countries and between States transfers because India has a large land size (3.287 million km^2) and the distance between two States can get as large a 1000 km. In this context, monitoring the use of transfers sent from a different State or a different country poses comparable types of difficulties to the sender. Table 1 presents some descriptive statistics of the sample. About 55% of the households had a migrant child in 2006 during the first wave of the survey. By 2009, almost all household had a migrant child. The average amount transferred in 2006 is 2050 INR (30 $US), about half of what is observed in 2009. This amount is low because a household that had no migrant child in 2006 received zero transfer in 2006. The average number of school age (6-17 years) children per household is 1.8. In the state of Jharkhand, there are differences in schooling costs across school levels. Primary school education is highly subsidized and parents incur relatively low schooling costs as opposed to secondary education where schooling costs are higher. Following this heterogeneity in schooling costs, we subdivide school-age children into three sub groups: children of primary school-age (6-10 years), children of secondary school-age (11-15 years) and children of secondary school-age (16-17 years).

TABLE 1 HERE: Descriptive statistics

4.2 The empirical model

The empirical model aims at identifying the education/old age care motive for migrant remittances and at testing the model's predictions.

First, regarding identification, our strategy is based on the idea that the number of school age siblings in the family has different implications on the migrant's behavior, depending on his/her objective. Because of informational asymmetries and the lack of enforcement devices, the migrant has to rely on the parent's decision in order to invest in his/her region of origin. If the migrant competes with siblings for inheritance and sends remittances for this purpose, then he/she certainly does not want that the position of the sibling be improved thanks to a higher level of education. Therefore, under the strategic bequest motive, we expect remittances to be relatively low when siblings are attending school and relatively high when siblings have left school. The education/old age care motive leads to exactly opposite predictions as the migrant's aim is to improve education. More generally, any type of alternative investment goal, such as housing or business, gives rise to the same opposition. Indeed, the presence of school age children in the household should deter remittances sent for a private investment purpose, as education opportunities may divert remittances, which are allocated by parents, from their primary investment goal.

Second, the model predicts that the education/old age care motive should take place in relatively poor families, where liquidity constraints are binding and where, as a result, remittances have a positive impact on education. Hence, under the education motive, the presence of school-age children should attract remittances, mainly in poor families. We estimate two equations.

Because our identification is based on within variation in household composition, the first equation is estimated with family fixed effects:

$$r_{it} = \alpha_i + \beta * n_{it} + \gamma * w_i * n_{it} + \delta * m_{it} + h_i + \mu_{it}, \tag{24}$$

where r_{it} stands for total remittances received by household i in year t, n_{it} is the number of school age children in household i in year t, w_i is a measure of household wealth, m_{it} is the number of migrant children in household i in year t, h_i is the household fixed effect, and μ_{it} is an error term. More specifically, w_i is a measure of land surface that we use as a proxy for wealth. Alternative measures of wealth have been tested as well. The estimations results with these alternative measures are almost identical to those presented in the main text with land as a proxy for wealth.[6] The main variable of interest is n_{it}, the number of school-age children. Notice that we make use of the age of siblings rather than school attendance per se, since it gives a strictly exogenous variation. With the use of actual school attendance, estimation of equation (24) would be potentially affected by reverse causality. Indeed, if education is partly financed by remittances, a shock affecting the migrant's income can negatively affect n_{it}, if n_{it} measures the number of siblings actually attending school. This reverse causal relationship would still be an indication that remittances and education are positively related, which would suggest that remittances are sent for that purpose. Nevertheless, in order to have a clean causal relationship and to avoid biases in the estimation of the other coefficients, we stick to the demographic composition and hence opt for the age of siblings. If the education motive prevails, we expect that $\partial r_{it}/\partial n_{it} \geq 0$. Alternatively, if the strategic bequest or the private investment motive is the most

[6] Two alternative proxies are used for wealth. The first is the number of durables goods owned by the household. The set of durables considered has 18 items and includes fan, fridge, gas stove, motorcycle pressure cooker, pumpset, radio, tv and camera. The second proxy used is annual household expenditures net of all transfers. Results with these alternative measures are available upon request.

relevant, we should have $\partial r_{it}/\partial n_{it} < 0$. According to equation (24), the effect of n_{it} on r_{it} is given by

$$\frac{\partial r_{it}}{\partial n_{it}} = \beta + \gamma w_i.$$

Because the model predicts that $\partial r_{it}/\partial n_{it}$ is negatively affected by household wealth, we introduce an interaction term between n_{it} and family wealth w_i. Indeed, the number of school age siblings should not impact remittances received if the family can reach first best education levels, even in the absence of remittances. Therefore, for high levels of wealth, $\partial r_{it}/\partial n_{it} = 0$, while for lower levels $\partial r_{it}/\partial n_{it} > 0$. As a result, we expect that $\gamma < 0$ and $\beta > 0$. In contrast, the strategic bequest motive results in $\beta \leq 0$. Regarding the interaction term, we can expect a negative sign for γ, because the deterrent effect of school age siblings on remittances should be stronger when the inheritance at stake is larger. Quite naturally, since r_{it} measures the aggregate amount of remittances received, we also control for the number of migrants. In the model, we only have a single migrant. The extension to mutliple migrants is not trivial as strategic interaction between migrants would come into play. However, we can reasonably guess that total remittances received are increasing in m_{it} ($\delta > 0$), even though the education of siblings can be seen as a club good in the migrants' viewpoint, which could give rise to free riding.

The second equation that we estimate looks more closely at old age support. In the terms of the model, we want to capture the second period transfer of the migrant t_m. To this end, we relate remittances directly to family wealth and to the age of the parents. More specifically, we estimate the following equation with random effects:

$$r_{it} = \lambda_0 + \lambda_1 * w_i + \lambda_2 * a_i + \lambda_3 m_{it} + \lambda_4 \bar{m}_i + \lambda_5 * n_{it} + \lambda_6 * \bar{n}_i + \epsilon_{it}, \tag{25}$$

where a_i is the age of the household head, $\bar{n}_i$ and $\bar{m}_i$ are time averages of n_{it} and m_{it} respectively, and ϵ_{it} is an error term. If migrants support their parents at old age, we expect that $\lambda_2 > 0$. Besides, according to Proposition 2, we should have $\lambda_1 < 0$, because the need for transfers will be lower if parents are rich. The strategic bequest theory again predicts an opposite sign ($\lambda_1 > 0$), given that rich parents should be able to attract more transfers. Because our variable of interest w_i is time invariant, we cannot obtain an estimate of its coefficient λ_1 in (25) with household fixed effects. Therefore, we make use of random effects. However, in order to control as much as we can for observed heterogeneity, we introduce time averages of time-varying variables, as suggested by Mundlak (1978). Notice that, according to the education motive, we also expect that $\lambda_5 > 0$ for the reasons exposed above.

4.3 Estimation results

The estimation results of the first model (equation 24) are presented in table 2.

TABLE 2 HERE: Estimation results of the first model

We test different specifications with different age categories for defining the number of school age siblings. For each of them, we estimate the model with and without the interaction term between the number of school age siblings and land. Specifically, columns (1) and (2) report the results for all age categories grouped together, with and without the interaction term. Similarly, columns (3) and (4) provide our estimates with the age of primary school pupils; (5) and (6) for lower secondary school; (7) and (8) for upper secondary school.

First, as expected, the effect of the number of migrants m is significantly positive across all specifications.

Second, as regards the coefficient of the number of school age siblings β, it turns out to be significantly positive (with a p-value below 5%) for upper secondary school only. In the other cases, the point estimate is positive, with the exception of primary school age, but not significantly different from zero. These results provide thus more support to the education/old age care motive than to the strategic bequest or private investment motive. We interpret the fact that the effect of the number of siblings of upper secondary school age is the highest in the following way: As already mentionned, it is the education level at which public subsidies are the lowest. It might thus be at this age that the probability to drop out is the highest. This is therefore the age at which migrant remittances, which allow to relax the parent's liquidity constraint, could have the highest marginal return by allowing the sibling to achieve one additional year of education.

Finally, the coefficient of the interaction term between the number of school age siblings and land, which was expected to be negative, is not significantly different from zero. Our interpretation is that the sample being essentially composed of poor households, liquidity constraints seem to be binding for most of them. As a result, the effect of n on remittances remains positive across all wealth levels in the data.

The estimation of the second model (25) are presented in Table 3.

TABLE 3 HERE: Estimation results of the second model

Different specifications are again tested with different age categories for defining n_{it} and $\bar{n}_i$. Column (1) reports the estimation results for all school-age categories grouped together. Columns (2) to (4) consider successively primary school, lower secondary and higher secondary pupils. Column (5) considers all school age categories, but taken separately.

Across all specifications, $\lambda_1 < 0$ and $\lambda_2 > 0$, as expected. Put differently, poor and/or old parents attract more remittances, which we interpret as follows. On the one hand, the negative effect of wealth contradicts the strategic bequest motive, especially because wealth is proxied by land ownership. Indeed, land is the typical heritable asset. Under imperfect land markets, it is also illiquid, which makes it compatible with the strategic bequest theory, as we discuss in Section 2.[7] On the other hand, the combined effects of wealth and age of parents supports the old age care motive, according to which children, and migrants in particular, provide support to old parents, especially when they are poor.

Finally, consistently with fixed effect estimation, we see that the effect of the number of school-age siblings is significantly positive only when higher secondary pupils are considered.

5 Conclusion

In this paper, we have investigated the interplay between migrant remittances, education and old age support within households in developing countries. We have shown both theoretically and empirically that migrant children, originating from relatively poor families and who anticipate that they will need to make transfers to their old parents in the future, either by altruism or by social obligation, have an interest to contribute to their young siblings' education.

More precisely, the model highlights that, if they anticipate that all children will make interior transfers to parents at old age, then both the parent and the migrant internalize the aggregate family income when making their investment decisions. In particular, selfish parents internalize the young sibling's earnings and invest in education. Because the migrant and the parent's decisions are made sequentially, the migrant's

[7] This is confirmed by the fact that no sale transaction over land has been registered during the survey period.

behavior has an impact on the parent's decisions: while remittances foster parental investment, migrant savings have an opposite disincentive effect.

Two types of situations may then arise. Either the migrant and the parent are rich enough and the parent ends up with interior savings, or they are not and the parent faces liquidity constraints in equilibrium. In the former situation, we have shown that one unit of remittance and one unit of migrant saving produced the same amount of aggregate investment at the family level. As a result, the migrant simply invests where marginal returns are the highest: he/she sends remittances if returns to savings are higher at the parent's location and saves in his/her host region otherwise. Also, the parent invests in education at an optimal level. In the case where liquidity constraints are binding, the parent allocates a higher fraction of remittances to current consumption and investment in education is suboptimal. However, this is also the situation where migrant remittances have a positive effect on education.

Our empirical analysis tries to identify the education motive for remittances by opposing the predictions of our model to the those of the strategic bequest and private investment motive. We conjecture that migrants whose aim is to foster education send more remittances when their siblings are of school age and potentially less after. On the contrary, migrants with a private investment goal or who competes with siblings for inheritance send potentially less remittances when the parent can invest them in education and potentially more after. We exploit exogenous variation in household composition and find more support for the education motive. Also, the old age support story is supported by the fact that poorer and older parents tend to receive more transfers from migrants. Globally, our results indicate that the tradeoff between altruism and bequest motives does not appear clearly in our data. This does not mean that the bequest motive is absent, but at least that it is dominated by the education/old age care motive. It would be interesting to estimate how this tradeoff is resolved in different economic and institutional contexts.

References

Adams, Richard H, J. (1998). Remittances, investment, and rural asset accumulation in pakistan. *Economic Development and Cultural Change*, 47(1), 155–73.

Adams Jr., R. H. & Cuecuecha, A. (2010). Remittances, household expenditure and investment in guatemala. *World Development*, 38(11), 1626–1641.

Baland, J.-M., Demont, T., Somanathan, R., & Tenikue, M. (2011). *Microfinance mechanisms: evidence from observational panel data about Self-Help Groups in India*. Technical report, University of Namur.

Baland, J.-M. & Robinson, J. A. (2000). Is child labor inefficient? *Journal of Political Economy*, 108(4), 663–679.

Becker, G. S. (1974). A theory of social interactions. *Journal of Political Economy*, 82(6), 1063–93.

Bergstrom, T., Blume, L., & Varian, H. (1986). On the private provision of public goods. *Journal of Public Economics*, 29(1), 25–49.

Bernheim, B. D., Shleifer, A., & Summers, L. H. (1985). The strategic bequest motive. *Journal of Political Economy*, 93(6), 1045–76.

Cameron, L. A. & Cobb-Clark, D. A. (2001). *Old-Age Support in Developing Countries: Labor Supply, Intergenerational Transfers and Living Arrangements*. IZA Discussion Papers 289, Institute for the Study of Labor (IZA).

Cox, D. (1987). Motives for private income transfers. *Journal of Political Economy*, 95(3), 508–46.

De Arcangelis, G., Joxhe, M., McKenzie, D., Tiongson, E., & Yang, D. (2015). Directing remittances to education with soft and hard commitments: Evidence from a lab-in-the-field experiment and new product take-up among filipino migrants in rome. *Journal of Economic Behavior & Organization*, 111(C), 197–208.

de la Briere, B., Sadoulet, E., de Janvry, A., & Lambert, S. (2002). The roles of destination, gender, and household composition in explaining remittances: an analysis for the dominican sierra. *Journal of Development Economics*, 68(2), 309–328.

Delpierre, M. & Verheyden, B. (2014). Remittances, savings and return migration under uncertainty. *IZA Journal of Migration*, 3(1), 1–43.

Edwards, A. C. & Ureta, M. (2003). International migration, remittances, and schooling: evidence from el salvador. *Journal of Development Economics*, 72(2), 429–461.

Gallego, J. M. & Mendola, M. (2009). Labor migration and social networks participation in southern mozambique. *Centro Studi Luca d'Agliano Development Working Papers*, 279.

Goetghebuer, T. & Platteau, J.-P. (2010). Inheritance patterns in migration-prone communities of the peruvian highlands. *Journal of Development Economics*, 93(1), 71–87.

Hoddinott, J. (1992). Rotten kids or manipulative parents: Are children old age security in western kenya? *Economic Development and Cultural Change*, 40(3), 545–565.

Hoddinott, J. (1994). A model of migration and remittances applied to western kenya. *Oxford Economic Papers*, 46(3), 459–76.

Lillard, L. A. & Willis, R. J. (1997). Motives for intergenerational transfers: Evidence from malaysia. *Demography*, 34(1), 115–134.

Lucas, R. E. B. & Stark, O. (1985). Motivations to remit: Evidence from botswana. *Journal of Political Economy*, 93(5), 901–18.

Medina, C. & Cardona, L. (2010). The effects of remittances on household consumption, education attendance and living standards: the case of colombia. *Lecturas de Economia*, (72), 11–44.

Mundlak, Y. (1978). On the pooling of time series and cross section data. *Econometrica*, 46(1), 69–85.

Osili, U. O. (2004). Migrants and housing investments: Theory and evidence from nigeria. *Economic Development and Cultural Change*, 52(4), 821–49.

Rapoport, H. & Docquier, F. (2006). The economics of migrants' remittances. *Handbook on the Economics of Giving, Reciprocity and Altruism*, 1, 1135–1198.

Stark, O. & Falk, I. (1998). Transfers, empathy formation, and reverse transfers. *American Economic Review*, 88(2), 271–76.

Stark, O. & Levhari, D. (1982). On migration and risk in ldcs. *Economic Development and Cultural Change*, 31(1), 191–96.

Stohr, T. (2015). Siblings' interaction in migration decisions: who provides for the elderly left behind? *Journal of Population Economics*, 28(3), 593–629.

World-Bank (2016). *Migration and Remittances Factbook 2016, Third Edition*. Number 23743 in World Bank Publications. The World Bank.

Yang, D. (2008). International migration, human capital, and entrepreneurship: Evidence from philippine migrants exchange rate shocks. *The Economic Journal 118*, 118(531), 591–630.

6 Appendix 1: Proof of Proposition 1

At the First Best, the social planner seeks to maximize the following objective function:

$$\begin{aligned} W &= \lambda_m \left[u\left(c_{m1}\right) + \delta u\left(c_{m2}\right) + \gamma\left(u\left(c_{p1}\right) + \delta u\left(c_{p2}\right)\right)\right] \\ &\quad + \lambda_b \delta \left[u\left(c_b\right) + \gamma u\left(c_{p2}\right)\right] \\ &\quad + \lambda_p \left[u\left(c_{p1}\right) + \delta u\left(c_{p2}\right)\right], \end{aligned}$$

where $\{\lambda_p, \lambda_m, \lambda_b\}$ are the Pareto weights attributed to each agent.

We start by determining the First Best level of remittances, which gives us the optimal distribution of family resources in period 1. To this end, we take the first order condition with respect to r:

$$\begin{aligned} \frac{\partial W}{\partial r} &= \lambda_p u'\left(c_{p1}\right) + \lambda_m \left[-u'\left(c_{m1}\right) + \gamma u'\left(c_{p1}\right)\right] = 0 \\ \iff & \quad u'\left(c_{m1}\right) = \frac{\lambda_p + \gamma\lambda_m}{\lambda_m} u'\left(c_{p1}\right). \end{aligned}$$

Applying CES preferences, we obtain

$$\frac{\partial W}{\partial r} = 0 \iff c_{p1} = \phi_m c_{m1},$$

where

$$\phi_m = \left(\frac{\lambda_p}{\lambda_m} + \gamma\right)^{\frac{1}{a}}.$$

Combining with the budget constraint, which imposes that

$$c_{p1} + c_{m1} = Y_1,$$

we end up with equations (2) and (3).

Similarly, in period 2, First Best transfer levels $\left\{t_m^{FB}, t_b^{FB}\right\}$ are respectively such that

$$\begin{aligned} \frac{\partial W}{\partial t_m} &= \lambda_p \delta u'\left(c_{p2}\right) + \lambda_m \delta \left[-u'\left(c_{m2}\right) + \gamma u'\left(c_{p2}\right)\right] = 0 \\ \iff & \quad u'\left(c_{p2}\right) = \frac{\lambda_m}{\lambda_p + \gamma\lambda_m} u'\left(c_{m2}\right), \end{aligned}$$

and

$$\begin{aligned}\frac{\partial W}{\partial t_b} &= \lambda_p \delta u'(c_{p2}) + \lambda_b \delta\left[-u'(c_b) + \gamma u'(c_{p2})\right] = 0 \\ \iff & u'(c_{p2}) = \frac{\lambda_b}{\lambda_p + \gamma\lambda_b} u'(c_b).\end{aligned}$$

Applying CES preferences, we obtain

$$c_{p2} = \phi_m c_{m2} = \phi_b c_b.$$

Combining with the budget constraint, which imposes that

$$c_{p2} + c_{m2} + c_b = Y_2,$$

with end up with equations (4), (5) and (6).

We now turn to the proof of the second point of Proposition 1. Substituting for the optimal values of the agents' consumption levels, the objective function of the planner becomes

$$\begin{aligned}W\left(r^{FB}, t_m^{FB}, t_b^{FB}\right) &= (\lambda_p + \gamma\lambda_m) u(\alpha_{p1} Y_1) + \lambda_m u(\alpha_{m1} Y_1) \\ &\quad + \delta\left[\lambda_m u(\alpha_{m2} Y_2) + \lambda_b u(\alpha_b Y_2) + (\lambda_p + \gamma\lambda_m + \gamma\lambda_b) u(\alpha_{p2} Y_2)\right].\end{aligned}$$

Applying CES preferences, we obtain

$$W\left(r^{FB}, t_m^{FB}, t_b^{FB}\right) = \chi_1 \frac{Y_1^{1-a}}{1-a} + \delta\chi_2 \frac{Y_2^{1-a}}{1-a},$$

where χ_1 and χ_2 are given by equations (7) and (8), respectively. The first order conditions with respect to the different forms of investment (s_p, s_m, e) are as follows

$$\begin{aligned}\frac{\partial W}{\partial s_p} &= -\chi_1 u'(Y_1) + \delta\chi_2 u'(Y_2)\tau_p \leq 0, \\ \frac{\partial W}{\partial s_m} &= -\chi_1 u'(Y_1) + \delta\chi_2 u'(Y_2)\tau_m \leq 0, \\ \frac{\partial W}{\partial e} &= -\chi_1 u'(Y_1) + \delta\chi_2 u'(Y_2) w_b'(e) = 0.\end{aligned}$$

Because $w_b'(0) \to +\infty$, the last condition is always satisfied with equality.

7 Appendix 2: Proof of Proposition 2

The migrant m and the sibling b determine their transfer non-cooperatively. The objective functions of m and b, which are evaluated in period 2, are respectively given by

$$\begin{aligned}U_{m2} &= u(c_{m2}) + \gamma u(c_{p2}), \\ U_b &= u(c_b) + \gamma u(c_{p2}).\end{aligned}$$

We obtain their reaction function by taking the following first order conditions:

$$\begin{aligned}\frac{\partial U_{m2}}{\partial t_m} &\leq 0 \iff -u'(c_{m2}) + \gamma u'(c_{p2}) \leq 0, \\ \frac{\partial U_b}{\partial t_b} &\leq 0 \iff -u'(c_b) + \gamma u'(c_{p2}) \leq 0.\end{aligned}$$

Under CES preferences, this gives

$$\begin{aligned}
\frac{\partial U}{\partial t_m} &\leq 0 \iff c_{m2} \geq \frac{c_{p2}}{\omega}, \\
\frac{\partial U}{\partial t_b} &\leq 0 \iff c_b \geq \frac{c_{p2}}{\omega},
\end{aligned}$$

where $\omega \equiv \gamma^{\frac{1}{a}} \in (0,1]$, with a the elasticity of substitution.

Let us start by postulating that both m and b provide interior transfers to the parent. In this case, both conditions are satisfied with equality, which implies that $c_{m2} = c_b = c_{p2}/\omega$. Combining with the budget constraint, which imposes that

$$c_{m2} + c_b + c_{p2} = y_{m2} + y_b + y_{p2},$$

we obtain the equilibrium transfers in the interior case, namely expressions (11) and (12).

Of course, this solution is not valid for any set of individual endowments. It is indeed straightforward to show that if $y_b/\left(y_b + y_{m2} + y_{p2}\right) < 1/\left(2+\omega\right)$, then t_b^* would be negative. In other words, the latter inequality determines the condition under which a corner solution for the sibling occurs. In this case, the migrant's level of old age support is only determined by his/her first order condition. Accounting for the fact that $t_b = 0$, solving $c_{p2} = \omega c_{m2}$ for t_m yields equation (10).

8 Appendix 3: Proof of Lemma 1

Let us define $c_{p2}\left(S,e\right)$ as the function that maps the investment strategy, namely the total amount invested S and the amount allocated to education, into the parent's second period consumption level c_{p2}, taking account of the contribution equilibrium described in Proposition 2. For a given level of total investment S, this function writes[8]

$$\begin{aligned}
c_{p2}\left(S,e\right) &= \frac{\omega}{1+\omega}\left(y_{m2} + \tau_p\left(S-e\right)\right), \text{ if } e \in \left[0, \tilde{e}_b\right), \\
&= \frac{\omega}{2+\omega}\left(y_{m2} + w_b\left(e\right) + \tau_p\left(S-e\right)\right), \text{ if } e \in \left[\tilde{e}_b, +\infty\right).
\end{aligned}$$

For a fixed total investment $S = s_p + e$, the disutility associated to a lower level of first period consumption remains obviously constant, whatever the fraction allocated to education. Therefore, the optimal investment strategy just aims at maximizing $c_{p2}\left(S,e\right)$ with respect to e.

The partial derivative with respect to e is given by

$$\begin{aligned}
\frac{\partial c_{p2}\left(S,e\right)}{\partial e} &= \frac{\omega}{1+\omega}\left(-\tau_p\right) < 0, \text{ if } e \in \left[0, \tilde{e}_b\right), \\
&= \frac{\omega}{2+\omega}\left(w_b'\left(e\right) - \tau_p\right) > 0, \text{ if } e \in \left[\tilde{e}_b, e_p^*\right), \\
&= \frac{\omega}{2+\omega}\left(w_b'\left(e\right) - \tau_p\right) \leq 0, \text{ if } e \in \left[e_p^*, +\infty\right),
\end{aligned} \tag{26}$$

because of decreasing marginal returns to education and because by definition of e_p^*, $w_b'\left(e_p^*\right) = \tau_p$.

Let us first consider cases where $S \in [0, \tilde{e}_b)$. In these cases, investing in education does not yield transfers at old age since the sibling is at a corner, by Proposition 2, so that $e^*\left(S\right) = 0$.

[8] Of course, e cannot exceed S, but we study the function c_{p2} over $\mathbb{R}_+$ in order to cover all the cases.

Second, we analyze cases where $S \in \left[\tilde{e}_b, e_p^*\right)$. In these cases, the function $c_{p2}(S,e)$ is monotonically decreasing in the interval $[0,\tilde{e}_b)$ and monotonically increasing in the interval $[\tilde{e}_b, S)$. Two local maxima thus need to be compared $c_{p2}(S,e=0)$ and $c_{p2}(S,e=S)$:

$$\begin{aligned} c_{p2}(S,e=S) \quad &\geq \quad c_{p2}(S,e=0) \iff \frac{\omega}{2+\omega}\left(y_{m2}+w_b(S)\right) \geq \frac{\omega}{1+\omega}\left(y_{m2}+\tau_p S\right) \\ &\iff \quad \beta(S) \equiv (1+\omega)\, w_b(S) - (2+\omega)\,\tau_p S - y_m \geq 0, \end{aligned}$$

where $\beta(S)$ denotes the net gain of investing the total amount S in education rather than investing S in savings. The first and second derivatives of the function $\beta(S)$ are respectively given by

$$\begin{aligned} \beta'(S) &= (1+\omega)\, w_b'(S) - (2+\omega)\,\tau_p \geq 0 \iff S \leq e^{Max} = w_b'^{-1}\left(\frac{2+\omega}{1+\omega}\tau_p\right), \\ \beta''(S) &= (1+\omega)\, w_b''(S) < 0, \end{aligned}$$

The function is therefore initially increasing and concave. We make here the assumption that $\beta\left(e^{Max}\right) > 0$. This ensures that equilibria where the sibling receives education exist in the model. Also, define $\tilde{e}_p$ as the lowest value of S such that $\beta(\tilde{e}_p) = 0$.[9] Besides, we have $\beta(\tilde{e}_b) < 0$. Indeed,

$$\begin{aligned} \beta(\tilde{e}_b) &= (1+\omega)\frac{y_{m2}+y_{p2}}{1+\omega} - (2+\omega)\,\tau_p\tilde{e}_b - y_{m2} \\ &= -(1+\omega)\,\tau_p\tilde{e}_b < 0. \end{aligned}$$

since $y_{p2} = \tau_p\tilde{e}_b$ and

$$w_b(\tilde{e}_b) = \frac{y_{m2}+y_{p2}}{1+\omega},$$

by equation (9). Therefore, $\tilde{e}_b < \tilde{e}_p$.

If $S \in \left[\tilde{e}_b, e_p^*\right)$, then $e^*(S) = S$ will be chosen for S such that $\beta(S) \geq 0$. Hence, for $S \in \left[\tilde{e}_b, e_p^*\right)$, the parent invests the total amount in education of and only if $S \geq \tilde{e}_p$. Indeed, as $w_b'(S) - \tau_p > 0$, c_{p2} is maximized for $e^*(S) = S$.

Third and finally, for $S \in \left[e_p^*, +\infty\right)$, the parent maximizes c_{p2} by choosing $e = e_p^*$. This is indeed the level of education such that the first order condition of the parent's maximization problem is satisfied:

$$\frac{\partial c_{p2}(S,e)}{\partial e} = 0 \iff w_b'(S) - \tau_p = 0,$$

by (26). $S - e_p^*$ is then invested in savings.

9 Appendix 4: Proof of Lemma 2

The parent chooses S so as to maximize his/her utility. The first order condition is given by[10]

$$\frac{\partial U_p}{\partial S} = -u'\left(c_{p1}(S^*)\right) + \delta u'\left(c_{p2}^*(S^*)\right)\frac{\partial c_{p2}^*(S)}{\partial S} = 0, \tag{27}$$

[9] Notice that, because $\beta(S)$ is decreasing after e^{Max}, there exists a second indifference threshold, higher than e^{Max}. Above this value for S, the parent reverts to full savings. In order to get rid of this situation where a rich parent would not invest anything in education, we assume that this second threshold is very large, in particular larger than e_p^*, and we do not consider it in the analysis.

[10] Notice that the second order condition is indeed satisfied:

$$\frac{\partial^2 U_p}{\partial S^2} = u''\left(c_{p1}(S^*)\right) + \delta u''\left(c_{p2}^*(S^*)\right)\left(\frac{\partial c_{p2}^*(S)}{\partial S}\right)^2 + \delta u'\left(c_{p2}^*(S^*)\right)\frac{\partial^2 c_{p2}^*(S)}{\partial S^2} < 0,$$

where

$$\begin{aligned}
\frac{\partial c_{p2}^{*}(S)}{\partial S} &= \frac{\omega}{2+\omega} w_b'(S), \text{ if } S \in \left[\tilde{e}_p, e_p^{*}\right), \\
&= \frac{\omega}{2+\omega} \tau_p, \text{ if } S \in \left[e_p^{*}, +\infty\right),
\end{aligned}$$

and where

$$c_{p1}(S^{*}) = y_{p1} - S^{*}.$$

Applying the implicit function theorem to the first order condition yields

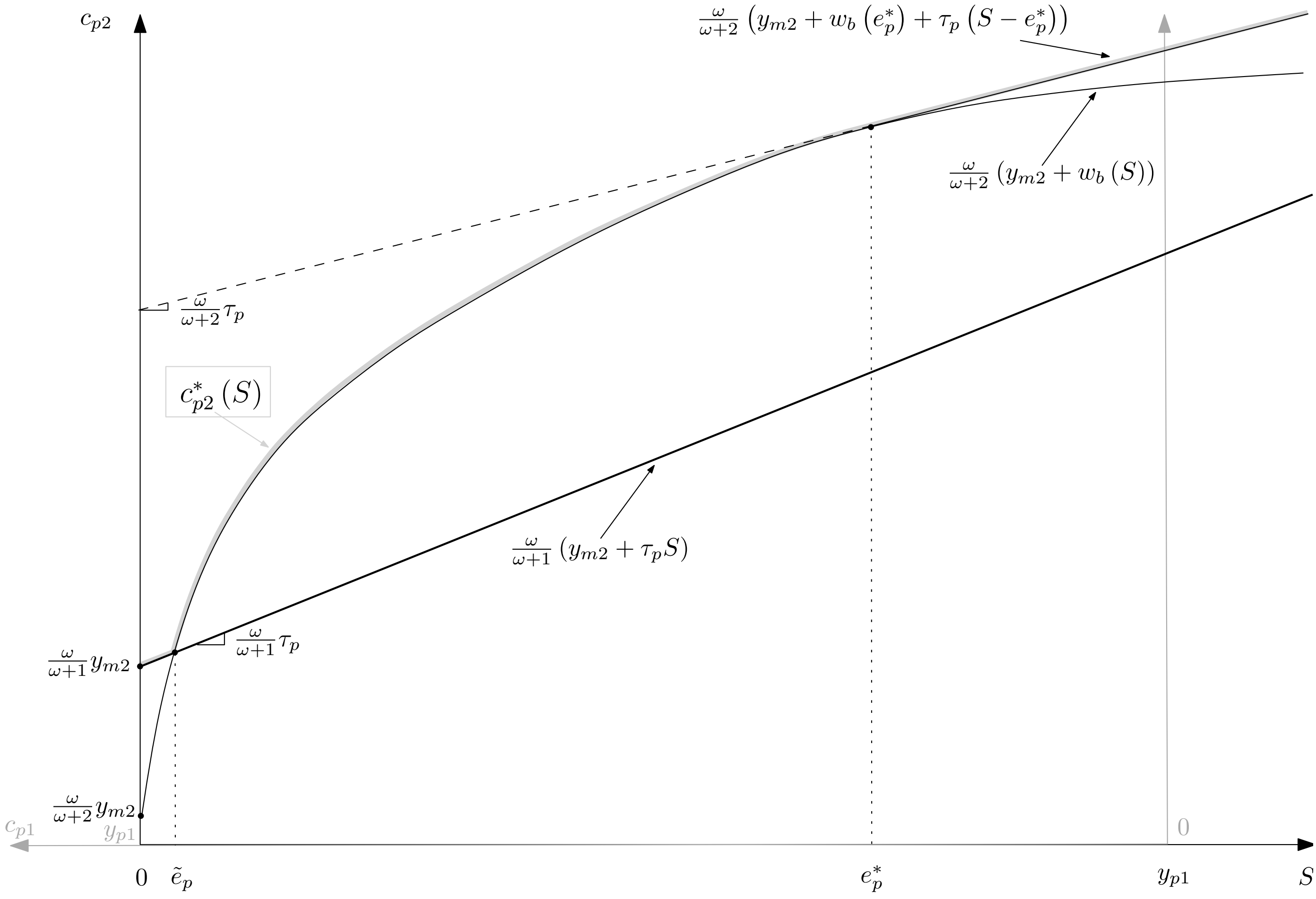
$$\frac{\partial S^{*}}{\partial y_{p1}} > 0 \iff -u''(c_{p1}(S^{*})) > 0.$$

Because S^{*} is monotonically increasing in y_{p1}, there exists a threshold value $\tilde{y}_{p1}$ such that $S^{*} = e_p^{*}$. Notice that because by definition $w_b'(e_p^{*}) = \tau_p$, $\partial c_{p2}^{*}(S)/\partial S$ is a continuous function of S.

---

where

$$\begin{aligned}
\frac{\partial^2 c_{p2}^{*}(S)}{\partial S^2} &= \frac{\omega}{2+\omega} w_b''(S) < 0, \text{ if } S \in \left[\tilde{e}_p, e_p^{*}\right), \\
&= 0, \text{ if } S \in \left[e_p^{*}, +\infty\right),
\end{aligned}$$



c_{p2}
$\frac{\omega}{\omega+2}\left(y_{m2}+w_b\left(e_p^*\right)+\tau_p\left(S-e_p^*\right)\right)$
$\frac{\omega}{\omega+2}\left(y_{m2}+w_b\left(S\right)\right)$
$\frac{\omega}{\omega+2}\tau_p$
$c_{p2}^*\left(S\right)$
$\frac{\omega}{\omega+1}\left(y_{m2}+\tau_p S\right)$
$\frac{\omega}{\omega+1}\tau_p$
$\frac{\omega}{\omega+1}y_{m2}$
$\frac{\omega}{\omega+2}y_{m2}$
c_{p1}
y_{p1}
0
0
$\tilde{e}_p$
e_p^*
y_{p1}
S

Table 1: Descriptive statistics

	2006		2009		All	
Variable	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Annual Transfer (in INR*)	2094.98	4286.54	7055.50	11447.26	4575.24	8985.16
Number of school age children (6-17 years)	1.85	1.53	1.64	1.39	1.75	1.46
Number of primary school age children (6-10 years)	0.85	0.99	0.74	0.89	0.79	0.94
Number of secondary school age children (10-15 years)	0.80	0.90	0.67	0.84	0.74	0.87
Number of superior school age children (16-17 years)	0.20	0.41	0.23	0.43	0.22	0.42
Land (ha)	2.11	2.18	2.11	2.18	2.11	2.18
Number of durables goods owned	2.77	2.01	2.85	2.32	2.81	2.17
Age of the household head	49.81	9.54	52.81	9.54	51.30	9.64
Number of children who have migrated	0.59	0.77	1.04	0.75	0.82	0.79
Age of the migrant	23.45	8.07	26.45	8.07	24.95	8.21
Obs	273		273		546	

*1$US = 66 INR

Table 2: Estimation results of the first model

VARIABLES	(1) Remittances	(2) Remittances	(3) Remittances	(4) Remittances	(5) Remittances	(6) Remittances	(7) Remittances	(8) Remittances
Number of migrants	4,098.720***	4,099.410***	3,811.148***	3,806.587***	4,007.354***	4,009.232***	3,995.178***	3,985.649***
	(556.319)	(557.424)	(534.932)	(535.637)	(532.742)	(533.496)	(517.268)	(518.264)
Number of school age siblings	488.345	447.055						
	(632.054)	(851.601)						
Number of school age*land		21.176						
		(292.037)						
Number of school age (prim)			-912.247	-428.461				
			(760.894)	(1,122.792)				
Number of school age (prim)*land				-322.606				
				(550.008)				
Number of school age (sec)					417.741	42.133		
					(759.547)	(1,070.977)		
Number of school age (sec)*land						163.398		
						(327.995)		
Number of school age (sup)							3,155.398**	3,708.285**
							(1,221.554)	(1,605.775)
Number of school age (sup)*land								-302.673
								(569.538)
Constant	382.338	383.823	2,192.531**	2,283.116**	1,001.604	1,048.765	637.159	662.765
	(1,368.857)	(1,371.529)	(882.034)	(896.506)	(838.181)	(844.668)	(600.958)	(603.681)
Observations	546	546	546	546	546	546	546	546
R-squared	0.176	0.176	0.178	0.179	0.175	0.176	0.194	0.195
Number of obs	273	273	273	273	273	273	273	273

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Estimation results of the second model

VARIABLES	(1) Remittances	(2) Remittances	(3) Remittances	(4) Remittances	(5) Remittances
Land	-391.860**	-425.636**	-382.289**	-424.000**	-397.391**
	(169.161)	(170.066)	(166.494)	(169.064)	(167.204)
Age of hh head	158.150***	148.105***	165.456***	148.585***	163.017***
	(39.416)	(39.424)	(38.883)	(39.237)	(38.964)
Number of migrants	4,098.720***	3,811.148***	4,007.354***	3,995.178***	4,008.662***
	(556.319)	(534.932)	(532.742)	(517.268)	(551.203)
Number of migrants time-AVG	818.059	1,134.533	935.214	955.152	943.675
	(945.777)	(937.926)	(923.948)	(928.755)	(937.769)
Number of school age siblings	488.345				
	(632.054)				
Number of school age time-AVG	-15.730				
	(688.830)				
Number of school age (prim)		-912.247			-606.934
		(760.894)			(792.235)
Nber of school age (prim) time-AVG		870.466			43.160
		(881.719)			(918.444)
Number of school age (sec)			417.741		773.556
			(759.547)		(814.628)
Nber of school age (sec) time-AVG			1,121.510		1,049.966
			(901.082)		(971.089)
Number of school age (sup)				3,155.398***	3,432.750***
				(1,221.554)	(1,270.708)
Nber of school age (sup) time-AVG				-2,987.748*	-4,366.576**
				(1,663.236)	(1,718.034)
Constant	-7,307.016***	-5,900.972***	-8,020.491***	-6,001.482***	-7,435.511***
	(2,109.114)	(2,043.222)	(2,039.275)	(1,995.978)	(2,084.639)
Observations	546	546	546	546	546
Number of obs	273	273	273	273	273

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1