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Migrants' Remittances and Investments in Children's Human Capital: The Role of Asymmetric Preferences in Mexico

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Abstract

This paper evaluates the ability of migrants' remittances to spur development via investments in children's human capital. Findings reveal that this depends largely on the gender of the de facto household head, as remittances sent by migrant fathers to mothers are those most likely to be invested in education. Assuming that mothers and fathers have asymmetric preferences, I present a two-stage model of migrants remittances. In stage one, migrants decide how much to remit, and in stage two this remittance is received and allocated by the de facto household head. I show that remittances sent by migrant fathers are spent differently from other income sources and have the potential to benefit children via two effects. The first is the change in allocative power of the mother and the second is her revealed preference for investments in children's education. The model is then tested using data provided by the Mexican Migration Project. Empirical results here confirm that remittances have the potential to effect household level development, as they are received by households that are neither extremely poor nor extremely rich, and that remittance allocation decisions differ for mothers and fathers. Mothers are in fact more likely to report that migrant income was spent on education. Finally, I analyze the effect of parental absences on children's education, using an innovative measure for educational attainment. Fathers' absences due to migration during all age ranges of the child's life have positive effects on educational attainment, while variables denoting the number of months the mother was absent are insignificant.

JEL Codes: D13, F22, F24, O15.
Keywords: Remittances, Mexico, Human Capital, Intrahousehold Allocation,
Asymmetric Preferences

1 Introduction

The past decade has seen a surge in the number of international migrants, as the stock of those living abroad increased from 154 million in 1990 to 175 million in 2000 (UN International Migration Report, 2002). Many of these migrants leave their home countries in times of economic downturn, in search of a new life, higher incomes, and improved opportunity. While some emigrate permanently and take their family with them, moving the family is too costly and risky a venture for many. Those who leave immediate or extended family members behind often engage in temporary, more frequent migrations and remit a portion of their earnings home on a regular basis. The volume of such remittances has grown significantly within the past few decades. Estimates vary, depending on how remittances are defined and which countries are studied.

Most agree, however, that Mexico is among the world's top recipients and the United States is among the largest senders. The United States sent $26.9 billion in remittances in 2003, $30.8 billion in 2004, and $31.8 billion in 2005, while Mexico received $13.73 billion, $17.09 billion, and $20 billion in the corresponding years (in terms of 2005 US dollars; IMF Balance of Payments Statistics, various years). These transfers have exceeded the inflow of foreign direct investment and income from tourism in all years, suggesting that they have enormous potential to influence welfare and development. In this paper, I bring evidence on this issue by studying the case of Mexico and the United States, which is important due to both the absolute and relative magnitudes of these flows. In 2003, remittances were approximately 80% of the value of petroleum exports, 73% of the profit from maquiladoras, and 2.1% of GDP.[1] By 2004, remittances were 70% and 87% of petroleum exports and maquiladora profits, and 2.5% of GDP. These percentages remained relatively stable in 2005; remittances were 71% of petroleum exports and 2.8% of GDP.[2] The small size of remittances relative to GDP suggests that the level of production and existing infrastructure in Mexico is relatively high and that the significant inflow of remittances can be put to productive use. These remittance flows are of course preceded by immigrant flows, both documented and undocumented, from Mexico to the US. It has been estimated that in 2004 there were 11.2 million Mexicans residing in the US, 57% of whom were undocumented (Passel 2005). Among the 11.1 million unauthorized migrants living in the US in March 2005, 6.2 million, or 56%, were from Mexico, and 22% from the rest of Latin America (Passel 2006). Many of these migrants are farm workers from agricultural areas who migrate on a temporary basis and who remit a large percentage of their earnings.

The effect of such inflows on the Mexican economy depends in part on how remittances are spent, and whether they are consumed or invested. Investment, of course, need not take the form of

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[1] Maquiladoras are factories along the US-Mexico border that import materials on a duty-free basis. In 2006, they accounted for 45% of Mexico's exports (author's calculations from www.banxico.org.mx).

[2] www.banxico.org.mx

savings, real estate, or businesses, but may also include spending on children's health and education. Investments in human capital are essential for development, and therefore whether remittances are being spent in this way will largely determine their ability to foster development and have long term effects. Knowledge of how remittances are being spent is thus necessary in order to determine what, if any, developmental impact these transfers are having on recipient countries. Understanding the determinants of remittances will also be important, as these may give us insight into their intended end use.

In approaching these issues, I provide empirical evidence that remittances sent from the US to Mexico *are* being invested in children's human capital when fathers migrate and remit to a de facto female head. This type of transfer comprises the majority of remittances sent from the US to Mexico. As explained by the Pew Hispanic Center and Multilateral Investment Fund (2003), "The one characteristic that clearly distinguishes remittance receivers from the general population is that a majority are women" (p.5). Hanson and Woodruff (2003) also find that "in the majority of rural migrant households it is the father who goes abroad"(p.13). This combined with the finding by Esquivel and Huerta-Pineda (2006) that 10% of rural households receive remittances (as compared with 3% of urban households) suggests that the majority of remittance recipients are de facto female heads. The study of this specific flow (from migrant father to resident mother) and its consequences for children is therefore essential in determining the long term effects of remittances. I show that remittances are a unique income source that may have developmental effects different from other types of income. This is due to the paternal absence accompanying these transfers, the revealed preference of mothers for investments in children's education, and the increase in allocative power she experiences in the absence of her husband. I first present a two-stage model which determines both the size of the remittance and how it is allocated once received by the (de facto) household head. There are two types of investment goods: physical and human capital. The model assumes that mothers prefer to invest in human capital, as confirmed by the data, and incorporates the asymmetric parental preferences via an implicit price index. This makes remitting increasingly "costly" to the migrant as preferences diverge. The theoretical contribution of this paper includes both the use of a price index to capture asymmetric preferences and the incorporation of the remittance decision with the allocation of said transfer.

Data provided by the Mexican Migration Project are used to estimate the determinants of remittances as well as how they are spent, paying special attention to the gender of the household head. I first show that remittance-receiving households lie in the middle of the income distribution, which has important consequences for the potential effects of remittances on development, as these households will be more likely to invest a portion of the remittance rather than spend them entirely

on current consumption. I then provide evidence of asymmetric parental preferences, and demonstrate that mothers are more likely to report having spent remittances on education. I estimate the change in expenditure on children's human capital using equations derived in the model and mean occupation data. Here I find that increases in education spending *are* feasible, and unrealistic parameter values are not necessary for these to occur. I also examine the effects of parental absence on children's educational attainment and find that while increases in the number of months a father is gone due to a US migration increase a child's educational attainment, maternal absences have no significant effect. Overall, I show that this additional income source can help foster development and have beneficial impacts for children in Mexican households, due largely to the increased decision-making power of mothers and their preference for educational investments.

The remainder of the paper is structured as follows. Section II provides a brief survey of the relevant literature and Section III presents the model. Section IV discusses the data, Section V provides empirical results, and Section VI concludes.

2 Literature Review

2.1 Overall Effect of Remittances: Beneficial or Detrimental?

The effect of remittances on a nation's path to development has been a subject of ongoing debate. While some have stressed the importance of remittances as a source of foreign exchange, even referring to this inflow as the "mother's milk for poor nations" (Kapur and McHale 2003,1), others claim that this reliance on first world incomes places developing nations in an inescapable cycle of dependency (Keely and Tran 1989). Because of their unpredictable and fluctuating nature, reliance on a constant flow of remittances to meet daily needs can be extremely costly. They may also worsen already existing inequalities, due to the high costs of emigration which only the relatively well-off are able to afford. Keely and Tran (1989) also claim that remittances may hinder the development process, since they are spent mostly on consumption goods, although this point is debated highly in the literature. Stahl (1982) suggests that emigration may lead to a decrease in the per capita income of the remaining population, as emigrants often have higher saving rates and fewer children. Emigration and remittances, he claims, are especially detrimental to the rural sector, since young males are both the most common emigrants and the most efficient workers in the rural sector. Human capital may also be destroyed since skilled migrants often remain in low-skilled positions abroad, causing the "skills acquired before emigration [to] be diminished or lost altogether" (Stahl 1982,888).

Proponents of remittances claim their importance hinges on the multiplier effects they have on

local economies. Durand, Kandel, Parrado, and Massey (1996) emphasize that these effects are especially prominent when the majority of remittances are spent on current consumption. Durand, Massey, and Parrado (1996) suggest that multiplier effects are most pronounced when they go to the lowest income strata of society, as poor families spend money quickly, increasing the velocity of money. When local incomes are augmented by remittances, local demands rise, leading to an increase in production to meet these demands. This production response increases earnings more, which then further increases demands. Glystos (1993) obtains individual consumption patterns of residents in Florina, Greece, both before and after remittance receipt, separately for farm and non-farm workers. He finds that remittances nearly double the overall consumption of both categories of workers, with particularly large increases in spending on recreation and education. In line with much of this previous research, I find that US remittances are received in Mexico by households that are neither extremely rich nor extremely poor, suggesting that they may be invested at the household level and may therefore have positive long run consequences for welfare and growth.

2.2   How Remittances are Spent

Many studies have analyzed the spending patterns of remittance recipients. As noted by Keely and Tran (1989), most find that remittances are spent on current consumption, health, and education, and that remittances are a significant portion of household income. Puri and Ritzema (1999) note that the number of years since emigration, the household income level, employment of other household members, education level, and occupational level of migrants are all important determinants of remittance spending. Often, migrants have more power in determining how remittances are spent when the date of emigration is recent, and as time passes and the level of supervision wanes, those left behind gain control of resource allocation. Durand and Massey (1992) suggest that many studies leave out the most important determinant: the life-cycle stage of the household. Active U.S. migrants, for example, are frequently in their twenties and thirties, a time of marriage, family formation, and raising children. Demands for family maintenance, housing, and medical care are greatest during this phase, and it is not surprising that such migrant households spend their remittances on current consumption. Hanson and Woodruff (2003) note that the manner in which remittances are spent likely depends on whether the remittances are made to the household or to the entire community.[3]

However, the conclusions regarding the extent to which remittances are spent on productive investment and community-wide improvements are mixed. Griffith (1985), for example, examines remittance flows to rural Jamaica in 1985 and finds no increase in the households' ability to generate

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[3]They note that communities as a whole often raise funds for coyotes and other travel expenses, leading to a community-wide remittance in the form of repayment.

income, that is, no evidence of investment in farming supplies or expansions of the farm. In a similar vein, Banerjee (1984) considers rural India in 1975-76, and finds little support for the notion that remittances are spent on capital expenditure and improvements on the farm. Only 40% of those who remitted to aid agriculture said there had been any agricultural improvements or investments since their migration. There is, however, some evidence of remittances being used for productive investment. Woodruff and Zenteno (2001) survey 6000 firms in 44 urban areas of Mexico, and find that remittances are responsible for almost 20% of the capital invested in microenterprises. They find a high correlation between a firm's cash flow and its rate of ongoing investment, suggesting that firms depend on their "own internal generation of investment funds" (p.7), and that firms are credit constrained. This motivates the potentially important role of remittances in relieving some of these credit constraints. Woodruff and Zenteno (2001) find that the median investment in enterprises owned by individuals born in high migration states is significantly larger than in enterprises owned by those born in low migration states. Remittances seem to play an important role in easing financial constraints and allowing for productive investment.

An essential question in the development debate is whether remittance receipt allows for increased investment in education. Some literature claims that emigration is detrimental to the stock of human capital, as those most able to afford migration costs and successfully settle abroad are those with the most education. Hanson and Woodruff (2003) suggest two possible effects of a migrant family member on the educational attainment of those left behind. The first is a positive income effect, as migrants often send remittances, which may allow children to delay entering the work force and further their education. The second, however, is an adverse effect on household organization. They suggest that the reduction of adult role models may increase the child-rearing responsibilities of older children, forcing them to leave school. Emigration is found to have the largest positive effect when parents have low levels of education. In households in which the mother has 0-2 years of schooling, having an external migrant is associated with an extra 0.35 to 0.52 years of schooling for girls and 0.22 to 0.42 years of schooling for boys. This is consistent with the hypothesis of binding credit constraints in these households preventing investment in education. Similarly, Yang (2006) analyzes the effects of remittances on household investments using changes in migrant currency exchange rates as a source of exogenous variation. He finds that there are increases in child schooling, educational expenditures, hours worked in self-employment, and the propensity to start a capital intensive business. Thus, it would seem that remittances certainly have the potential to increase investments in human capital and therefore to foster development via these investments. Lacuesta (2006) studies the Mexico-US migrant flow and finds little evidence of human capital gains for *returning* migrants. She concludes, however, that "While it is true that human capital losses appear

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to be significant and not recovered, remittances may increase the welfare or even the productivity of those who are left behind "(p.34). My contribution to this literature is directly linked to this insight, as I show that remittances *are* being invested in children's human capital and therefore *will* have implications for welfare and productivity. I show via simulations of my theoretical model that increases in expenditure on children's education are both feasible and realistic.

2.3   Male versus Female-Headed Households

Whether remittances are spent in this way, however, will often depend on which family members have migrated and who is left in charge of resource allocation. Spending patterns out of remittances are found to differ not only across households of different income levels and socioeconomic status, but also according to the gender of the de facto household head. There has been significant rejection of Becker's 'unitary household model' throughout the literature. Intra-household allocation decisions have become increasingly important, as outcomes often differ when mothers and fathers make spending decisions. Thomas (1990) employs data from a 1974-75 Brazilian survey of urban households, and finds that mother's income positively affects both height and weight of the children, whereas fathers' income only affects height. He claims that "women apparently direct more resources under their control toward improving household nutrition" (p. 647).

Duflo (2003) also finds evidence rejecting the unitary model of the household. She examines the effects of the expansion of the social pension program in the early 1990's in South Africa concluding that the impact on child nutrition varied according to the gender of the recipient. She finds evidence for an "all-female link, [as] the pension seems to be effective only if it was received by the mother of a girl's mother. This evidence points in the direction of rejecting the unitary model of the household" (p. 12). Similarly, Griffith (1985) studies the role of peasant women in Jamaica in their husbands' absences, and finds that farm production was maintained, but did not increase during these periods. He takes this as evidence of the different priorities of men and women, suggesting the possibility that these women were in fact spending more money on their children. Parreñas (2005) finds that migrant Filipino mothers tend to remit to the eldest child instead of the father, as "men are not entrusted by migrant women with their remittances"(p.325). There would of course be no deviation of fathers' spending patterns from migrant mothers' desires if parental preferences were not asymmetric. Rangel (2006) analyzes the effects of changes in alimony legislation in Brazil and finds that an increase in alimony rights (which he associates with an increase in outside options for women) increases mothers' leisure time and increases investments in schooling, especially that of older girls. Finally, in their study of the effects of a migrant family member on children's educational attainment, Hanson and Woodruff (2003) find that 13 to 15 year old boys and girls obtain more

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schooling when their mother is a solo household head. Improvements in human capital may therefore be more likely to occur when the father migrates, leaving resource allocation in the hands of the mother. My paper contributes to this literature not only by providing supportive empirical evidence of asymmetric preferences and mothers' revealed preference for education, but also by presenting the first theoretical model to incorporate both the migrants' remittance decision and the allocation of said transfer. Asymmetric preferences enter via an implicit price index, increasing the cost of remitting for the migrant as his preferences diverge from those of the mother. I take issue with the claim by Cañales (2005) that the productive potential of remittances is equivalent to that of any other income source, since they are often received by a de facto household head who has a greater preference for children's education than her spouse as well as greater allocative power in his absence.

3   Theory

This section introduces a model of migrants' remittances that incorporates the migrant's decision to remit, and the household's allocation decision, once the remittance is received. The model consists of a two-stage Stackelberg game in which the migrant first chooses the amount of his remittance, and the household then decides on its allocation.[4] This model implies that it is not merely the size of the remittance that determines its ability to improve well-being and foster human capital development, but also the gender of the recipient.

There are four goods available for consumption by the household.   The parents' consumption goods are C_{father} and C_{mother}, corresponding to C_{own} and C_{spouse} below, depending on whether the utility function in question is that of the mother or father.[5]   The other goods are children's goods. x_1 is investment in children's human capital and x_2 is a composite of all other investment in children.   None of the above goods include basic necessities, and expenditure on x_1, x_2, C_{father} and C_{mother} will be zero until all immediate needs, Z, are met.   Mothers and fathers both have altruistic utility of the form

$$U = \left[\gamma^{1/\theta} C_{own}^{(\theta-1)/\theta} + (1-\gamma)^{1/\theta} C_{hh}^{(\theta-1)/\theta} \right]^{\theta/(\theta-1)}, \tag{1}$$

where θ is the elasticity of substitution and C_{hh} represents utility from other household members' consumption.   This is defined by

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[4]The decision to migrate and the choice of which family member shall go are *not* endogeneized in an effort to simplify the model and focus on the remittance element. Such a decision process has been modeled by Borjas and Bronars (1991), Katz and Stark (1986), Hoddinott (1994), and others, and will be incorporated in future extensions of this model.

[5]For simplicity I will assume throughout this section that the father is both the household head and the migrant. The terms mother, spouse, and de facto household head will thus be used interchangeably.

$$C_{hh} = C_{spouse}^{\delta} C_{children}^{1-\delta}. \tag{2}$$

$C_{children}$ is also a subutility function, and this is where the asymmetry in preferences lies. It is represented by

$$C_{children} = \frac{x_1^{\beta} x_2^{1-\beta}}{\beta^{\beta}(1-\beta)^{1-\beta}} \tag{3}$$

for fathers and

$$C_{children} = \frac{x_1^{\alpha} x_2^{1-\alpha}}{\alpha^{\alpha}(1-\alpha)^{1-\alpha}} \tag{4}$$

for mothers.[6] All goods are defined to be a peso's worth of the corresponding consumption good, as opposed to a physical unit, so that both relative and actual prices are one. This assumption implies the divisibility of all four consumption goods. Since the children's goods are investment goods and the parents' goods can be thought of as indices of consumption, divisibility is not necessarily unreasonable.

I allow for the possibility that $\alpha \neq \beta$, implying that mothers and fathers have different preferences over the share of total expenditure allocated to each of the children's goods.

3.1 Setup and Fundamental Assumptions

For simplicity I assume that $\alpha > \beta$ when they are not equal, so that mothers devote a greater share of their expenditure to children's human capital than fathers. This assumption is consistent with findings from a number of empirical studies.[7] I assume that both parents have altruistic preferences and are interested primarily in the well-being of their children.[8] The difference in preferences is motivated by the distinction between physical and human capital. Fathers prefer to invest in physical assets and the expansion of family farming and business activities, while mothers prefer to invest in human capital. Both parents, however, ultimately aim to maximize the future well-being of their children.
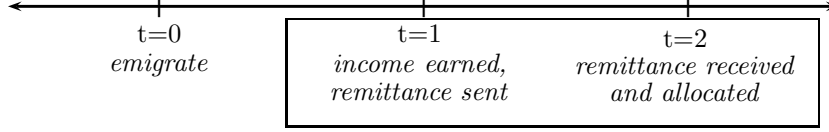
The timeline of the model is as follows. The first period, period 0, occurs *before* the model begins, and will be of varying lengths for each individual. In this period, all individuals become educated and acquire a skill set. After completing his education, each begins to search for work in

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[6]The model assumes that parents are equally altruistic, and hence that γ and δ are the same for mothers and fathers. The model therefore predicts minimalist effects for children. If mothers are more altruistic in *addition* to preferring human capital investments, the improvements in children's outcomes will be magnified.

[7]See Thomas (1990), Duflo (2003), Griffith (1985), Hanson and Woodruff (2003), Katz and Chamorro (2003), among others.

[8]Some studies motivate this difference in preferences as one in which the mother is interested in the well-being of her children while the father spends most income on himself and on recreational activities. See Song (1999), Levin et al. (1999), Hoddinott and Haddad (1995), Quisumbing and Maluccio (2000), among others.

the domestic market. At the end of period 0, one either decides to continue to work/search for work domestically, or migrate. Those who stay at home will not enter my model. At the beginning of period 1, the migrant is abroad, and my snapshot of his life begins. Debt has possibly been incurred to finance the migration, living expenses in the US are incurred, the migrant earns income in the US, and ultimately decides how much to consume and how much to remit. In period 2, this remittance is received by the household in Mexico, at which point the recipient will decide how to allocate it among C_{own}, x_1, and x_2.

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      |                    |                      |
    t=0                  t=1                    t=2
  emigrate           income earned,        remittance received
                     remittance sent          and allocated
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I am abstracting from modeling the migration decision here because it is often impertinent in the determination both of whether to remit and how much to send. While the migration decision is one based on ex-ante *expectations*, as the migrant chooses to locate where the discounted expected present value of future utility is greatest, the remittance decision is one based purely on ex-post *reality*. On the one hand, high earnings may be expected, but if the migrant faces unemployment upon arrival, there will be no remittance. On the other hand, there *may* be a utility gain even if there is no income gain, but an increase in utility is clearly not remittable. The study of remittances will be selected, since I am only able to observe *current* recipients of remittances.

The maximization problem will involve two separate budget constraints: one faced by the household in Mexico, and the other faced by the international migrant. They are, respectively,

$$Y_{mother} + R - Z_{MEX} = x_1 + x_2 + C_{mother} \tag{5}$$

and

$$Y_{migrant} = C_{migrant} + R + B + Z_{US}. \tag{6}$$

For simplicity I assume that the parents are the only income earners. The household also receives a remittance R from the migrant, which they take as given, and this together with the mother's earnings finances total consumption after immediate needs Z have been met. The migrant, similarly, earns income $Y_{migrant}$ in the US which is used to finance expenditure on the consumption good abroad, $C_{migrant}$, the remittance he sends, R, his living expenses in the US, Z_{US}, and repayment of any debt incurred to finance this initial migration, represented by B. The migrant faces an additional constraint of $R = PC_{hh}$, stating that the utility gain he receives from household consumption times its respective price index must equal the value of the remittance.[9]

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[9]The implicit price of remitting will be derived and discussed in detail below.

3.2   Solving the CES model: Stage 1

Substituting the migrant's budget constraint into equation (1) for $C_{migrant}$ as well as $\frac{R}{P}$ for C_{hh}, the migrant then chooses R to maximize his utility. The migrant's consumption good is defined to be one dollar's worth of US consumption, giving it a corresponding price of one. The maximization yields

$$R^* = \frac{P^{1-\theta}(1-\gamma)(Y_{migrant} - B - Z)}{P^{1-\theta}(1-\gamma) + \gamma} \tag{7}$$

as the optimal remittance. Plugging this into the appropriate constraints then gives

$$C_{hh}^* = \frac{P^{-\theta}(1-\gamma)(Y_{migrant} - B - Z)}{P^{1-\theta}(1-\gamma) + \gamma} \tag{8}$$

as the migrant's choice for "good" C_{hh}, and

$$C_{migrant}^* = \frac{\gamma(Y_{migrant} - B - Z)}{P^{1-\theta}(1-\gamma) + \gamma} \tag{9}$$

for his own consumption. As expected, we find that the signs of $\frac{\partial C_{hh}^*}{\partial P}$, $\frac{\partial C_m^*}{\partial P}$, and $\frac{\partial R}{\partial P}$ all depend on the value of the elasticity of substitution. In the case of R, we have that

$$\frac{\partial R^*}{\partial P} = \frac{[\gamma P^{-\theta}(Y_{migrant} - B - Z)][(1-\theta)(1-\gamma)]}{[P^{1-\theta}(1-\gamma) + \gamma]^2}, \tag{10}$$

where γ is the weight that the migrant places on his own consumption relative to the household's, and is therefore always less than one. The sign of $\frac{\partial R^*}{\partial P}$ therefore depends entirely on whether the elasticity of substitution, θ, is greater or less than one. For $\theta > 1$, as the degree of substitutability between own consumption and household consumption rises, remittances will fall as the relative price of remitting rises. This is an intuitive result, as the migrant will switch from financing household consumption to financing his own consumption when P rises if the two are highly substitutable.

On the other hand, for $\theta < 1$, remittances will be increasing in price. As $\theta \to 0$, we approach no substitutability between C_{hh} and C_m, and as the implicit price of remitting rises, the migrant will remit more. As discussed below, an increase in P represents an increase in the disparity between the preferences of the migrant and the de facto household head. As this gap widens, it becomes necessary for the migrant to remit more in order to achieve his desired level of household consumption. If C_{hh} and C_m were substitutable, the increase in P would induce him simply to increase his own consumption, but when $\theta < 1$ and C_m cannot be easily substituted for C_{hh}, it will instead induce him to remit more. The effect of an increase in P on C_{hh}^* and C_m^* will also depend on the size of θ. As will be shown below, when $(\alpha - \beta)$ and hence P rise, the migrant will allocate more

resources to his own consumption, and less to the household, provided that $\theta > 1$ and the two forms of consumption are relatively substitutable. [10]

3.3 Solving the model: Stage 2

The second stage of the Stackelberg game begins upon receipt of the remittance by the de facto household head, at which point the decision is made regarding how to allocate the remittance. She chooses x_1, x_2, and C_{own} (taking C_{spouse} as given) to maximize her utility, given by

$$V = \left[\gamma^{1/\theta} C_{own}^{(\theta-1)/\theta} + (1-\gamma)^{1/\theta} C_{hh}^{(\theta-1)/\theta} \right]^{\theta/(\theta-1)},$$ (11)

subject to a budget constraint of

$$p_1 x_1 + p_2 x_2 + P_{mother} C_{mother} = Y^{mother} + R,$$ (12)

where the subutility functions provided in equations (2) and (4) serve as additional constraints. [11] The solution to this problem can be thought of as a two-staged budgeting decision, where the mother first chooses how much of her income to devote to own consumption and how much to spend on the rest of the household. Given the father's absence, she then divides the resources allocated to the household between the two children's goods, x_1 and x_2. This system's solution assumes that the mother is able to allocate *all* of the remittance and her own income according to *her* preferences in the father's absence. In some instances, however, remittances are sent with spending stipulations, often previously agreed upon by the couple.[12] Oftentimes remittances are sent to finance a special event or a specific purchase, in which case not all of the transfer would be available for the de facto head's allocation. I will denote by μ^R the share of pooled household income which the mother is able to allocate according to her preferences, leaving a share $(1-\mu^R)$ to be allocated according to the migrant's preferences. While μ^R may be less than one, I will assume that μ^R is strictly greater than μ, representing the share of income the mother is able to allocate when the father is present.[13] The father's migration will therefore necessarily increase the mother's allocative power. These share parameters will be taken as exogenous, but are likely determined by the size of relative incomes, among other factors.[14]

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[10]Results for the case of Cobb-Douglas utility are provided in the Appendix. Expenditure shares are constant in this case and the value of remittances is independent of the price index.

[11]This assumes that there is a one way flow of resources and the de facto household head does not send transfers to the migrant.

[12]See King, Dalipaj, and Mai (2006), Garcia and Paiewonsky (2006), Jolly and Reeves (2005), among others for a discussion of remittances being sent with spending stipulations.

[13]Although exogenous in this model in an effort to simplify, allocative share parameters have been endogeneized throughout the literature. See Anderson and Eswaran (2005), Chiappori (1997), and Browning and Chiappori (1998) for a discussion.

[14]Remittances sent by the household head are unique in that the de facto head's power to allocate them will rely

3.3.1   The case of binary sharing parameters ($\mu^R = 1, \mu = 0$)

While the assumption of binary sharing parameters is probably unrealistic, it greatly simplifies the allocation problem and leads to clear-cut solutions. This will serve as the benchmark case. The case of non-binary parameters will be presented in the following subsection. In the case of ($\mu^R = 1, \mu = 0$), the de facto head has complete control of household income in the migrant's absence but no control in his presence.

Upon receipt of the remittance R, the de facto household head pools this with her own earnings, Y^{mother}, and then maximizes her utility taking her spouse's consumption as given (as this has been predetermined by the migrant before sending the remittance). She first decides how much to allocate to C_{own} and $C_{children}$, and then how to divide $C_{children}$ between x_1 and x_2. The optimal demands will then be

$$C^*_{mother} = \gamma(Y^{mother} + R) \tag{13}$$

$$C^*_{children} = (1-\gamma)(Y^{mother} + R) \tag{14}$$

$$x^*_1 = \alpha(1-\gamma)(Y^{mother} + R) \tag{15}$$

$$x^*_2 = (1-\alpha)(1-\gamma)(Y^{mother} + R). \tag{16}$$

The counterfactual occurs when the migrant is present in the Mexican household and his preferences determine the household allocation rules. In this case, the optimal demands are

$$C^*_{father} = \gamma(Y^{mother} + Y^{father}) \tag{17}$$

$$C^*_{hh} = (1-\gamma)(Y^{mother} + Y^{father}) \tag{18}$$

$$C^*_{mother} = \delta(1-\gamma)(Y^{mother} + Y^{father}) \tag{19}$$

$$x^*_1 = \beta(1-\delta)(1-\gamma)(Y^{mother} + Y^{father}) \tag{20}$$

$$x^*_2 = (1-\beta)(1-\delta)(1-\gamma)(Y^{mother} + Y^{father}). \tag{21}$$

3.3.2   The case of non-binary sharing parameters ($1 > \mu^R > \mu > 0$)

Intra-household allocations in the case of non-binary sharing parameters have recently been modeled by various authors, although usually in implicit form. Most of these papers have one exclusively private good and impose at least weak separability, as this greatly increases tractability and allows decision rules to be extracted from expenditure data. Thomas (1990), Shultz (1990), Lundberg, Pollak, and Wales (1997), and Browning, Bourguignon, Chiappori, and Lechene (1994) all use these

less upon her contribution to household income, due to the migrant's absence.

assumptions to reject the income pooling hypothesis. Browning and Chiappori (1998) introduce a "distribution" function μ which is a function of prices and incomes. Households are then taken to maximize a weighted sum of utility, weighted by the sharing parameters. In my case, a given household with sharing parameter μ would then maximize

$$V = \mu U^{mother} + (1 - \mu)U^{father} \tag{22}$$

subject to the budget constraint.

This system is tractable and solvable when preferences are at least weakly separable, and when at least one of the goods in question is private. In my case, however, even weak separability is not obtained, and all goods enter both parents' utility functions. I have abstracted from the separability assumption for reasons of plausibility. As explained by Gronau (1991), "separability implies that the elasticity of substitution between any good belonging to the separable group and a good outside it is the same...[this] would imply that the elasticity of substitution between parents' consumption of nonalcoholic beverages and alcohol is the same as that between nonalcoholic beverages and clothing" (p. 228). This certainly seems improbable. Deviating from this assumption implies that (22) cannot simply be maximized over the choice variables, since the mother's and father's utility functions have a functional form which is constant elasticity of scale over two Cobb-Douglas indices. However, since all goods are essentially public goods, we *can* find equilibrium contributions using a non-cooperative approach.

Defining W as total household income devoted to children's expenditures when the father is abroad, gives

$$W = (1 - \gamma)(Y^{mother} + R). \tag{23}$$

Carrying forward the de facto head's optimal allocations from the case of binary sharing parameters, we know that she would choose

$$(x_1^*, x_2^*) = (\alpha W, (1 - \alpha)W) \tag{24}$$

if she had all household resources at her disposal. The mother, however, is only able to allocate $\mu^R W$ according to her preferences. Whether or not she is able to obtain her optima will therefore depend entirely on the size of μ^R relative to α. There are three relevant states: $\mu^R > \alpha > \beta$, $\alpha > \mu^R > \beta$, and $\alpha > \beta > \mu^R$. These correspond to her control of the resources being sufficient to obtain her own optima, being sufficient to reach the migrant's optima but not her own, and not being sufficient to obtain either of their optima. When $\mu^R > \alpha$, the de facto household head will

provide αW of x_1 since her resources are sufficient, and will then contribute $(\mu^R - \alpha)W$ to x_2. There is complete information and she knows that upon expecting her allocation of αW to x_1, the migrant will in turn devote no resources to that good and instead allocate $(1 - \mu^R)W$ to x_2, making this his best response. Her choice of $(\alpha W, (\mu^R - \alpha)W)$ is also a best response to his allocation, making this a Nash equilibrium. Total provision of children's goods is then

$$(x_1^*, x_2^*) = (\alpha W, (1 - \alpha)W). \tag{25}$$

In the second case, in which the de facto head has the resources to reach the migrant's optima but not her own, she will contribute all of her resources to x_1, getting as close to her optimum value of this good as possible. She will therefore provide $\mu^R W$ of x_1 and no x_2. She knows that the migrant will allocate all of his resources to x_2, due to the fact that $\mu^R > \beta$. And since $(1 - \mu^R) > (1 - \alpha)$, it will not be optimal for her to provide any x_2. Equilibrium values of children's goods in this case are therefore

$$(x_1^*, x_2^*) = (\mu^R W, (1 - \mu^R)W) \tag{26}$$

The final possibility is that the de facto head does not have enough resources to reach either optimum. In this case, when $\alpha > \beta > \mu^R$, the migrant's share of resources $(1 - \mu^R)$ *is* sufficient to obtain his optimal value for good two, which surpasses the de facto head's optimum value by assumption. In this case, the migrant will allocate $(1 - \beta)W$ to x_2, and $((1 - \mu^R) - (1 - \beta))W$ to x_1. The de facto head then allocates $\mu^R W$ to x_1. Children's goods then take values of

$$(x_1^*, x_2^*) = (\beta W, (1 - \beta)W). \tag{27}$$

In all three of these cases, the optimal mother's consumption takes the value of

$$C_{mother}^* = (\delta(1 - \mu^R)(1 - \gamma) + \mu^R \gamma)(Y^{mother} + R). \tag{28}$$

The counterfactual similarly depends on the relative ranking of α, β, and μ. The same three possibilities apply as above, with μ^R being replaced by μ. In this case, however, the total income devoted to children's expenditures changes to

$$W_1 = (1 - \gamma)(1 - \delta)(Y^{father} + Y^{mother}). \tag{29}$$

When $\mu > \alpha > \beta$, the mother allocates αW_1 to x_1 and $(\mu - \alpha)W_1$ to x_2. The father allocates none

of his income to x_1 and $(1-\mu)W_1$ to x_2. Equilibrium provisions of children's goods are thus

$$(x_1^*, x_2^*) = (\alpha W_1, (1-\alpha)W_1). \tag{30}$$

When $\alpha > \mu > \beta$, the mother allocates μW_1 to x_1 and nothing to x_2 while the father provides no x_1 and $(1-\mu)W_1$ worth of good 2, making equilibrium provisions

$$(x_1^*, x_2^*) = (\mu W_1, (1-\mu)W_1). \tag{31}$$

Finally, when $\alpha > \beta > \mu$, the father is able to achieve his optimal x_2 of $(1-\beta)W_1$ and spends $(1-\mu)W_1 - (1-\beta)W_1$ on x_1. The mother will spend μW_1 on x_1 and contribute nothing to the provision of x_2. Equilibrium allocations in this case are

$$(x_1^*, x_2^*) = (\beta W_1, (1-\beta)W_1). \tag{32}$$

In all three cases, equilibrium values of mother's and father's consumption are

$$C_{father}^* = \gamma(1-\mu)(Y^{mother} + Y^{father}) + \mu(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}) \tag{33}$$

$$C_{mother}^* = \gamma\mu(Y^{mother} + Y^{father}) + (1-\mu)(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}), \tag{34}$$

represented by the sum of what each allocates for himself and that which is provided by the spouse. The state-dependent solutions presented in this section for both the case of the migrant's absence as well as the counterfactual representing his presence in Mexico will be important in identifying possible changes in children's consumption patterns below. They will also be used in the construction of the implicit price of remitting, presented in the following section.

3.4 Creation of the Price Index P

In this section, I derive the implicit price of remitting P faced by the migrant, which will largely depend upon how different the mother's and father's preferences are. As will be discussed in detail below, it is precisely the divergence of the de facto head's spending patterns from those desired by the migrant that impose an extra cost on the act of remitting.

3.4.1 The case of $\mu^R = 1$ (the mother controls all resources when the father is away)

In the equilibrium solutions to the first stage of the game, P is the implicit price of R, and therefore C_{hh}, for the migrant. For every dollar that the migrant remits, he would like a share δ to be spent

on the mother's consumption, $(1-\delta)\beta$ on x_1 and a share $(1-\delta)(1-\beta)$ on x_2. However, upon receipt of the remittance R, the de facto head spends γR on herself, $\alpha(1-\gamma)R$ on x_1 and $(1-\alpha)(1-\gamma)R$ on x_2.[15] Assuming that the entire remittance is spent according to the preferences of the de facto household head, when the migrant "spends" $(1-\delta)\beta R$ on x_1, he gets $x_1 = \alpha(1-\gamma)R = \frac{1}{p_1}(1-\delta)\beta R$, where the price of x_1 is $p_1 = \frac{\beta}{\alpha}\frac{(1-\delta)}{(1-\gamma)}$, and similarly he "spends" $(1-\delta)(1-\beta)R$ on x_2, and receives $x_2 = (1-\alpha)(1-\gamma)R = \frac{1}{p_2}(1-\delta)(1-\beta)R$, so that the price of x_2 is $p_2 = \frac{(1-\beta)}{(1-\alpha)}\frac{(1-\delta)}{(1-\gamma)}$. When $\alpha = \beta$ the migrant and the de-facto household head have the same preferences over x_1 and x_2, which implies $p_1 = p_2 = \frac{(1-\delta)}{(1-\gamma)}$, and the two children's goods have a relative price of one.

The indirect utility function of the migrant over household consumption in Mexico can be represented by

$$
\begin{aligned}
u &= \left[\gamma(Y^{mother}+R)\right]^{\delta}\left\{\left[\frac{\alpha}{\beta}\right]^{\beta}\left[\frac{1-\alpha}{1-\beta}\right]^{1-\beta}(1-\gamma)(Y^{mother}+R)\right\}^{(1-\delta)} \\
&= (Y^{mother}+R)\gamma^{\delta}(1-\gamma)^{(1-\delta)}\left\{\left[\frac{\alpha}{\beta}\right]^{\beta}\left[\frac{1-\alpha}{1-\beta}\right]^{1-\beta}\right\}^{(1-\delta)},
\end{aligned}
\tag{35}
$$

and replacing the household's resources with $E(P,u)$, denoting the minimum expenditure necessary to achieve utility level u given that the price level is P, gives

$$
E(P,u) = \left\{\left[\frac{\beta}{\alpha}\right]^{\beta}\left[\frac{1-\beta}{1-\alpha}\right]^{1-\beta}\right\}^{(1-\delta)}\gamma^{-\delta}(1-\gamma)^{\delta-1}u.
\tag{36}
$$

The price index P is then

$$
P = \left\{\left[\frac{\beta}{\alpha}\right]^{\beta}\left[\frac{1-\beta}{1-\alpha}\right]^{1-\beta}\right\}^{(1-\delta)}\gamma^{-\delta}(1-\gamma)^{\delta-1}.
\tag{37}
$$

We find that

$$
\frac{\partial P}{\partial \gamma} = \left\{\left[\frac{\beta}{\alpha}\right]^{\beta}\left[\frac{1-\beta}{1-\alpha}\right]^{1-\beta}\right\}^{(1-\delta)}\left\{\frac{(1-\delta)}{(1-\gamma)} - \frac{\delta}{\gamma}\right\},
\tag{38}
$$

which is greater than zero provided that $\gamma > \delta$. This of course implies that $\gamma > \delta(1-\gamma)$, suggesting that the mother allocates a greater share of income to herself than the father would. In this case, an increase in γ will rise the implicit price of remitting.

Defining

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[15]These shares come directly from the migrant's and the de-facto household head's utility functions, given by equations (1)-(3).

$$p = \left[\frac{\beta}{\alpha}\right]^{\beta} \left[\frac{1-\beta}{1-\alpha}\right]^{1-\beta}, \tag{39}$$

we can look at the effect of an increase in the parents' preference parameters, α and β, on the overall price level P by simply evaluating the derivatives of p with respect to these parameters.

The effect of an increase in the mother's preference parameter, α, is positive and increasing in $(\alpha - \beta)$. That is,

$$\frac{\partial p}{\partial \alpha} = \left(\frac{\beta}{\alpha}\right)^{\beta} \left(\frac{1-\beta}{1-\alpha}\right)^{1-\beta} \left[\frac{1-\beta}{1-\alpha} - \frac{\beta}{\alpha}\right] = p \left[\frac{(\alpha - \beta)}{\alpha(1-\alpha)}\right]. \tag{40}$$

An increase in α therefore has a greater effect on the migrant's price of remittances when preferences are more dissimilar. This derivative is always positive due to the assumption that $\alpha > \beta$. As the difference between preference parameters grows, an increase in α has a larger, more positive, effect and therefore further increases the implicit price of remittances for the migrant.

The effect of an increase in β on the price of remitting also has the expected effect. Since $\alpha > \beta$, a marginal increase in β implies that the preference parameters are converging. As $\beta \longrightarrow \alpha$, the migrant's desired share of the remittance to be spent on good one is converging to how the de facto head will actually spend it. The implicit price should therefore fall, suggesting that $\frac{\partial P}{\partial \beta} < 0$. We find that

$$\frac{\partial p}{\partial \beta} = p \left[\ln\left(\frac{\beta}{\alpha}\right) + \ln\left(\frac{1-\alpha}{1-\beta}\right)\right]. \tag{41}$$

Given the assumption that $\alpha > \beta$, the terms in parentheses are always less than one, making the bracketed term negative. The greater the distance between α and β, the greater the magnitude of this derivative. That is, when preference parameters are diverse, an increase in β has a more negative effect on price than when $\alpha \approx \beta$. An increase in either parent's preference parameter therefore has the greatest effect on the implicit price of remitting when $(\alpha - \beta)$ is at a maximum.

The effect of a change in either α or β on the amount remitted will of course operate through P, and will therefore depend on the value of θ. Due to the fact that $\frac{\partial P}{\partial \alpha}$ is greater than zero under the model's parameter restrictions, the effect of an increase in α on R will depend entirely upon the sign of $\frac{\partial R}{\partial P}$. When $\theta < 1$, C and C^m are un-substitutable, causing the migrant to remit *more* as P rises. In this case, an increase in α will lead to an increase in the level of remittances. When $\theta < 1$, however, C and C^m *are* substitutable, and an increase in α will decrease R. The effects of an increase in β are similar, leading to increased remittances for $\theta > 1$, and a fall in remittances when $\theta < 1$.

3.4.2 The case of $\mu^R < 1$ (mother not able to allocate all of the remittance)

When the mother is not able to allocate all of the remittance income, due to the transfer being made with some spending stipulation or the existence of some previous agreement, there are three possible price indices that emerge, each corresponding to one of the state dependent cases above.

These are

$$P = (\mu^R \gamma)^{-\delta} (1-\gamma)^{\delta-1} \left[\left(\frac{\beta}{\alpha} \right)^\beta \left(\frac{1-\beta}{1-\alpha} \right)^{1-\beta} \right]^{1-\delta}, \tag{42}$$

$$P = (\mu^R \gamma)^{-\delta} (1-\gamma)^{\delta-1} \left[\left(\frac{\beta}{\mu^R} \right)^\beta \left(\frac{1-\beta}{1-\mu^R} \right)^{1-\beta} \right]^{1-\delta}, \text{ and} \tag{43}$$

$$P = (\mu^R \gamma)^{-\delta} (1-\gamma)^{\delta-1} \left[\left(\frac{\beta}{\beta} \right)^\beta \left(\frac{1-\beta}{1-\beta} \right)^{1-\beta} \right]^{1-\delta}, \tag{44}$$

for the cases where $\mu^R > \alpha > \beta$, $\alpha > \mu^R > \beta$, and $\alpha > \beta > \mu^R$, respectively. The first is a monotonic transformation of p, implying that $\frac{\partial P}{\partial \alpha} > 0$ and $\frac{\partial P}{\partial \beta} < 0$ will still hold. It can easily be verified that $\frac{\partial P}{\partial \beta} < 0$ in the case where $\alpha > \mu^R > \beta$, and the price index is a function neither of α nor of β in the case where both preference parameters exceed the value of μ^R. All three price indices are also decreasing in μ^R. As $\delta \to 0$ for both parents, implying that neither of them get utility from spousal consumption, these price indices simplify to

$$P = \frac{1}{1-\gamma} \left[\left(\frac{\beta}{\alpha} \right)^\beta \left(\frac{1-\beta}{1-\alpha} \right)^{1-\beta} \right], \tag{45}$$

$$P = \frac{1}{1-\gamma} \left[\left(\frac{\beta}{\mu^R} \right)^\beta \left(\frac{1-\beta}{1-\mu^R} \right)^{1-\beta} \right], \text{ and} \tag{46}$$

$$P = \frac{1}{1-\gamma}. \tag{47}$$

In this section of the paper I have introduced a model in which asymmetric parental preferences over children's investment goods allow for increases in expenditure on children's human capital when the father migrates and remittances are received. I will now justify empirically the assumption of asymmetric preferences and evaluate the effect of remittances on children's education. In the next section I describe the data employed, and empirical results will follow.

4   Data

The data utilized here are the most recent version of the Mexican Migration Project, MMP107. The Mexican Migration Project is jointly housed at the University of Guadalajara and Princeton

University. Annual surveys are administered in Mexico and the United States and have been conducted since 1982. The data is cross-sectional in form, as communities, and thus households, are visited only once. Households are visited in Mexico during the months of December and January, as these are the months when most seasonal migrants are present. Although households within each community are selected at random, the communities themselves are *not* chosen via a random process. Communities are selected in an effort to represent different patterns of social and economic organization (different sizes, regions, ethnic compositions, and areas of economic specialization), but most of the sampled communities lie in central-western Mexico, as these are the states from which the majority of Mexico's emigrants originate.[16]

Once a community is chosen, approximately 200 households from that community are selected at random and surveyed. Five files are then created from the household information: a person-level file, a household-level file, a migration file, and life histories of both the household head and his or her spouse. The person-level file contains demographic information, economic indicators, and characteristics of both the first and last migration to the United States. The household level file has variables denoting the composition of members, land ownership and usage, real estate, amenities, as well as vehicle, livestock, and business ownership. The migration file contains information regarding the migration experience of the household head only, including types of documentation used, costs, method and number of crossings, number of deportations, and measures of social and economic resources.[17] This file also has information on the migration experience of the household head's family of origin, average monthly remittances, average monthly savings, and the intended purpose of these savings or remittances.[18] For both the household head and his spouse, a year-by-year life history is created, which includes information regarding childbearing, ownership of properties and businesses, and complete migration and labor histories. There is also a corresponding community-level file, which has information on population, labor force, industries, agriculture, infrastructure, institutions, and natural resources. Some variables of interest here include the percentage of community members who are illiterate, the number of primary and secondary schools, the proportion of adults with migration experience, and whether migrants' remittances were used to finance any community-level projects. This is the first data set to contain such detailed information on migration and remitting behavior. Summary statistics of the data can be found in Table 1.

Each household is also asked if they have family members or friends who have settled in the US and who might be willing to be interviewed. A telephone interview is conducted, and the household

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[16]The states of Jalisco, Guanajuato, and San Luis Potosi each contain more than 10 sampled communities. The states of Baja California Sur, Campeche, Chiapas, Coahuila, D.F., Estado de Mexico, Hidalgo, Morelos, Queretaro, Quintana Roo, Sonora, Tamaulipas, and Yucatan were not sampled at all.

[17]Detailed information is provided for up to 25 crossings of the household head.

[18]Savings are defined as money carried home by the migrant, whereas remittances are sent home while the migrant is still away.

head is asked if he has friends or family from his home community in Mexico that have settled in the US as well. If so, these relatives are interviewed via telephone, and upon the completion of the questionnaire, asked if they have further contacts in the US from their hometown, and the process continues. This is known as 'snowball sampling' and is clearly non-random.

These US based communities have been dropped from the sample for three reasons. Because I am interested in the remitting behavior of migrants, I am interested primarily in those who have left immediate family behind in Mexico. Families who migrate as a whole do not enter my model, and hence should not enter the empirical analysis. Among those households where the survey was performed in the US and the head was in the US at the time of the survey, the number of observations in which the spouse was *not* in the US is zero. This suggests that in such cases the entire family has migrated, precisely the households I am excluding from my model. The second reason these households have been dropped is based on the construction of probability weights for the US sample as well as the sampling methodology. Due to the fact that households are chosen at random, but communities are not, all probability weights are community, not household, specific. These weights are constructed by dividing the number of interviewed households by the number of eligible households. Since the US sample is constructed via referrals, the US population must be estimated. According to the staff at the Mexican Migration Project, the accuracy of these estimates is highly questionable, making the reliability of the weights uncertain. In addition, US households are not chosen randomly but rather selected via the method of 'snowball sampling.' For these reasons, the US communities have been dropped.[19]

Several other necessary changes have been made. One of the most important variables for this study is the gender of the de facto household head. In the MMP survey, the gender of the household head is an entirely subjective question. It is therefore possible that the mother answers the survey and refers to her husband as the household head, even if he is absent and has been absent for an extended time. For my purposes, it is important to know who is making the day-to-day spending and allocation decisions. In the above case, this will likely be the mother, although the reported household head variable would suggest that it is the father. It is indeed uncommon for the mother to refer to herself as the household head when the father is in the US. Among the 1,178 women who refer to themselves as the household head in this survey, and state the purpose for their union "dissolution," 554 are widows, 381 have been separated or divorced, and only 1 is a migration-induced female head. I have therefore created a binary variable, *femaleheads* , which receives a value of one if *either* the reported gender of the household head is female, *or* the reported gender is male *and* the household head is currently in the US. The latter is clearly a migration-induced, de

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[19]Communities 20 through 24 have also been dropped on the advice of the MMP staff, as these were the first communities surveyed and they appear to contain much error.

facto female head.

I have also made adjustments to the variable denoting whether the household receives remittances or not. The variable provided by MMP is a binary variable, with a value of one representing the fact that the household receives remittances. This variable, however, is coded for *every* household, even those that do not have members abroad. It therefore picks up the migration decision in addition to the remittance decision. The question of remittance receipt, however, is clearly only applicable for households with migrants abroad. I have thus created *remittance_receipt*, which contains values for migrant households only. Another household characteristic of interest is whether or not they rely on income from agriculture. Due to the fact that agriculture experiences extreme fluctuations and is heavily dependent on weather, these households may be more prone to financial shocks, which may be smoothed by the presence of remittances. The variable *farming_household* has therefore been created. It takes a value of one if the family business type is agriculture, if either the household head or his spouse is an agricultural worker, or if the household reports having family workers on its farm.

5   Empirical Analysis

In this section of the paper I test the model's predictions. The empirical analysis contains four main components, the first of which is a series of logit regressions. Beginning in period 0 of the model, I first identify the determinants of whether a household sends a migrant abroad, and whether the individual sent abroad is the household head. This distinction is important, as it is only in those households in which the father migrates that a change in the allocative power of the mother will be possible. Although the theoretical analysis ignored the migration decision process, it will be important to separate those characteristics which only affect the ex-ante decisions made when the entire family is in Mexico, and the ex-post decisions made by the migrant upon his arrival in the United States. Transitioning to period 1 in the model, I test for the determinants of *remittance_receipt*, a variable which takes values for those households that currently have a migrant abroad. In the following section I test for the determinants of the volume of remittances. Here the sample is limited to households that receive positive remittances. It will be shown that some determinants differ from those that were important in the decision to remit.

There is a potential selection bias here due to the focus on households that are receiving remittances (or have a member abroad) *at the time of the survey.* Households that have received remittances in the past, or will receive remittances in the near future, will clearly be coded as zero as long as they are not *currently* receiving remittances. Since all covariates are *current* measures and I clearly have no knowledge of future behavior, I am restricted to focusing on the determinants

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of whether a given household is currently receiving remittances or currently has a member abroad. This will introduce bias *only* in the event that the econometric model systematically differs across these groups (those that have a migrant abroad in the present, in the past, or in the future). While variation will certainly exist, there is no reason to suspect systematic changes in the importance of the covariates, and therefore no reason for the selection criteria to impose bias.

The next component of the empirical analysis deals with predictions from stage 2 of the model, when the remittance is received in Mexico and the de facto head determines its allocation. Although this data set does *not* provide detailed expenditure information, respondents are asked to identify the primary, secondary, and tertiary purpose of the remittance or savings. As will be seen, the gender of the respondent matters greatly. I then simulate the increase in x_1 expenditure resulting from the father's migration and show that increased spending on children's human capital is feasible under reasonable parameter values. Finally, I present the determinants of children's educational attainment and discuss the potential role of migration and the ensuing change in gender of the de facto household head.

5.1 Sending a Migrant Abroad and the Decision to Remit

In this section I begin to work through the timeline of the theoretical model, and estimate the probability that a given household sends a member abroad, sends its head abroad, and/or receives remittances from the US. Logit results will be presented for the following system of estimated equations:

$$prob(Y_i = 1) = prob(\beta_0 + X_{1i}\beta_1 + X_{2i}\beta_2 + X_{3i}\beta_3 + X_{4i}\beta_4 + \varepsilon_i > 0) \qquad (48)$$

where Y_i=[$member\_abroad_i$ $headinUS_i$ $remittance\_receipt_i$], X_{1i} is a column vector of family characteristics, X_{2i} is a vector of household characteristics, X_{3i} contains variables denoting migration history, and X_{4i} is a vector of community-level variables. That is,

$$X'_{1i} = [De\_Facto\_Femalehead_i \quad Head\_Education_i \quad Spouse\_Education_i \quad Nonworkers_i$$
$$No\_Children_i \quad AllChildren\_Under13_i$$
$$Some\_Children\_Teenagers_i \quad Some\_Children\_Adults_i],$$
$$X'_{2i} = [Farming\_Household_i \quad Washing_i \quad Number\_Properties_i$$
$$Number\_Vehicles_i \quad Sewer_i \quad Electric_i],$$
$$X'_{3i} = [Members\_inUS_i \quad US\_Experience_i], \quad \text{and}$$
$$X'_{4i} = [Running\_Water_i \quad Cantread_i].$$

Equation (48) is estimated for each of the four dependent variables and, with a few exceptions, includes the same covariates in each regression. For example, $Members\_inUS$ is removed from X_{3i} in the $member\_abroad$ and $headinUS$ logits, since these dependent variables were created using the $Members\_inUS$ variable, and $Other\_members\_inUS$ is added to the $headinUS$ regression. The expectation here is that household heads may be more likely to migrate in cases where a strong network already exists in the US, making the endeavor less risky. The $de\_facto\_femaleheads$ variable similarly gets dropped from the $member\_abroad$ and $headinUS$ regressions due to a lack of variation in the dependent variables when $de\_facto\_femaleheads = 1$. The $headinUS$ regression is restricted to cases where there is a male head of household, since divorced or widowed mothers (the only types of de jure female heads) are probably much less likely to emigrate, even in situations of dire need. The determinants of the probability of their emigration are likely very different from those affecting a male head's migration decision, and could thus bias the results.

Beginning with the model's period 0 decisions, the propensity of a household to send a migrant abroad likely depends on a variety of demographic characteristics. One would expect households that face income fluctuations and uncertainty in earnings to be more prone to send members abroad, as well as households that have previous migration experience or a network of members already present in the US.[20] Expectations regarding the relative income levels of these households as compared to non-migrant households are less clear. While the need to rely on migration and endure familial separation for an extra income flow suggests that these households should be relatively poorer, there is also tremendous risk involved in the migrant journey. For those with no option but the undocumented route, emigration entails risk of arrest or deportation and therefore the possibility of zero income flow to the remaining members in Mexico. Those without an existing network in the US will likely face larger initial fixed costs; these may be difficult for those in absolute poverty to overcome. This prediction of migrant households lying somewhere in the middle of the income distribution is verified in Table 2.

As reported in the table, the propensity of having a member abroad is decreasing in the education levels of both the household head and his spouse, but increasing in the indicator for farming households. An additional year of schooling for the household head or his spouse decreases the probability of having a migrant abroad by 0.6 and 0.7 percent, respectively. Being a farming household, on the other hand, increases this probability by 2.5 percent.[21] This suggests that households facing greater income fluctuation and uncertainty, or those toward the lower end of the income spectrum are most

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[20]The notion of migration and remittances being used as a form of insurance for households with fluctuating incomes is presented by Rosenzweig and Stark (1989), Lucas and Stark (1985), and Yang and Choi (2007), among others.

[21]Marginal effects of indicator variables should interpreted with caution, as the corresponding "marginal" change for these variables is from 0 to 1. That is, for the case of *Farming Household*, it denotes the effect due to a change from non-farming to farming, holding all other variables constant at their sample mean.

likely to send a migrant abroad. On the other hand, households with a member abroad are also more likely to have a washing machine, electricity, fewer nonworking members, and a greater number of households with running water in their communities, features which do not characterize the poorest members of society. While households that send migrants abroad *do* seem to be exposed to income fluctuations and have lower household income, they are clearly not living in abject poverty.

The propensity to send a member abroad is increasing in the number of months previously spent in the US by the household head (*US_Experience*). The probability increases by 0.1 percent for every additional month spent in the US by the household head. This may reflect that insights and networking information can be passed on to other household members, potentially encouraging further migration. The negative signs on all four lifecycle variables were somewhat unexpected, suggesting that households with no children, all young children, some children teenagers, or all children teenagers are *all* less likely to send a member abroad than a household with all adult children (the excluded category). I would have expected that households with children would be more likely to send migrants abroad due to the increased number of individuals to provide for. These results suggest, however, that households with all adult children most frequently send members abroad. This likely reflects the common occurrence of older children remitting to support their adult parents, as documented by Antman (2007). In addition, households with many young children may be less likely to send the father abroad due to the high level of uncertainty accompanying dependence on migrant income.

The results for the variable *headinUS* are drastically different from those for *member_abroad*. I would expect a household that sends its head abroad to be economically worse off than one sending a son or some other member to the US. The decision for a household head to migrate suggests that *expected* conditions in the US will be better than *current* conditions in Mexico, that is, the household head is likely unemployed or earning income with severe fluctuations. Since household heads are commonly the main income-earner of any given household, the presence of uncertainty in the head's income suggests a relatively low level of economic well-being for the household. As compared with households that send another member abroad, those that send the household head are less likely to have vehicles or properties and are less likely to have all adult children. The number of other household members in the US increases the likelihood that the household head will migrate by 0.7 percent for each additional member abroad. This is not surprising, as a larger preexisting network in the US will decrease the associated risk of migration. Similarly, the propensity for the household head to migrate is also increasing in the number of months spent in the US, *USexperience*, which also decreases the uncertainty associated with migration.

Continuing through the timeline of the model, in period 1 the migrant has settled in the US,

obtained work, earned income, and incurred expenses. It is at this point that the remittance decision occurs. What, then, are the determinants of whether a household in Mexico receives remittances? As evidenced in Table 2, among households with at least one member abroad, those that have a greater number of members in the US, have electricity, and live in a community where most households have access to running water, but a large percentage of those over age 15 are illiterate are more likely to receive remittances. The presence of electricity increases the likelihood of remittance receipt by 4.5 percent, while a percentage increase in the share of community members with running water increases the probability by 0.3 percent. Again, these results make evident the fact that remittance receiving households are not living in abject poverty. The insignificance of all life cycle variables, and the share of nonworkers, suggests that household composition is not an important element of the remittance decision. Finally, de facto female heads are 16.8 percent more likely to receive remittances, suggesting that the de jure household heads, or fathers, are more likely to remit than other household members. This will be important for the potential gain in allocative power by the female heads of household.

Overall, it is evident that migrant households lie in the middle of the income distribution, and while exposed to income fluctuations and high levels of uncertainty, they are certainly *not* living in abject poverty. This is not surprising since the high cost of migration as well as the risks involved require a minimum level of resources. I find that families that send the household head abroad, however, tend to be worse off than those sending other family members. This finding was also expected, since the risk of income loss in the event of deportation or unemployment in the US carries much graver consequences for the household head, who is typically the main provider for the household. Finally, among households with members abroad, those most likely to receive remittances are those with more members abroad and a de facto female head. These households are also more likely to have running water and electricity, again suggesting that the extreme poverty does not characterize the average remittance recipient. This has important consequences for the potential effects of remittances, since households in abject poverty will only be able to spend such remittances on necessities. As predicted by the model, families whose immediate needs have not been met will not be investing in children via expenditures on human or physical capital. Finally, households with the father abroad are more likely to receive remittances than those who have sent a child or other family member to the US. This suggests that remittance receiving households may be more likely to invest in children's human capital, as this is the preferred investment good of the mother and an absent father will likely provide her with more decision-making power.

The final element of the model's stage 1 predictions involves the determinants of the size of the remittance. Unfortunately, the variable *remit_size* is only available for household heads. Although

the indicator variable, *remittance_receipt*, contains values for all households with a member abroad, *remit_size* only has values for households in which the head is the migrant. No data is provided for children of the household head or other family members that remitted money home. The question asked of the household head (or the spouse in his absence) is the average value of monthly remittances during his last (or current) trip to the US. The sample in this section is restricted to those households which reported a non-zero value of remittances, and whose response was within three standard deviations of the sample average, 290.39 US dollars.[22] Regression results are reported in Table 3 for the estimated equation

$$Remit\_Size_i = \beta_0 + X_{1i}\beta_1 + X_{2i}\beta_2 + X_{3i}\beta_3 + X_{4i}\beta_4 + \varepsilon_i, \tag{49}$$

where the covariates are defined as above.[23] The only changes are the inclusion of $lastMONTHLY$ $US\_earnings$ and $LastUS\_TripDuration$ in the X_{3i} vector, as well as the removal of de_facto $femalehead$ from X_{1i} since this regression is restricted to migrations of the household head. As expected, the coefficient on the size of the migrant's last US earnings is positive and highly significant, as is that on the number of months spent in the US. A one percent increase in real monthly US earnings increases remittance size by 0.2 percent, while an extra month of US experience increases the remittance by 0.1 percent. Those with numerous trips to the US likely have a strong network and have found ways to minimize their living expenses. They are also likely to be more familiar with the available methods for remitting money home, and have therefore likely minimized the transaction costs, allowing them to send a greater sum to their families in Mexico. The value of the average monthly remittance is also found to be decreasing in trip duration, suggestive of the fact that remittances are waning over time.

Average monthly remittances are higher for families with some teenagers and with all children under 13, likely because there are more dependents within the home. Similar to many of the logit results, the volume of remittances is also increasing in the prevalence both of running water and illiterate individuals in the community. A 1 percent increase in either of these variables results in a 0.3 percent increase in remittance size. There are a few important distinctions between the results for the *remit_size* and the *remittance_receipt* regressions. Parents' educational attainment, for example, while insignificant in the determination of whether a household *receives* remittances, has a positive and significant effect on remittance size. This is a result of the difference of selection into the two samples. The regressions on *remittance_receipt* include all households with a member

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[22]The staff at MMP admit that there was likely some confusion among respondents, and it appears that some gave the average annual amount. The mean on the entire sample is 290.39, with a standard deviation of 541.80 and a maximum value of 12,000. When outliers are cut, the mean falls to 271.53 with a standard deviation of 247.12 and a maximum value of 1,800.

[23]Results for an alternative Tobit specification are provided in table 14 in the Appendix.

abroad, while the regressions on *remit_size* include only those households in which the head was (or is) a migrant. *Given* that the migrant is the household head, and *given* that he remits a positive amount, this amount is increasing in his educational attainment, possibly because he is able to obtain more secure employment in the US. Similarly, although *US_Experience* was an insignificant determinant of the propensity to remit, *remit_size* is increasing in *US_Experience*. Again, *given* that a positive remittance is sent home (clearly limiting the number of return migrants in this select sample), the amount will be greater for those who have made numerous previous trips to the US.[24] Differences in results for *remit_size* and *remittance_receipt* are likely a result of the selection bias and do not necessarily imply that these are two entirely separate decision processes.

5.2   Evidence of Asymmetric Preferences

In stage 2 of the model, the remittance is received by the de facto head in Mexico, and she allocates it over herself and the children. The novelty of the model lies in the fact that parents have asymmetric preferences, and the developmental impact of the remittance will depend not only on the size of the remittance, but also on the gender of the recipient and the allocative power that he or she holds. In order to fully test this assumption, we would need to observe household expenditures before and during the migration, in addition to being able to identify whether the migrant was the father or some other household member. Although the Mexican Migration Project does contain detailed migration information, expenditure data is *not* provided for these households. Migrant households are, however, asked to identify the primary, secondary, and tertiary purpose of the most recently received remittance. This question, however, is only asked in reference to migrations of the household head and is therefore not available for remittances sent by a child or an extended family member. If the household head is present, that is, he has already returned from his most recent migration, he answers these questions. However, where the migrant is still away, or has returned but is simply not at home when the surveyor arrives, the spouse answers these questions. Any significant difference in the responses given by the household head and his spouse will be evidence of the existence of asymmetric preferences. *All* of the households for which responses to this question are provided are migrant households, are remittance receiving households, *and* are households in which the head migrated. The *only* differences are the timing of the trip relative to the arrival of the surveyor and the identification of the respondent (the migrant or his spouse); these alone are insufficient reasons to expect systematic differences. Any significant difference in responses can then be attributed to a difference in preferences. Tables 4 through 9 contain differences in means across the variable *Female_Informant*, which is defined simply as whether the mother or father answers the

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[24]As mentioned previously, those who have traveled to the US many times likely have an existing network, which may help them to secure low-cost housing and employment. This will enable remitters to send a greater sum.

remittance purpose questions, regardless of whether the father has returned home or not.[25] Any significant difference in means suggests that mothers and fathers have different primary objectives, a clear signal of asymmetric preferences.

The statistics in Table 4 can be interpreted as follows. When asked the primary purpose of the migrant's remittance, mothers replied food and maintenance 50% of the time, as compared with 32% for fathers. Mothers *never* replied that financing a special event was the primary purpose. Fathers stated that the primary purpose was the purchase of agricultural inputs, house construction or repair, and health expenses significantly more than mothers. Table 5 contains similar results for the secondary purpose. Here, fathers were significantly more likely to reply "other" or "health expenses," while for mothers debt payments or education were the major secondary purposes of the remittance. Mothers stated education 39% of the time, as compared with only 5% for fathers. As assumed in the model, mothers seem to have a greater preference for expenditure on education than fathers, and this result is consistent for the tertiary purpose as well, presented in Table 6. Identical questions were asked of the purposes for the migrant savings carried home by the father on his last trip to the US.

While significant differences regarding the spending of remittances likely reflect the difference between the mother's behavior and the father's expectation, as the father is away and the mother is making spending allocations, differences regarding the spending of migrant savings are more difficult to interpret. Due to the fact that migrant savings are carried home with the father, there should be much less (and possibly no) asymmetric information regarding *how* this income was spent. These results can be found in Tables 7 through 9. Significant differences here do not necessarily suggest that the income was spent in a manner different from either parent's expectations, since both were present at the time expenditure decisions were made. They may, however, signal a difference in opinion regarding spending priorities within the household, which is still evidence of different preferences. Fathers cited the purchase of livestock, health expenses, recreation, or "other" more frequently, while mothers claimed that savings were most often used for food and maintenance or education. Forty percent of mothers, for example, stated food and maintenance, compared with 22% of fathers. The secondary purpose was more frequently claimed to be health, education, or food and maintenance by mothers, while fathers stated recreation, livestock, and "other" more often. Education again appears significantly in responses to the tertiary purpose, and was stated more often by mothers. Again, it is difficult to ascertain whose responses are more in line with actual expenditure behavior here, since both parents were present when allocation decisions were

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[25] It is possible that the father has returned from his migration, and is simply not home at the time of the survey, in which case someone else answers these questions. It is also possible that the father is still away, but the mother is not home at the time of the survey. These differences are restricted to those cases *only* where the mother or father is the informant.

made. The different responses do, however, suggest that mothers and fathers have different senses of prioritization within the household, again reflecting the presence of asymmetric preferences. When significant, mothers replied "education" more frequently than fathers, and fathers chose livestock and agricultural inputs more often. These findings are in line with the model's assumptions regarding parental differences in preferences over physical and human capital investments.

5.3   Determinants of Remittance Allocation

This section concerns the determinants of the primary, secondary, and tertiary spending purposes of the remittance and of migrant savings. The results presented above showed that responses differed significantly by gender. Here I show that these results are not diminished by the presence of other demographic and socioeconomic characteristics in the regression.[26]   A series of logits is estimated in the same format as (48), where

$$Y' = [Food\_Maintenance \quad HousePurchase\_Repair \quad Livestock \quad Agricultural\_Inputs$$
$$Consumer\_Goods \quad Education \quad Health \quad Debt\_Payment \quad Savings].$$

(50)

Separate logit regressions were run for each of the above expenditure purposes for the primary, secondary, and tertiary cases for both remittances and migrant savings.[27]   The same four vectors of independent variables were used, with the addition of $water$ and $refrigerator$ in X_2, the vector of household characteristics. These were added due to their expected role in determining whether migrant income was spent on health needs. $Members\_inUS$ was dropped from X_3 due to its seeming irrelevance in determining expenditure patterns, and $Female\_Informant$ replaced $de\_facto\_femalehead$ in X_1.

Not surprisingly, without access to running water and without a refrigerator were more likely to claim health as the primary purpose, while those with property and no sewer system stated livestock. Food and maintenance was unexpectedly stated by households with all adult children more than those with some children teenagers, but also by those with all children under 13. As expected, the sign and significance of the coefficients on $Female\_Informant$ are consistent throughout with the results found from the difference in means analysis in the previous section. The probability that the primary purpose was food and maintenance, for example, increases by 21% as a result of the mother answering these questions. The corresponding increase for education being the secondary purpose is

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[26]These results are not reported for space considerations. They are available from the author upon request.

[27]There are therefore six logit regressions for each dependent variable. For health, for example, the first logit has a dependent variable which takes values of 1 when health was stated as the primary purpose of the remittance, and 0 when any other purpose was given. The second and third logits correspond to the secondary and tertiary purpose of the remittance. The fourth logit has a dependent variable which takes a value of 1 when health was stated as the primary purpose of migrant savings, and so on.

10%. In the cases of both the primary and the secondary purpose of the remittance, the addition of other household variables has not affected the sign or significance of this coefficient, and there was no reason to expect any systematic correlation. The value of *Female_Informant* is determined simply by who was home at the time of the survey, and whether the most recent migration of the household head had already ended or was still ongoing. The fact that *Female_Informant* has maintained significance in the presence of these other covariates implies that whether the respondent was the mother or the father played a significant role. Results are also consistent in the case of the tertiary purpose, where *Female_Informant* maintains its significance in the education regression.

Some independent variables were dropped from the regressions due to a lack of variance in the dependent variable. In the education regressions, for example, there were no households with no children that stated education as the primary purpose of the remittance, as was the case for households without a refrigerator, a sewer system, or access to running water. This is not surprising, as households without these basic amenities will not be spending on education; as assumed by the theoretical model, basic needs must be met before investments can even be considered. Also, no households without water access stated livestock or agricultural inputs as objectives, as families without running water are obviously not farmers. The consistent significance of *Female_Informant* after controlling for demographic characteristics suggests that the gender of the respondent is an important predictor of the way in which remittance income is allocated. The finding that female informants are more likely to claim education and male respondents, house construction and repair as the purpose of remittances is in line with the key assumption of the theoretical model, namely that mothers prefer investments in human capital and fathers tend to invest in physical capital.

5.4   Feasibility of an Increase in Human Capital Expenditures

In this section, I evaluate the likelihood of an increase in x_1 expenditures resulting from the father's migration. While the previous section confirmed mothers' preference for investments in human capital, this alone does not guarantee that the absence of the father will increase total expenditure on children's education. Whether this occurs will largely depend on the size of the remittance relative to the previous *domestic* earnings of the father, in addition to parameter values. Using average earnings and remittance data specific to the occupation of the household head, I will simulate the change in x_1 expenditure for all possible parameter combinations. I am resolved to estimating the change in human capital investment in this way due to the lack of expenditure information in the data.

As defined in the stage-two solutions for non-binary sharing parameters, there are three possible equilibrium outcomes for (x_1^*, x_2^*), depending on the relative rankings of α, β, and μ^R. There

are symmetric possibilities for the counterfactual, when the father is present in Mexico, with μ^R replaced by μ. Given the assumptions that $\alpha > \beta$ and $\mu^R > \mu$, there are five possible rankings, which determine the four equations to be simulated.[28] These are:

$$\Delta x_1 = \alpha(1-\gamma)(Y^{mother} + R) - \beta(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}) \tag{51}$$

$$\Delta x_1 = \mu^R(1-\gamma)(Y^{mother} + R) - \beta(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}) \tag{52}$$

$$\Delta x_1 = \alpha(1-\gamma)(Y^{mother} + R) - \mu^R(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}) \tag{53}$$

$$\Delta x_1 = \mu^R(1-\gamma)(Y^{mother} + R) - \mu(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}) \tag{54}$$

Whether any one of these equations provides positive output will depend on the size of R relative to Y^{father}, as well as the size of the relevant parameters. In order to assess the likelihood of an increase in x_1 expenditure being observed, I simulate these equations over possible values of α, β, μ, and μ^R, and use sector-specific averages for values of Y^{mother}, Y^{father}, and R. I then simulate these equations for each sector. I also assume that $\delta = 0$, as any change in human capital expenditures which is positive for the case of $\delta = 0$ will also be positive for $\delta > 0$. In the case of the agricultural sector, for example, Y^{father} is the average wage of male household heads that work in the agricultural sector. Y^{mother} is then the product of the probability that a female spouse is employed, given that her husband works in agriculture, and the average wage of employed females whose spouses work in agriculture. This is therefore the average Y^{mother} in households in which the father works in agriculture, accounting for the fact that many spouses do not work. Finally, R is the average remittance reported by migrants who claim agriculture as their occupation. In addition to the agricultural sector, results for Administrators and Directors, Professionals, Unskilled Manufacturing, and Personal Services are also given. Table 10 contains the sector-specific values that were used in these simulations.

Equations (51), (52), (53), and (54) are evaluated over all possible values of α, β, μ, and μ^R, provided that $\alpha > \beta$ and $\mu^R > \mu$. The graphical presentation of these results by sector can be seen in Figures 1-5. For all sectors, the largest change in x_1 expenditure occurs when the difference in parameters is largest. That is, the increase is largest for high values of $(\alpha - \beta)$ in case A, $(\mu - \beta)$ in case B, $(\alpha - \mu)$ in case F, and $(\mu^R - \mu)$ in case G.[29] These are merely the differences in the share of income spent on children's human capital when the father is away minus the share spent when he is a migrant, and correspond to the different parameter rankings mentioned above. Those occupations with the most positive output (the most parameter combinations yielding an increase

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[28]The derivation of these equations is discussed in Appendix C.
[29]A,B,F, and G correspond to equations 51, 52, 53, and 54, as derived in Appendix D.

in x_1 expenditure) are Agriculture, Personal Services, and Unskilled Manufacturing. This is not surprising since the size of $\frac{R}{Y^{father}}$ is greater than one for these sectors, and thus these households experience a rise in disposable income resulting from the father's absence.

Similarly, those sectors with the smallest ranges of parameters for which an increase is possible are Professionals and Administrators and Directors. These are sectors with higher average earnings, and although the average remittance is also somewhat higher, the average size of $\frac{R}{Y^{father}}$ is relatively smaller. The important conclusion from these results is that increases in expenditure on children's human capital *are* feasible, and not only for extreme values of parameters. For all of the displayed sectors, increases in x_1 can be found for parameter values that are less than $\frac{1}{2}$, and for relatively small differences in parameters. It is not necessary that the share of income spent on x_1 be unrealistically large in the father's absence and/or unrealistically small in his presence. Under the imposition of average earnings per occupation and average remittances, increases in expenditure on children's human capital can be found to occur under a wide range of parameter combinations. This finding suggests that remittances sent from migrant fathers to mothers have the potential to improve children's educational attainment and therefore have long run effects on social mobility and growth. This can be contrasted to the findings of Borjas (1987, 1993, 2006), in which the experience of migrant children is documented. These studies demonstrate a lack of upward social mobility for both the initial immigrants from less developed countries to the US and their cohorts. While improvements to social mobility are in general not found for Mexican immigrants that are followed by their children, I find that human capital gains are possible for children remaining in Mexico. In order for these investments to have long run effects on social mobility and growth in Mexico, it is pertinent that these children do not migrate. This is consistent with the finding by Caponi (2004), "every extra year of schooling is worth 5.28% less for those working in the US than for those working in Mexico" (p.10). Remittance receipt by de facto female heads and the resulting investment in the education of non-migrant children may therefore be a successful avenue for achieving upward mobility.

5.5 Effects of Migration/Remittance Receipt on Children's Educational Attainment

In previous sections I provided evidence that migrant's remittances may be spent by the de facto household head in a manner that differs from the expectations or desires of the migrant. Specifically, results suggested that mothers were more likely to see education as one of the top three spending purposes of the remittance. I also illustrated via simulations of the theoretical model that increases in expenditure on children's human capital is both feasible and realistic. A follow-up question is

of course whether the increase in resource allocation power given to mothers, combined with their preference for investments in human capital, will have any effect on outcomes for children. There are some difficulties, however, in analyzing these effects. The first relates to the lack of expenditure data necessary to conclude whether increases in expenditure on children's education is occurring. It is possible, for example, that the remittance was primarily allocated to this investment good, but that other income sources were simultaneously lost. Total household expenditure on children's human capital before, during, and after the migration would be ideal in evaluating these effects, but none of this information is available. Second, the mapping of spending on education into educational attainment or quality of education is not entirely intuitive. Expenditure on education may include college tuition, the purchase of needed supplies, transportation to school, or private school tuition, all of which would alter a child's quality of education to varying degrees. The removal of a child from the labor force to attend school would have the largest potential effects, as the marginal effects of extra education will be largest for those with little or no education at all. Such a change in labor allocation within the household, however, would not show up in education expenditures. Given these caveats, I analyze the determinants of children's education. Findings regarding the effects of parental migrations on children's educational attainment have important implications for the developmental consequences of remittances, but can only be interpreted as indirect evidence of the model's predictions, at best.

Tables 11 through 13 contain results for educational attainment. The left hand side variable for all education regressions, *Educational_Progress*, is defined as

$$Educational\_Progress = \frac{\text{Years of Education}}{\text{Age - 5}}, \tag{55}$$

assuming that the average child starts attending school at age six. The variable takes a value of one for any child that has been continuously attending school since age six, and values less than one for those who have stopped attending school or have attended in intermittent years. This variable is used in lieu of years of education or years of education over age, due to the consistency across age groups provided by the *Educational_Progress* variable. The use of years of education alone as a dependent variable would equate two individuals of different ages with the same amount of schooling. Controlling for age on the right hand side identifies that overall trends of education proceed with age, but a ten year old and a twenty year old with the same amount of schooling are still given the same left hand side values. Using the conventional measure of years of education over age, on the other hand, provides the same value for a six year old child with one year of education as for an eighteen year old with three years of education. These two individuals, however, clearly have very different levels of educational progress and should not be given the same numerical value. Regressions were

also restricted to children of the household head. There are many households, especially in rural areas, where numerous families co-reside. Detailed information regarding educational attainment and life histories are provided only for the household head and his or her spouse. I therefore lack parental information for any children that are *not* offspring of the household head. An additional restriction is that the children must be between age 6 and 26. Assuming that the average doctorate takes five years to complete, an individual with a PhD would have completed 21 years of education. A child of 26 years with a doctorate degree would therefore have an educational attainment value of one. Similarly, a fifteen year old still attending school would have a value of one, while any children no longer attending school at that age would have some value less than one. This variable captures a child's education relative to what it would be had they been continuously attending school since age six.[30]

I begin by evaluating the general determinants of children's educational attainment, and will then focus on the effects of parental absences due to US migrations. The first set of results are provided in Table 11, where the second regression contains variables that break the female-headed household variable into two groups: female heads that are de facto heads, or induced by migration, and those that are divorced or widowed mothers. The latter group is defined as *Other_femaleheads.* As expected, children's education is increasing in the educational attainment of both of their parents. Children that have taken numerous trips to the United States or are members of a farming household have lower levels of educational attainment. This is not surprising; trips to the US may impede school attendance and those living on a farm likely have restricted access to schools and are needed at home as laborers. Similarly, children living in households with electricity or a washing machine have higher educational attainment.

Finally, a child's educational attainment is increasing in the number of trips taken to the US by both the household head and his spouse, as well as in the presence of a female head. As mentioned previously, however, there is a timing inconsistency between the left and right hand sides of this equation, making the significance of this variable difficult to interpret. That is, femaleheads is a current variable, denoting whether the household is headed by a female in the present year, while a child's educational attainment has been accrued over the lifetime. If, for example, the household head is currently on a migration, but this is his first trip to the US, the presence of a female head will have little effect on the children's education levels. Similarly, it is unlikely that older children in such a household will be affected by the father's absence, especially if they were pulled out of school and placed into the labor force at an earlier age in an attempt to smooth shocks before the migration decision was made. The positive and significant sign on *Heads_US_trips*, however, may suggest that

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[30]Any child of the household head whose recorded age was greater than the head's age has been dropped, in addition to those children who have years of educational attainment greater than their age. These are clearly data entry errors.

the receipt of remittances and allocation of decision making power to the mother throughout the child's life has positive effects on educational attainment. When the *Female_Head* variable is split into *De facto* and *Other* femaleheads, the *de facto* variable remains positive and significant while the coefficient on *Other_femaleheads* is insignificant. The true significance of these variables, however, is still difficult to gauge due to the inconsistencies in the time dimension.

In an effort to resolve this problem and to evaluate the effects of parents' absences *throughout* a child's life, as opposed to merely at the time of the survey, I have created variables which capture the timing of parents' trips relative to the children's ages, and replace *Female_Head* with these variables. Using the life histories provided for both the household head and his spouse, I have constructed the number of trips taken by the mother and father during various age intervals of a child's life. For those trips to the US where the duration is provided, I have also created the total number of months that a given parent was absent during the same intervals. That is, for the periods before birth, 0 to 5, 6 to 10, 11 to 15, and 16 to 20 for each child, I have constructed the variables *Number_mothersTRIPS, Number_fathersTRIPS, monthsgone_mother,* and *monthsgone_father*. This technique is similar to that found in Antman (2006), although her focus is on the child's age at the time of the *first* migration to the US, as opposed to incorporating *all* of the parents' trips, as well as their length. All covariates are the same as for the previous education regressions, with the exception of *Heads_US_Trips* which has been dropped due to its obvious correlation with the added variables. These results can be found in Tables 12 and 13. In an effort to isolate the effects of parental absences on children's educational attainment, these regressions will include a family-level fixed effect. This will eliminate any concerns of endogeneity due to selection bias or omitted variables. If household-wide unobservable characteristics simultaneously determine both parental migration decisions as well as children's schooling, OLS estimates will be inconsistent. The equations to be estimated are[31]

$$
\begin{aligned}
Educational\_Progress_i = {} & \beta_0 + \beta_1 Male_i + \beta_2 Eldest\_child_i + \beta_3 Youngest\_child_i + \\
& \beta_4 US\_Experience_i + \beta_5 NumberTrips\_MotherBEFOREBIRTH_i + \\
& \beta_6 NumberTrips\_Mother0to5_i + \beta_7 NumberTrips\_Mother6to10_i + \\
& \beta_8 NumberTrips\_Mother11to15_i + \beta_9 NumberTrips\_Mother16to20_i + \\
& \beta_{10} NumberTrips\_FatherBEFOREBIRTH_i + \beta_{11} NumberTrips\_Father0to5_i + \\
& \beta_{12} NumberTrips\_Father6to10_i + \beta_{13} NumberTrips\_Father11to15_i + \\
& \beta_{14} NumberTrips\_Father16to20_i + \alpha_h + \epsilon_i
\end{aligned}
\tag{56}
$$

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[31]Fixed effects are used in lieu of random effects in these regressions due to an unequivocal rejection of the assumptions implicit in the random effects model by the Hausman test.

and

$$Educational\_Progress_i = \beta_0 + \beta_1 Male_i + \beta_2 Eldest\_child_i + \beta_3 Youngest\_child_i +$$
$$\beta_4 US\_Experience_i + \beta_5 Monthsgone\_MotherBEFOREBIRTH_i +$$
$$\beta_6 Monthsgone\_Mother0to5_i + \beta_7 Monthsgone\_Mother6to10_i +$$
$$\beta_8 Monthsgone\_Mother11to15_i + \beta_9 Monthsgone\_Mother16to20_i + \quad (57)$$
$$\beta_{10} Monthsgone\_FatherBEFOREBIRTH_i + \beta_{11} Monthsgone\_Father0to5_i +$$
$$\beta_{12} Monthsgone\_Father6to10_i + \beta_{13} Monthsgone\_Father11to15_i +$$
$$\beta_{14} Monthsgone\_Father16to20_i + \alpha_h + \epsilon_i$$

The results indicate that the number of trips taken to the US by both parents prior to the child's birth significantly increase his or her educational attainment. As suggested by Antman (2006), this may be because savings from migrations allow for later investments in education, or because time spent in the US has caused the parents to value education and therefore stress the importance of educational attainment to their children. The number of trips taken by either parent while the child was between the ages of 11 to 15 similarly has positive effects on the child's education. There are also positive effects for the number of trips taken by the father between the ages of zero to five and six to ten. For a child of 22 years, these coefficients suggest that an additional trip taken by the father during the 0 to 5 and 6 to 10 age ranges increases educational attainment by 0.57 and 0.69 of a school year, respectively.[32] The eleven to fifteen age range is a critical one, as these are the ages at which children are likely able to work productively and may be pulled from school to provide extra hands on family farms or within family businesses. The significance of the mother's trips during this age range was unexpected.

These variables, however, do not denote purpose or length of trip, simply the number of times each parent traveled to the US. It is highly possible that mothers traveling to the US do so on business or vacation. If so, these trips may be correlated with transitory positive income shocks, a fact which may be causing the positive correlation between mothers' trips and children's educational attainment. It is for these reasons that the variables denoting months of absence were created, and the results for regressions replacing the number of trips variables with the number of months gone variables for the same age ranges are presented in Table 13. Here the coefficients on variables denoting maternal absences are all insignificant. The number of months the father was absent, however, has a positive and significant impact during *all* age ranges of the child's life. The key age

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[32]These numbers are derived as follows. For a 22 year old child, the coefficient on the number of trips taken by the father while the child was 0 to 5 is 0.034. Since the denominator of *Educational Progress* is constant at 17, this suggests that educational attainment (the numerator) must increase by 0.034*17=0.57.

ranges here are 11-15 and 16-20, and the positive result suggests that mothers may be less likely to pull children from school to enter the labor force when fathers are absent for an extended period of time. Evaluating these effects again for a 22 year old child, an additional year spent in the US by the father while the child was 11 to 15 increases educational attainment by 0.323, or about three months. The fact that the absence of the mother versus the father has different effects on children's educational attainment is further evidence that asymmetric preferences *do* exist, and that the gender of the de facto household head will have important consequences for children's human capital and development.

These findings have important implications for the long run effects of programs like PROGRESA, which provide transfers directly to disadvantaged mothers. PROGRESA was first implemented in Mexico in 1997 and provides grants to poor households with children in grades three through nine. Children are required to attend 85% of school days and the transfer value increases with child's age, recognizing the increased opportunity cost of attendance for older children (Behrman et al. 2005). These sizeable transfers, corresponding on average to a 22% increase in family income, are given directly to the female head of household (Adato et al. 2000). My finding that mothers are more likely to invest in children's human capital suggests that these transfers will increase children's educational attainment provided that mothers have say in their allocation. This program *has* been found to significantly alter the distribution of decision making power within the household. Adato et al. (2000), for example, find that PROGRESA decreases the probability that husbands make decisions alone in five out of eight decision making categories, and that women become more likely over time to allocate solely the extra funds provided by these transfers. Significant increases in educational attainment have been effected by this socially innovative program, and "There is evidence that the program has reduced income related inequalities in enrollment" (Schultz 2004, 216). These evaluations of the PROGRESA program combined with my empirical results confirming mothers' preferences for children's education suggest that placing resources in the hands of mothers is the most effective method to improve children's development via investments in their human capital.

6   Conclusion

This paper has combined an innovative model with recent data to illustrate that remittances *do* have the potential to effect household-level development via investments in human capital. I presented a model that explicitly solves for the value of remittances, taking differences in preferences into account, and then determines how such remittances are allocated by the recipient household. While the unitary model of household decision making has been rejected empirically by many, few have

incorporated asymmetric preferences into their modeling techniques. I have incorporated asymmetric preferences into the remittance decision via an implicit price index, where remitting becomes increasingly expensive for the migrant as preferences of the migrant and the de facto household head diverge. The model allows for both binary and non-binary sharing parameters, under the assumption that de facto heads gain allocative power in the absence of the migrant. The developmental impact of remittances is therefore predicted to depend both on the size of the remittance as well as the gender of the recipient and the allocative power he or she possesses.

Empirical analysis using data provided by the Mexican Migration Project illustrated that remittances resulting from paternal migration have important implications for educational attainment and development, as they are more likely than other income sources to be invested in children's human capital. Remittance-receiving households were found to lie in the middle of the income distribution, implying that remittances may in fact be invested, as opposed to being spent entirely on food and other basic needs, and therefore may effect household-level development. While some literature has suggested that remittances trap families in a vicious cycle of dependence on first-world incomes and that they are spent only on immediate needs (see Cañales (2005), Levitt (1996), Garcia and Paiewonsky (2006), Keely and Tran (1989), among others), the results presented in this section suggest otherwise. While those families sending a household head abroad *are* generally worse off than those sending other family members, migrant-sending and remittance-receiving families are *not* living in abject poverty, implying that the inflowing income may be spent in productive ways.

The assertion of asymmetric preferences was also confirmed, by comparing responses given by mothers and fathers regarding expenditure patterns out of migrants' remittances and savings. Tests for differences in means regarding the primary, secondary, and tertiary purposes of migrants' savings and remittances show that the gender of the informant significantly alters the responses given. Given that the households for which these responses are given are households in which the head migrated, and the purposes can be recalled, there is no reason to expect systematic differences in responses *unless* mothers and fathers have asymmetric preferences. These results hold when logits were run on the determinants of the different expenditure purposes of savings and remittances, suggesting again that the gender of the informant is independently important and not simply correlated with other covariates.

Estimations of the changes in expenditure on children's human capital (comparing the case of remittance receipt to that where the migrant is present in the household) over various sectors of employment then illustrated that increased spending on education resulting from remittances is not an unrealistic prediction. Using averages from the Mexican data, these simulations showed that increases in investments in children's education *are* feasible, and the largest increases occur

when mothers' allocative power increases significantly, when preferences are most divergent, or when the size of the remittance is large relative to the domestic earnings contributed by the father before migration. Such conditions held most frequently in the sectors of Agriculture, Unskilled Manufacturing, and Personal Services. Ranges of parameters for which increases occurred, however, were found for *all* sectors.

Finally, in evaluating the ultimate effects of the shift in allocative power on outcomes for children, migration activity of children's parents was found to be a significant determinant of children's educational progress. Although results were mixed for the number of trips taken in different five year intervals of the child's life, the number of months during which the father was absent had a positive effects on the child's education for all age intervals of the child's life, while length of mothers' absences had no significant effect. Overall, remittances are found to increase investments in children's education via different avenues: first, remittances provide an extra income source to be allocated over all household expenditure, therefore increasing spending on children's education, and second, the absence of the migrant father increases the allocative power of the mother, giving extra weight to her preferences, which are biased towards investment in human capital over other physical goods. There is certainly potential for emigration and the ensuing remittances to have positive impacts on children.

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Figure 1: Agriculture

Fig 1a: Case A

Fig. 1b: Case B

Fig 1c: Case F

Fig. 1d: Case G

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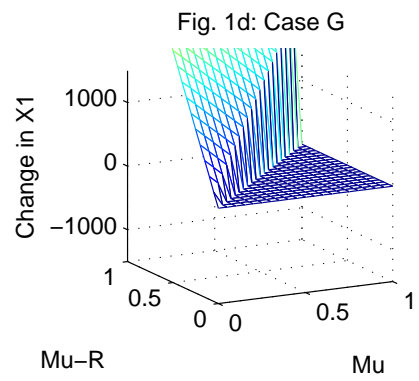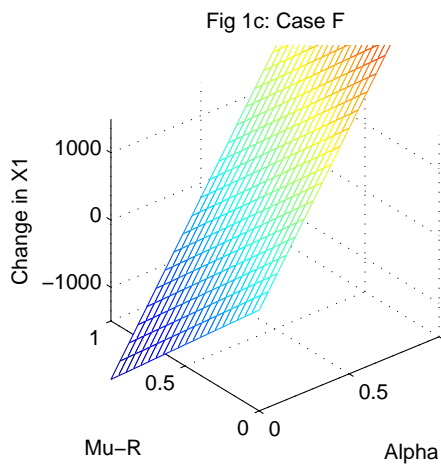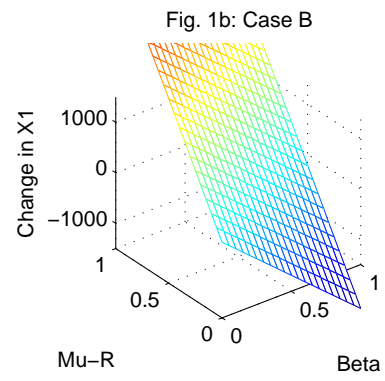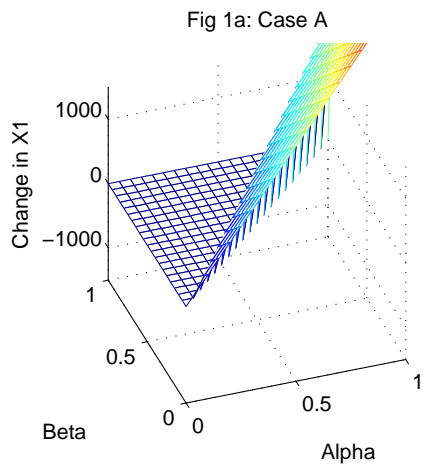
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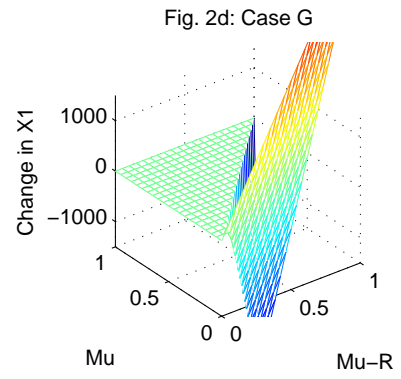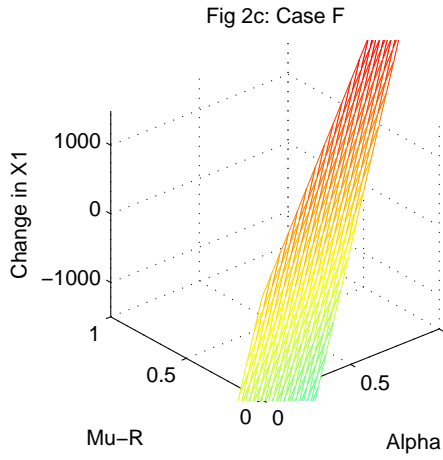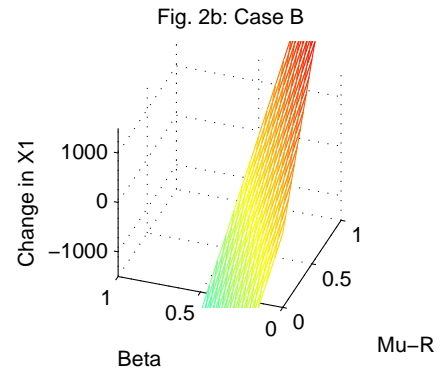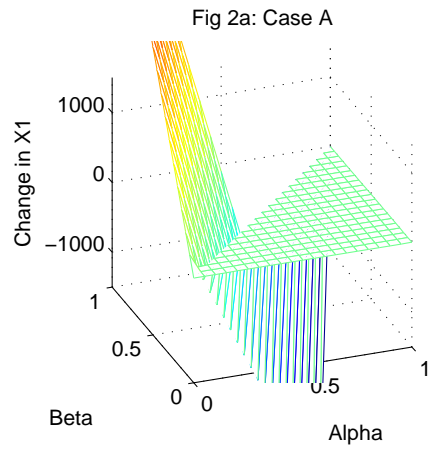
Figure 3: Unskilled Manufacturing
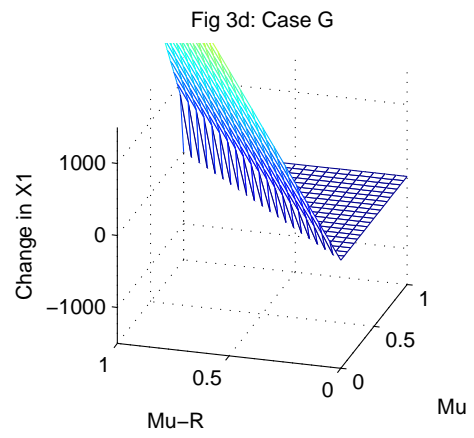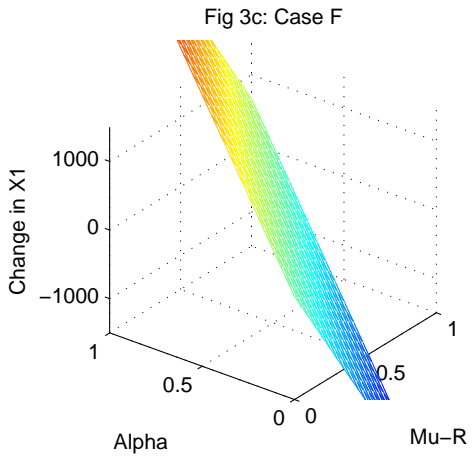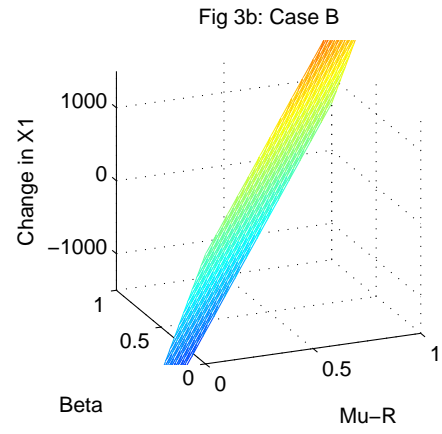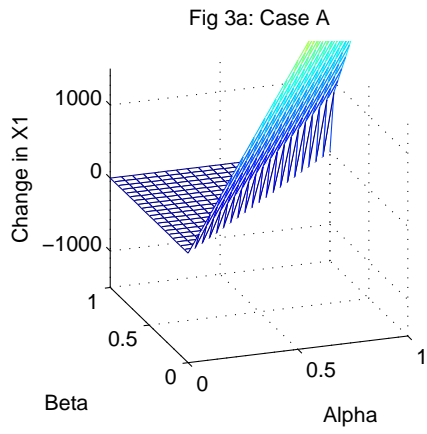
Figure 4: Professionals

Fig 4a: Case A

Fig. 4b: Case B

Fig. 4c: Case F

Fig. 4d: Case G

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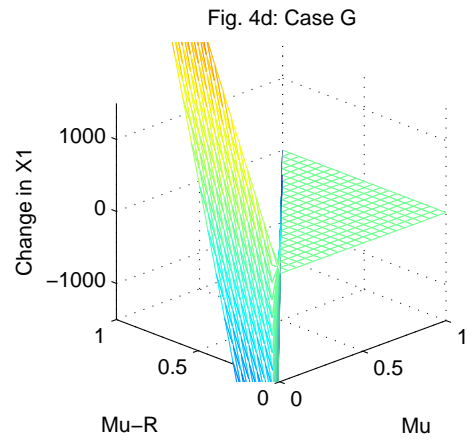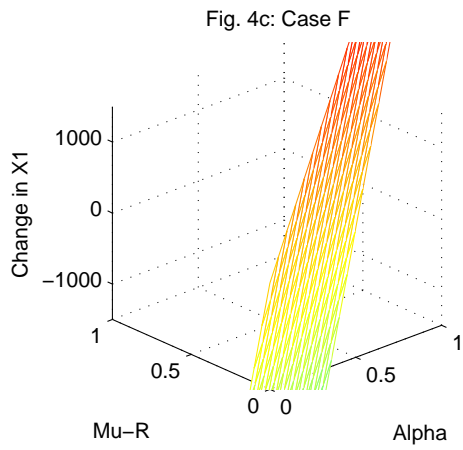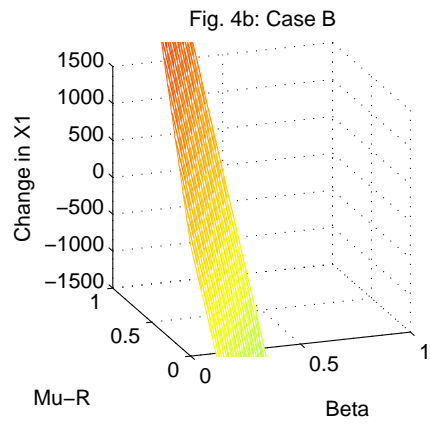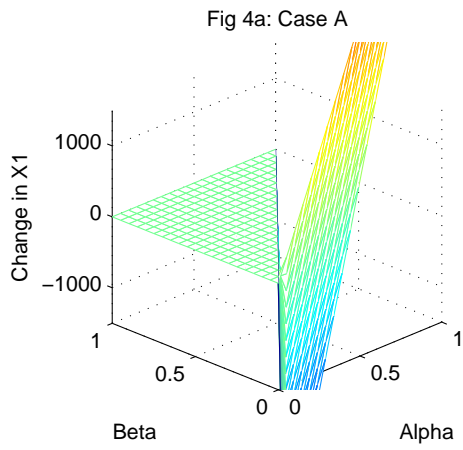
Figure 5: Personal Services

Fig 5a: Case A

Change in X1 (axis: 1000, 0, −1000)
Beta (axis: 0, 0.5, 1)
Alpha (axis: 0, 0.5, 1)

Fig 5b: Case B

Change in X1 (axis: 1000, 0, −1000)
Beta (axis: 0, 0.5, 1)
Mu−R (axis: 0, 0.5, 1)

Fig 5c: Case F

Change in X1 (axis: 1000, 0, −1000)
Mu−R (axis: 0, 0.5, 1)
Alpha (axis: 0, 0.5, 1)

Fig 5d: Case G

Change in X1 (axis: 1000, 0, −1000)
Mu (axis: 0, 0.5, 1)
Mu−R (axis: 0, 0.5, 1)
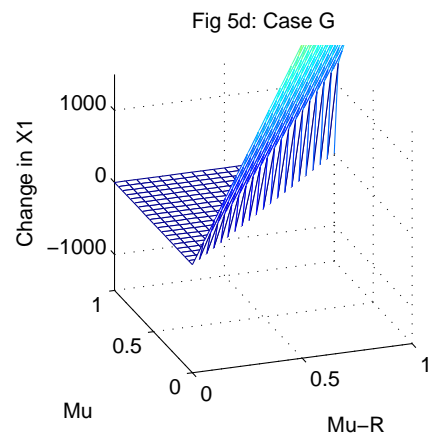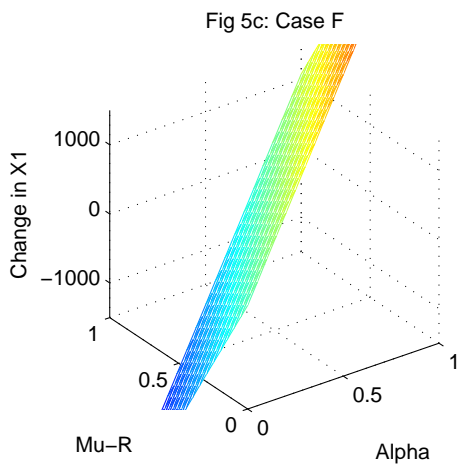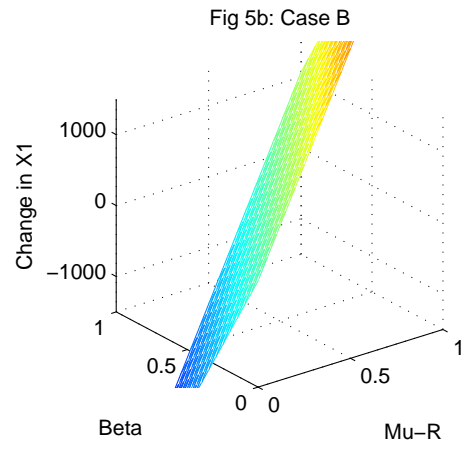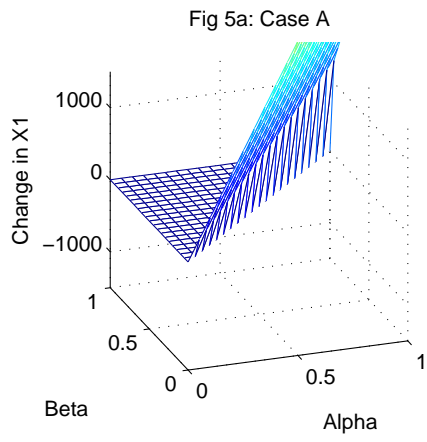
Table 1: Summary Statistics

Variable	N	Mean	Std. Dev.	Min.	Max.
Head Male (de jure)	16395	0.86	0.34	0	1
Head Education (years)	16376	5.63	4.57	0	28
Spouse Education (years)	13454	5.61	4.12	0	22
Head is Parent	16395	0.94	0.22	0	1
Spouse is Parent	13476	0.96	0.19	0	1
Head LF Participation	16314	0.86	0.34	0	1
Spouse LF Participation	13455	0.19	0.40	0	1
Head Employed (given LF Participation)	14070	0.97	0.15	0	1
Spouse Employed (given LF Participation)	2622	0.99	0.03	0	1
Head US Experience (years)	16296	1.52	4.38	0	65
Spouse US Experience (years)	9522	0.28	1.95	0	49
Sons	16395	1.32	1.33	0	10
Sons in LF	11135	0.69	0.98	0	10
Sons US Trips	11135	0.31	1.56	0	40
Daughters	16395	1.28	1.30	0	10
Daughters in LF	11032	0.36	0.70	0	6
Daughters US Trips	11032	0.07	0.53	0	20
Share Nonworkers	16395	0.61	0.23	0	1
Water	16387	0.95	0.21	0	1
Electric	16387	0.98	0.14	0	1
Sewer	16386	0.81	0.39	0	1
Stove	16381	0.94	0.24	0	1
Refrigerator	16383	0.72	0.45	0	1
Washing	16381	0.56	0.50	0	1
Radio	16383	0.91	0.29	0	1
Phone	16379	0.29	0.45	0	1
Female Informant	15554	0.60	0.48	0	1
Remittance Receipt	3269	0.22	0.41	0	1
Member Abroad	16395	0.20	0.40	0	1
Members in US	16395	0.43	1.12	0	12
Female Head (de facto *or* de jure)	16395	0.21	0.41	0	1
Farming Household	16395	0.28	0.45	0	1
Average Monthly Remittance (2004 $US)	4509	290.39	541.97	0	12000
Average Migrant Savings (2004 $US)	4205	1252.05	4514.48	0	150000
Educational Progress	107698	0.35	0.29	0	1
US Experience (Individual)	107698	0.96	3.60	0	65
Years Gone Father (0-5)	99414	0.20	1.40	0	61
Years Gone Father (6-10)	90477	0.16	1.19	0	48.33
Years Gone Father (11-15)	80629	0.15	1.16	0	51
Years Gone Father (16-20)	69812	0.20	1.39	0	61
Years Gone Father Before Birth	108691	0.52	2.56	0	64.5
Years Gone Mother (0-5)	99414	0.02	0.50	0	36.5
Years Gone Mother (6-10)	90477	0.01	0.54	0	36.5
Years Gone Mother (11-15)	80629	0.01	0.48	0	36.5
Years Gone Mother (16-20)	69812	0.03	0.56	0	34
Years Gone Mother Before Birth	108691	0.05	0.83	0	38

Table 2: Determinants of Sending a Member Abroad and Remittance Receipt, Marginal Effects Reported

	Member Abroad	Head in US	Remittance Receipt
De Facto Female Head			0.168
			(0.077)**
Head Education	-0.006	0.000	-0.002
	(0.001)***	(0.000)	(0.004)
Spouse Education	-0.007	0.000	0.001
	(0.001)***	(0.000)	(0.003)
Farming Household	0.025	-0.001	-0.056
	(0.014)*	(0.001)	(0.047)
US Experience	0.008	0.002	-0.001
(Years)	(0.000)***	(0.000)***	(0.000)
Members in US			0.014
			(0.008)*
Other Members in US		0.007	
		(0.000)***	
Lifecycle: No Children	-0.102	0.019	-0.075
	(0.009)***	(0.026)	(0.052)
Lifecycle: All Children under 13	-0.122	0.088	-0.042
	(0.013)***	(0.020)***	(0.038)
Lifecycle: Some Teenagers	-0.049	0.035	-0.020
	(0.008)***	(0.007)***	(0.018)
Lifecycle: Some Adults	-0.085	0.152	0.123
	(0.009)***	(0.070)**	(0.126)
Share Nonworkers	-0.040	0.002	0.095
	(0.014)***	(0.004)	(0.067)
Number Properties	-0.012	-0.004	-0.040
	(0.014)	(0.002)*	(0.033)
Number Vehicles	0.000	-0.002	0.043
	(0.004)	(0.001)*	(0.035)
Washing Machine	0.031	-0.001	0.015
	(0.008)***	(0.001)	(0.017)
Sewer	-0.029	-0.005	-0.057
	(0.016)*	(0.003)*	(0.075)
Electric	0.046	0.005	0.106
	(0.019)**	(0.002)***	(0.045)**
Runwater Community	0.001	0.000	0.017
(Percentage of Dwellings)	(0.000)***	(0.000)***	(0.003)***
Cantread Community	0.001	0.000	0.018
(Percentage of Aged 15+)	(0.001)	(0.000)*	(0.007)**
Observations	13429	13429	2547
Pseudo R^2	0.19	0.32	0.30

Marginal effects, robust standard errors in parentheses.

*significant at 10%;**significant at 5%;***significant at 1%

Table 3: Determinants of Remittance Size

Head Education	9.504	[0.132]
	(2.390)***	
Spouse Education	8.652	[0.121]
	(3.796)**	
Farming Household	-30.395	[-0.025]
	(17.453)*	
US Experience	0.941	[0.137]
	(0.164)***	
Last Monthly US Earnings	0.062	[0.189]
	(0.010)***	
Last Trip Duration	-0.976	[-0.050]
	(0.223)***	
Lifecycle: No Children	-6.934	[-0.001]
	(72.250)	
Lifecycle: All Children Under 13	78.809	[0.075]
	(28.989)***	
Lifecycle: Some Children Teenagers	80.095	[0.100]
	(25.670)***	
Lifecycle: Some Children Adults	16.001	[0.001]
	(60.151)	
Share Nonworkers	11.327	[0.020]
	(33.281)	
Number Properties	15.812	[0.052]
	(24.812)	
Number Vehicles	22.578	[0.034]
	(17.269)	
Washing Machine	-12.497	[-0.021]
	(27.531)	
Water	39.197	[0.104]
	(35.691)	
Sewer	26.837	[0.064]
	(20.046)	
Electric	-56.812	[-0.156]
	(75.956)	
Runwater Community	1.476	[0.296]
(Percentage of Dwellings)	(0.615)**	
Cantread Community	8.089	[0.304]
(Percentage of Aged 15+)	(2.042)***	
Constant	-135.843	
	(98.712)***	
Observations	2311	
Adjusted R^2	0.17	

Robust standard errors in parentheses; clustered at the community level.

Elasticities reported in square brackets.

Note: LHS variable is real average monthly remittance,

restricted to be > 0 and within 3 standard deviations of the mean.

Table 4: Difference in Means of Primary Remittance Expenditure Purpose Over Gender of Informant

	Father Informant		Mother Informant		Difference
	N	percent	N	percent	Mother-Father
Education Expenses	5	0.003	13	0.010	0.007**
Food/Maintenance	603	0.320	656	0.500	0.180***
House Construction/Repair	136	0.072	81	0.062	-0.010**
Health Expenses	830	0.440	412	0.314	-0.126***
Ag. Inputs Purchase	10	0.005	1	0.001	-0.005**
Recreation/Entertainment	1	0.001	4	0.003	0.003
Debt Payment	109	0.058	59	0.045	-0.013*
Start/Expand Business	5	0.003	3	0.002	0.000
Finance Special Event	2	0.001	0	0.000	-0.001
Purchase of House/Lot	24	0.013	12	0.009	-0.004
Livestock Purchase	7	0.004	4	0.003	-0.001
Consumer Goods Purchase	84	0.045	34	0.026	-0.019
Savings	31	0.016	15	0.011	-0.005
Other	36	0.019	17	0.013	-0.006
Total	1842		1281		

Table 5: Difference in Means of Secondary Remittance Expenditure Purpose Over Gender of Informant

	Father Informant		Mother Informant		Difference
	N	percent	N	percent	Mother-Father
Education Expenses	102	0.054	182	0.397	0.342***
Food/Maintenance	54	0.084	52	0.113	0.029
House Construction/Repair	109	0.170	97	0.211	0.042
Health Expenses	278	0.432	136	0.296	-0.136***
Ag. Inputs Purchase	3	0.005	2	0.004	0.000
Recreation/Entertainment	3	0.005	2	0.004	0.000
Debt Payment	30	0.047	45	0.098	0.051**
Start/Expand Business	11	0.017	9	0.020	0.003
Finance Special Event	4	0.006	2	0.004	-0.002
Purchase of House/Lot	24	0.037	18	0.039	0.002
Livestock Purchase	11	0.017	6	0.013	-0.004
Consumer Goods Purchase	91	0.142	77	0.168	0.026
Savings	25	0.039	13	0.028	-0.011
Other	97	0.151	38	0.083	-0.068**
Total	643		459		

Table 6: Difference in Means of Tertiary Remittance Expenditure Purpose Over Gender of Informant

	Father Informant		Mother Informant		Difference
	N	percent	N	percent	Mother-Father
Education Expenses	31	0.150	62	0.282	0.131***
Food/Maintenance	12	0.058	15	0.068	0.010
House Construction/Repair	15	0.073	20	0.091	0.018
Health Expenses	96	0.466	105	0.477	0.011
Ag. Inputs Purchase	3	0.015	4	0.018	0.004
Recreation/Entertainment	8	0.039	3	0.014	-0.025
Debt Payment	26	0.126	36	0.164	0.037
Start/Expand Business	8	0.039	4	0.018	-0.021
Finance Special Event	1	0.005	2	0.009	0.004
Purchase of House/Lot	3	0.015	4	0.018	0.004
Livestock Purchase	4	0.019	2	0.009	-0.010
Consumer Goods Purchase	17	0.083	16	0.073	-0.010
Savings	13	0.063	9	0.041	-0.022
Other	40	0.194	18	0.082	-0.112*
Total	206		220		

Table 7: Difference in Means of Primary Savings Expenditure Purpose Over Gender of Informant

	Father Informant		Mother Informant		Difference
	N	percent	N	percent	Mother-Father
Education Expenses	2	0.001	6	0.006	0.005**
Food/Maintenance	462	0.222	407	0.407	0.185***
House Construction/Repair	315	0.152	165	0.165	0.013
Health Expenses	472	0.227	159	0.159	-0.068***
Ag. Inputs Purchase	150	0.072	8	0.008	-0.064
Recreation/Entertainment	90	0.043	25	0.025	-0.018***
Debt Payment	116	0.056	44	0.044	-0.012
Start/Expand Business	47	0.023	19	0.019	-0.004
Finance Special Event	10	0.005	5	0.005	0.000
Purchase of House/Lot	62	0.030	36	0.036	0.006
Livestock Purchase	44	0.021	2	0.002	-0.019**
Consumer Goods Purchase	150	0.072	56	0.056	-0.016
Savings	160	0.077	74	0.074	-0.003
Other	135	0.065	48	0.048	-0.017***
Total	2078		1000		

Table 8: Difference in Means of Secondary Savings Expenditure Purpose Over Gender of Informant

	Father Informant		Mother Informant		Difference
	N	percent	N	percent	Mother-Father
Education Expenses	51	0.049	78	0.133	0.084**
Food/Maintenance	90	0.087	59	0.101	0.014***
House Construction/Repair	135	0.131	120	0.205	0.074
Health Expenses	336	0.325	110	0.188	0.137***
Ag. Inputs Purchase	6	0.006	6	0.010	0.004
Recreation/Entertainment	66	0.064	15	0.026	-0.038***
Debt Payment	45	0.044	34	0.058	0.015
Start/Expand Business	38	0.037	18	0.031	-0.006
Finance Special Event	8	0.008	7	0.012	0.004
Purchase of House/Lot	29	0.028	28	0.048	0.020
Livestock Purchase	21	0.020	7	0.012	-0.008**
Consumer Goods Purchase	102	0.099	47	0.080	-0.018
Savings	17	0.016	9	0.015	-0.001
Other	89	0.086	47	0.080	-0.006***
Total	1033		585		

Table 9: Difference in Means of Tertiary Savings Expenditure Purpose Over Gender of Informant

	Father Informant		Mother Informant		Difference
	N	percent	N	percent	Mother-Father
Education Expenses	43	0.111	44	0.157	0.046**
Food/Maintenance	9	0.023	10	0.036	0.012***
House Construction/Repair	24	0.062	15	0.054	-0.008
Health Expenses	117	0.302	85	0.304	0.001***
Ag. Inputs Purchase	5	0.013	2	0.007	-0.006
Recreation/Entertainment	12	0.031	3	0.011	-0.020***
Debt Payment	29	0.075	27	0.096	0.021
Start/Expand Business	25	0.065	16	0.057	-0.007
Finance Special Event	2	0.005	5	0.018	0.013
Purchase of House/Lot	9	0.023	4	0.014	-0.009
Livestock Purchase	10	0.026	7	0.025	-0.001**
Consumer Goods Purchase	25	0.065	23	0.082	0.018
Savings	23	0.059	8	0.029	-0.031
Other	54	0.140	31	0.111	-0.029***
Total	387		280		

Table 10: Summary Statistics for Simulations by Occupation of Household Head

Household Head Sector	N	Spouse Monthly Income	Spouse N	Head Monthly Income	Head N	Avg. Remit.	Remit. N
Administrators/Directors*	203	1747.97	29	8992.84	93	3523.05	43
Agriculture*	3629	344.63	120	2023.39	979	3956.16	1489
Professionals*	257	2647.94	31	10382.19	67	3796.31	23
Manufacturing Skilled*	2248	545.26	158	4909.37	740	4361.18	681
Manufacturing Unskilled*	1137	616.69	65	3658.11	325	4303.1	423
Personal Services*	440	1140.39	31	3520.89	166	4592.51	187
Technical Workers	128	1383.60	12	8590.79	43	2470.78	18
Educators	468	3004.59	68	7538.97	148	3201.14	64
Arts/Performances	128	625.87	19	3687.20	65	3530.57	43
Husbandry/Forestry	270	596.32	11	3791.53	68	6646.81	104
Manufacturing Supervisors	105	1193.68	14	6298.87	52	3458.79	33
Manufacturing Heavy Equip	133	1031.20	36	4064.85	104	4557.98	33
Transportation	685	767.89	53	5819.55	260	3306.61	161
Service and Administration	98	2177.10	23	6202.21	57	2887.20	18
Administration and Support	405	1432.86	21	5244.91	87	2772.09	80
Sales	1423	2227.19	112	6787.86	442	3552.86	452
Ambulatory	157	504.11	7	6043.79	34	3074.73	53
Security	228	641.81	15	3941.74	84	3307.84	46
Unemployed/Not in LF	1183	1025.24	62	3730.46	409	2504.83	368

*These are the sectors for which figures of simulation results have been provided.

Spouse N is the number of observations for which there is wage data for the spouse.

Similarly, Head N corresponds to wage data for the household head, and Remit. N to remittance data.

Table 11: Determinants of Children's Educational Attainment

Female Head	0.020	
	(0.007)***	
De Facto Female Head		0.018
		(0.007)**
Other Female Head		-0.092
		(0.060)
Head US Trips	0.001	0.001
	(0.000)***	(0.000)***
Spouse US Trips	0.007	0.007
	(0.002)***	(0.002)***
Farming Household	-0.025	-0.025
	(0.003)***	(0.003)***
Head Education (in Years)	0.008	0.008
	(0.000)***	(0.000)***
Spouse Education (in Years)	0.011	0.011
	(0.001)***	(0.001)***
Male	0.006	0.006
	(0.003)**	(0.003)**
Number Properties	0.006	0.005
	(0.003)*	(0.003)
Number Vehicles	0.021	0.021
	(0.002)***	(0.002)***
Washing Machine	0.034	0.034
	(0.003)***	(0.003)***
Electric	0.071	0.069
	(0.010)***	(0.010)***
US Experience (Years)	-0.024	-0.002
	(0.000)***	(0.000)***
Share Nonworkers	0.175	0.176
	(0.007)***	(0.007)***
Sewer	0.036	0.036
	(0.005)***	(0.005)***
Water	0.002	0.001
	(0.007)	(0.007)
Constant	0.292	0.294
	(0.013)***	(0.013)***
Observations	32089	31979
Adjusted R^2	0.16	0.16

Robust standard errors in parentheses,

community level fixed effects.

*significant at 10%;**significant at 5%;***significant at 1%

Table 12: Effect of Parents' Trips on Children's Educational Attainment

Male	0.006
	(0.003)**
Eldest Child	0.018
	(0.004)***
Youngest Child	-0.044
	(-0.005)***
US Experience (Years)	-0.024
	(0.001)***
Father Trips Before Birth	0.055
	(0.005)***
Father Trips (0-5)	0.034
	(0.006)***
Father Trips (6-10)	0.041
	(0.006)***
Father Trips (11-15)	0.030
	(0.006)***
Father Trips (16-20)	0.001
	(0.007)
Mother Trips Before Birth	0.018
	(0.039)
Mother Trips (0-5)	0.027
	(0.032)
Mother Trips (6-10)	0.027
	(0.026)
Mother Trips (11-15)	0.067
	(0.025)***
Mother Trips (16-20)	0.040
	(0.027)
Observations	32255
Adjusted R^2	0.04

LHS variable is Educational Progress, as defined in text.

Robust standard errors in parentheses, household level fixed effects

*significant at 10%; **significant at 5%; ***significant at 1%

Table 13: Effect of Parental Absence on Children's Educational Attainment

Male	-0.000
	(0.004)
Eldest Child	-0.029
	(0.010)***
Youngest Child	0.017
	(0.015)
US Experience (Years)	-0.007
	(0.001)***
Father Years Gone Before Birth	0.037
	(0.007)***
Father Years Gone (0-5)	0.033
	(0.007)***
Father Years Gone (6-10)	0.027
	(0.007)***
Father Years Gone (11-15)	0.019
	(0.007)***
Father Years Gone (16-20)	0.016
	(0.006)***
Mother Years Gone Before Birth	-0.003
	(0.030)
Mother Years Gone (0-5)	0.011
	(0.028)
Mother Years Gone (6-10)	0.007
	(0.027)
Mother Years Gone (11-15)	0.001
	(0.026)
Mother Years Gone (16-20)	-0.001
	(0.021)
Observations	9353
Adjusted R^2	0.02

Robust standard errors in parentheses; household level fixed effects.

*significant at 10%; **significant at 5%; ***significant at 1%

A   The case of Cobb-Douglas utility

As $\theta \to 1$, the CES utility function is undefined, but converges in the limit to a Cobb-Douglas utility function. In this case, expenditure shares are constant and results are more straightforward. The only changes occur in the first stage of the game. The utility function of the migrant is now

$$U = C_{own}^{\gamma} C_{hh}^{1-\gamma}. \tag{58}$$

This results in demands of

$$C_{own}^* = \gamma(Y_{migrant} - B - Z), \tag{59}$$

and

$$C_{hh}^* = \frac{(1-\gamma)(Y_{migrant} - B - Z)}{P}. \tag{60}$$

The corresponding level of remittance is then

$$R^* = (1-\gamma)(Y_{migrant} - B - Z). \tag{61}$$

While the Cobb-Douglas utility function produces much cleaner and simpler results, its plausibility is clearly restricted. The level of remittance produced by this function is independent of P, and therefore independent of $(\alpha - \beta)$. Such a model suggests that migrants will remit a constant share of their earnings, regardless of how different their own preferences are from those of the de facto household head, and this will occur even with the knowledge of how remittances will be spent. The level of remittance will only be affected by a change in the resources available to the migrant or a change in the share $(1-\gamma)$ of resources that he devotes to the consumption "good" C_{hh}.

B   Occupations Included in Sector Classifications

Skilled Manufacturing
  - Food, beverage, and tobacco production workers, including cooks in establishments.
  - Mine, quarry, and well workers.
  - Textile and leather production workers (includes tailors, upholsterers, cobblers, embroiderers, lithographers, seamstresses).
  - Wood and paper production or printing workers (includes carpenters, cabinetmakers, lynotypists, film developers, other skilled carpentry work).
  - Metal production and treatment workers; vehicle, machinery and equipment repair (includes casters, lathe operators, boilermakers, welders, jewelers, goldsmiths, locksmiths, metal polishers, tool sharpeners, blacksmiths, refrigerator repair, musical instrument repair).
  - Ceramic, tile, glass or other mineral production workers.
  - Construction, installation, maintenance and finishing workers (includes bricklayers, house painters, plasterers, roofers, floor polishers, plumbers, etc.).
  - Electrical equipment, electronics and telecommunications installation and repair workers.
  - Chemical, petroleum, oil and plastics production workers.
  - Other craftsmen or manufacturing workers, including those in unspecified industry.

Unskilled Manufacturing
  - Food, beverage and tobacco production unskilled workers.
  - Mine, quarry and well unskilled workers.
  - Textile and leather production unskilled workers (includes garment finishing work, sewing buttons).
  - Wood and paper production or printing unskilled workers (includes furniture production).
  - Metallurgical or automotive production or repair unskilled workers.

- Ceramic, tile, glass or other mineral production unskilled workers.
- Construction unskilled workers.
- Electrical equipment, electronics, and telecommunications installation and repair unskilled workers.
- Chemical, petroleum, oil and plastics production unskilled workers.
- Other unskilled workers, including those in unspecified industry.

Administrators and Directors in both Public and Private Sectors
- Government administrators and legislators.
- Presidents, directors, senior managers, large factory owners.
- Specialized directors, managers, and administrators.
- Directors of political, union and civil organizations.
- Small and medium-sized factory owners.
- Small and medium-sized service establishments.
- Other administrators such as entrepreneurs, managers, directors, when no further specification provided.

Personal Services Workers
- Innkeepers, bartenders, waiters, flight attendants.
- Launderers, pressers, other clothes cleaning service workers.
- Doormen, concierges, elevator operators, bellboys, cleaning workers, gardeners, movers, dishwashers.
- Barbers, hair stylists, etc.
- Workers in car rental, other movable rental establishments.
- Party planners, tour guides, event organizers, caregivers in institutions.
- Morticians, funeral home workers.
- Other personal service workers (includes parking lot attendants).

Professionals
- Architects; civil, chemical, industrial engineers.
- Physicists, astronomers, mathematicians, statisticians, actuaries.
- Chemists and pharmacists.
- Physicians, dentists, optometrists, nutritionists, professional nurses.
- Biologists, ecologists, marine biologists, etc.
- Agriculturalists, veterinarians, professionals in forestry and fishery.
- Social scientists, lawyers, psychologists.
- Economists, business administrators, CPAs.
- Religious and other professionals.

C Tobit

Table 14: Results for Tobit Regression over *Remittance Size*

Head Education	4.022
	(2.407)*
Spouse Education	5.371
	(2.526)**
Farming Household	-34.211
	(16.717)**
US Experience	1.109
	(0.126)***
Last Monthly US Earnings	-0.000
	(0.000)
Last Trip Duration	-1.731
	(0.211)***
Lifecycle: No Children	-21.732
	(44.348)
Lifecycle: All Children Under 13	125.422
	(25.527)***
Lifecycle: Some Children Teenagers	120.890
	(21.714)***
Lifecycle: Some Children Adults	69.291
	(54.856)
Share Nonworkers	11.614
	(36.433)
Number Properties	-4.680
	(14.033)
Number Vehicles	-5.764
	(9.283)
Washing Machine	-14.710
	(16.316)
Water	7.066
	(37.002)
Sewer	36.378
	(22.425)
Electric	57.863
	(64.811)
Runwater Community	3.466
	(0.534)***
Cantread Community	12.289
	(1.694)***
Constant	-431.305
	(90.037)***
Observations	2928
Pseudo R^2	0.01

D Derivation of Equations Used in Δx_1 Estimations

Evaluating the change in expenditures on children's human capital will require knowledge of the relative ranking of all four of these parameters. Due to the assumptions that $\alpha > \beta$ and $\mu^R > \mu$, there are five possible rankings of parameters. These are $\mu^R > \mu > \alpha > \beta$, $\mu^R > \alpha > \mu > \beta$, $\mu^r > \alpha > \beta > \mu$, $\alpha > \mu^R > \beta > \mu$, and $\alpha > \beta > \mu^R > \mu$. Allowing for the cases of both binary and non-binary sharing parameters, there are similarly four possible combinations of μ and μ^R. These are $(\mu = 0, \mu^R = 1)$, $(\mu = 0, \mu^R < 1)$, $(\mu > 0, \mu^R = 1)$, and $(\mu > 0, \mu^R < 1)$. Evaluating these possibilities over the relevant rankings of α, β, μ, and μ^R leaves seven possibilities for Δx_1 after eliminating duplicates, where Δx_1 is defined as $x_1^{father\ away} - x_1^{father\ home}$. They are:

$$\Delta x_1 = \alpha(1-\gamma)(Y^{mother} + R) - \beta(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}) \tag{62a}$$

$$\Delta x_1 = \mu^R(1-\gamma)(Y^{mother} + R) - \beta(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}) \tag{62b}$$

$$\Delta x_1 = \beta(1-\gamma)(Y^{mother} + R) - \beta(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}) \tag{62c}$$

$$\Delta x_1 = \alpha(1-\gamma)(Y^{mother} + R) - \alpha(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}) \tag{62d}$$

$$\Delta x_1 = \alpha(1-\gamma)(Y^{mother} + R) - \mu(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}) \tag{62e}$$

$$\Delta x_1 = \alpha(1-\gamma)(Y^{mother} + R) - \mu^R(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}) \tag{62f}$$

$$\Delta x_1 = \mu^R(1-\gamma)(Y^{mother} + R) - \mu(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}) \tag{62g}$$

I will discuss the determination of equilibria for one of the five parameter rankings. The other four were conducted identically. For the case of $\mu^R > \alpha > \mu > \beta$, $(x_1^*, x_2^*) = (\alpha(1-\gamma)(Y^{mother} + R), (1-\alpha)(1-\gamma)(Y^{mother} + R))$ when the father is abroad, and $(x_1^*, x_2^*) = (\mu(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}), (1-\mu)(1-\gamma)(1-\delta)(Y^{mother} + Y^{father}))$ when he is in Mexico.[33] This implies that $\Delta x_1 = \alpha(1-\gamma)(Y^{mother} + R) - \mu(1-\gamma)(1-\delta)(Y^{mother} + Y^{father})$. This is how the change in human capital expenditure equations were constructed.

Equations (62c) and (62d) require no simulation, since an increase in x_1 expenditure in these cases requires that $R > Y^{father}$. As can be seen from Table 10, this inequality holds for the sectors of Agriculture, Unskilled Manufacturing, Personal Services, and Husbandry/Forestry. For fathers that work in other sectors, if $\mu < \mu^R < \beta < \alpha$ or $\mu^R > \mu > \alpha > \beta$, the use of average earnings data suggests that an increase in expenditure on children's human capital will *not* occur. I have also eliminated the estimation of equation (62e) since any combination of parameters that yields a positive change for (62f) will necessarily also yield a positive change for (62e).

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[33]These allocations come directly from equations (25) and (26).