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David A. Grigorian and Tigran A. Melkonyan

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Middle East and Central Asia Department

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Prepared by David A. Grigorian and Tigran A. Melkonyan[*]

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Abstract

The paper explicitly models the dynamic strategic aspects of the interaction between the migrant and the remittance-receiving relative(s), with the migrant behaving as a Stackelberg leader. It is also different from other formalizations of remittance behavior in its treatment of the two parties' interaction to realize potential gains from exchange. We demonstrate that when the migrant and the relative(s) cooperate to maximize the joint utility of the household, this leads to higher level of remittances as well as investment and hours worked by the relative(s). We use data from Armenia to test our predictions regarding implications of remittances flows on behavior of receiving households. Consistent with our predictions, remittance-receiving households work fewer hours and spend less on the education of their children. While saving more, these households are not leveraging their savings to borrow from the banking system to expand their business activities. This evidence suggests that the benefits of remittances might be overstated and emphasizes the importance of measuring their impact in a general- rather than a partial-equilibrium context.

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I. INTRODUCTION

The New Economics of Labor Migration (NELM) offers a rich agenda for theoretical and empirical research with potential implications going far beyond the determinants of migration and remittances. One aspect of the NELM agenda that has received little attention deals with the implications of migration-driven remittances on the microeconomic incentives of family members left behind. This is an important issue to tackle if one is to fully grasp the developmental impact of remittances on receiving countries.

The world-wide flow of remittances has grown tremendously in recent years becoming the second source of development finance after foreign direct investment (World Bank, 2005). While a general consensus exists on the poverty-reducing implications of remittances, if looked through the prism of their overall developmental impact in a general-equilibrium setting, remittances could be a blessing in disguise. Apart from the macroeconomic policy challenges of managing remittance flows, there exist other factors that may swing the pendulum in the other direction. Often overlooked in this regard are the loss of productive labor for the home country as well as the potential disincentives to work, study, and stay in the home country for the family members left behind.[1] Some of these issues might be more relevant for countries that have high average levels of human capital and could otherwise develop more vibrant economies to employ their labor forces domestically. This would typically require a strong reform push underpinned by measures to reduce corruption and improve governance. Instead, remittances could act as disincentives for the authorities to improve the business and human rights' environments and deal with systemic economic and social problems. These are typically the initial reasons for peoples' desire to migrate and seek their fortunes elsewhere (Kireyev, 2006), turning this into a vicious cycle. Anecdotal evidence and some recent research (e.g., Mai, 2004) also indicate that migrants' expectations of opportunities abroad can be inflated and their well-being and earnings exaggerated upon return. These factors, if true, are likely to lead to excessive migration and less-than-expected remittance transfers. Empirical evidence presented in this paper, consistent with our theoretical predictions, suggests that the benefits of migration and remittances might indeed be overstated. Our estimates of the effect of remittances on labor supply, education spending, and saving and borrowing behavior help shed more light on the impact of remittances on future growth and development prospects.

This paper examines the microeconomic effects of remittances using data from Armenia, one of the most industrialized and socially (i.e., in terms of education and health) advanced republics of the former Soviet Union. Notwithstanding the differences in national income accounting between socialist and market-based economies, Armenia's industrial sector generated 55 percent of total output and employed 39 percent of the labor force in 1987 (USSR Statistical Handbook, 1988). In addition, with upper secondary and higher education

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[1] See Goldfarb *et al.* (1984) for an earlier study along these lines.

enrollments at 87 and 19 percent of the relevant population groups in 1989, Armenia was ahead of many of the leading socialist bloc countries prior to the demise of the Soviet Union.[2]

Since independence from the Soviet Union in 1991, Armenia has made headlines not only as one of the fastest growing transition/developing economies in recent years (World Bank, 2007), but also as one of the biggest exporters of population in the world, measured as a ratio of emigrants to a country's original population. Consistent with the pattern observed in many countries in the former socialist bloc, emigration from Armenia—especially in the early years of independence—has largely involved educated and skilled individuals, who were able to quickly adjust to markets and conditions abroad. The brain drain has been severe (IWPR, 2000).

Remittances in Armenia, which may have reached 20 percent of GDP in recent years (CBA, 2006), have certain peculiarities at the micro level. Relatively strong (extended) family ties observed in Armenia (see Alesina and Giuliano, 2007, for a comparison with other countries in the region) may have increased the demand for remittances, resulting in transfers going to households of which the migrant is not an immediate member.[3] Remittances in Armenia also originate from a large diaspora, the members of which do not necessarily have immediate family in Armenia but remit money to their distant relatives or friends. Thus, we observe a sizable amount of (out-of-household) transfers not directly linked with migration.

The contribution of this paper to the remittances literature is twofold. First, we present a model of remittance behavior which explicitly models the *dynamic strategic* aspects of the interaction between the migrant and the remittance-receiving relative(s). In addition, we consider the scenario where the two parties can devise a self-enforcing agreement to implement choices that maximize their total surplus, which represents a departure from the traditional Nash bargaining approach utilized in the literature. We then compare the non-cooperative and the self-enforcing outcomes. Second, we present some empirical evidence using data from a region that has not been previously studied. The results are quite intriguing: we find that remittances reduce incentives to work and lead to less spending on education. In addition, we find evidence that remittance-receiving families save more. This, however, does not result in more borrowing from the banking system, contrary to what the remittances-as-collateral argument would suggest.

The paper is structured in the following manner. Section II discusses the theoretical considerations behind remittance flows, highlighting the incentives to remit and outlining the determinants as well as the impact of remittances. Section III builds a model of a representative migrant's interactions with her household in a two period overlapping

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[2] See UNISEF TransMONEE database, available via the Internet: http://www.unicef-irc.org/databases/transmonee.

[3] Armenia's low divorce rate—with an average of 14.6 percent for 1989–2005, a fraction of that in a number of Central and Eastern European countries—could also serve as an indicator of strong family ties (UNISEF TransMONEE database).

generations framework with altruism and strategic behavior. Section IV describes the data and reports the econometric estimates. Finally, Section V concludes.

II. REVIEW OF THE LITERATURE

A. Incentives to Remit

The remittances literature has suggested a plethora of motives to remit. These incentives can be grouped into two broad categories: an altruistic motive and a self-interest motive, with the latter typically represented as part of a self-enforcing contract between the migrant and the remittance-receiving party (or parties). In terms of modeling remittance behavior, a migrant is said to exhibit altruism toward a household member (or some other party) left in the home country when the migrant's utility function contains the utility of the household member(s). Frequently, the migrant and the household member(s) have mutually beneficial opportunities to exchange time- and state-contingent resources and/or specify certain actions. When markets to exchange these resources and specify actions do not exist and contracts to realize gains from exchange are not feasible, the parties may rely on implicit arrangements that are self-enforced via benefits of long-run cooperation and threats of punishment in repeated social or familial interactions.

Often, both altruism and self-interest motives could simultaneously determine remittance behavior (e.g., van Dalen *et al.*, 2005) and even be complementary. A number of authors have suggested that altruism ensures enforcement of implicit contracts between the migrant and the remittance-receiving party (e.g., Stark and Lucas, 1988; Sana and Massey, 2005). Stark and Lucas (1988) argue that remittances are part of such "self-enforcing, cooperative, contractual" arrangements. Lucas and Stark (1985) dub incentives in the self-interest category as "enlightened selfishness," also called "tempered altruism." As one would expect, the altruistic and the self-interest motives could have different implications for microeconomic behavior. A notable example of divergent outcomes driven by the underlying differences between these motives is the effect of the remittance-receiving relative's income on the amount of remittances. While altruism is likely to result in more remittances being directed to poorer households, the self-interest motive is consistent with co-movement of the relative's income and remittances.

The self-interest literature has identified the following specific drivers behind remittances: (i) to allocate risks among the remitting and receiving parties (e.g., Stark and Lucas, 1988; Sana and Massey, 2005; and Amuedo-Dorantes and Pozo, 2006b); (ii) to receive inheritance/bequest (e.g., Bernheim *et al.*, 1985; Stark and Lucas, 1988; Hoddinott, 1994; and de la Briere *et al.*, 2002); (iii) to smooth consumption (e.g., Poirine, 1997); (iv) to relax capital constraints faced by the household members (e.g., Cox *et al.*, 1998; Durand *et al.*, 1996; Poirine, 1997; and Woodruff and Zenteno, 2007); (v) to accumulate wealth in the home country (e.g., Adams, 1991; and Dustmann and Kirchkamp, 2002); (vi) to defray migration costs or repay education expenses (e.g., Lucas and Stark 1985; and Johnson and Whitelaw, 1974); (vii) to pay for social status in the home country (e.g., Stark, 1995); (viii) to pay for services provided by the household members—such as taking care of the migrant's assets or relatives while the migrant is abroad (e.g., Rapoport and Docquier, 2005); and (ix) to encourage or discourage migration from the home country (e.g., Docquier and

Rapoport, 1998).[4] Given the fundamental differences between these motives to remit, it is not surprising that different models of remittance incentives frequently yield divergent comparative statics results.

In reality, however, remittances are likely to be driven by a combination of these motives that vary in strength depending on societal and economic factors underlying the country/culture as well as individual remitters/families in question. We review some of those factors in the following sections.

B. Empirical Determinants of Remittances

Underpinned by the postulates of the NELM, the decisions whether or not to remit and how much to remit have received significant attention in the recent literature. Factors that influence the likelihood and the amount of remittances include those pertaining to both the remitter as well as the receiving family. As argued by some, more educated migrants are likely to remit less because their migration is more often of a permanent nature (e.g., Faini, 2003). Closeness of family ties could give a boost to both the self-enforcement and the altruistic motives and have different implications for remittance behavior across countries (e.g., Van Dalen *et al.,* 2005, and Sana and Massey, 2005).[5] Similarly, income levels of receiving families could be a major determinant of remittances (e.g., Osili, 2007).[6] There is some evidence found in the migration literature to suggest that the link between a household's income and migration/remittances is not linear.[7] Finally, a high wage/income differential between the host and home countries could weaken the self-interest (e.g., bequest-related) motives, with subsequent implications for remittance behavior.[8]

Some analysts also predict a relationship between the time away and the likelihood of remittance transfers. According to the remittance decay hypothesis (RDH), the longer migrants live away from home, the less likely it is for them to remit funds. This relationship is likely to be non-linear, reflecting, on one hand, the dynamics of the migrants' experience

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[4] For a unified analysis of these issues see an excellent overview by Rapoport and Docquier (2005).

[5] Van Dalen *et al.* (2005) define family ties by the presence of a child, or parents, or a spouse in the home country. Interestingly, they find different patterns across some countries in the Middle East: in Egypt, the presence of a spouse is a strong factor behind remittances, while in Morocco what matters is the presence of a child. Turkey offers no significant results in this respect. Similarly, Sana and Massey (2005) show the difference in remittance patterns in the Dominican Republic and Mexico.

[6] Osili (2007) uses the U.S.–Nigeria Migration Study to find that poorer origin families tend to receive larger remittances.

[7] Minasyan and Hancilova (2005) report that migrants from Armenia are largely from families with average income, suggesting that the low-income households do not have the means to send a migrant abroad, while the rich ones do not have the incentives to do so.

[8] This is because in the presence of a sufficiently high differential, the migrant could save enough not to care about the assets he could inherit from his parents.

(and therefore, income) in the host country's labor market, and, on the other hand, the wearing out of the family ties as time passes (e.g., Rodriguez, 1996).[9] In addition, time away could have an impact on the migrant's probability of returning to the home country, and through that channel have implications for the way remittances are transferred and saved at home by the relatives.[10]

C. Impact of Remittances

The focus of the recent remittances literature has shifted away from the determinants of remittances toward the (macro and micro) implications of the remittance flows. Although most of the empirical work has focused on migrant-exporting countries with rather similar characteristics, the debate about the impact of remittances is far from over.

Using cross-country macro data, Chami and others (2005) report a negative effect of remittances on growth and productivity. They argue that this takes place because migration deprives the economy of the most productive workers, or that remittances have adverse effects on those staying behind, or both. Another macro study, Acosta and others (2007), finds that in addition to the usual nominal exchange rate channel, remittances result in a shrinkage of, and resource re-allocations away from, the tradable sector through (i) increasing prices in the nontradable sector, and (ii) reducing the labor supply to, and thereby increasing the production costs of, the otherwise labor-intensive nontradable sector. Using micro data from Morocco, van Dalen and others (2005) find that remittances have a potential to stimulate further migration among the family members left behind. These studies all point out that in the presence of these effects, the benefits of remittances, if any, could be less pronounced.

In terms of the microeconomic behavioral changes driven by remittances, the literature has focused on the impact of remittances on household expenditure (including such sub-components as expenditures on investment goods, health, and education) and labor-leisure allocation. While most studies find that remittances boost consumption, results vary as to how much of the remittances flows get siphoned away for more productive uses. Studies that find a positive relationship between remittances and various types of household investments include Taylor (1992), Glytsos (1993), Brown (1994), Adams (1998), Massey and Parrado (1998), Rozelle and others (1999), McCormick and Wahba (2001), Muent and others (2001), Dustmann and Kirchkamp (2002), Kule and others (2002), Taylor and others (2003), Mesnard (2004), Woodruff and Zenteno (2007), Yang (2007), and Zarate-Hoyos (2004). In contrast, others have argued that remittances are absorbed into immediate consumption and rarely finance productive investments (e.g., Lipton, 1980; Reichert, 1981; Massey *et al.*, 1987; Grindle, 1988; Ahlburg, 1991; Russell, 1992; and Brown and Ahlburg, 1999).

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[9] Hunte (2004) finds evidence supporting the RDH, while Brown (1997) finds evidence to the contrary.

[10] Osili (2007) demonstrates that the probability of the migrant's return is influenced by the fixed costs of emigration (causing the return to be less likely in the early years of migration but more likely as time passes) and the migrant's adaptation to the host country (reducing the probability of return as time passes), resulting in a U-shaped probability of return function.

As for the impact of remittances on education (i.e., expenditures, attendance, etc.) here too the empirical evidence is mixed. Yang (2007) finds that increased remittances lead to enhanced human capital accumulation; child schooling and educational expenditures rise. A study by Lopez Cordoba (2004) finds that Mexican municipalities that receive more remittances have greater literacy levels and higher school attendance among 6–14 year olds. Cox Edwards and Ureta (2003) find that remittances have a large and significant effect on school retention in El Salvador. Their estimated impact of remittances on school retention is considerably larger than the effect of other income. Hanson and Woodruff (2003) find that Mexican children in migrant households complete significantly more years of schooling and argue that their results are consistent with emigration helping relax household credit constraints on the financing of education. In contrast to these studies, Acosta (2006) finds that after controlling for sample selection and omitted variable biases, the positive impact of remittances on investment in children's education in El Salvador vanishes and even turns negative. Similarly, McKenzie (2005) finds that migration has a large negative impact on education in Mexican households: migration lowers years of completed education by 1.4 years for boys and 1.7 years for girls. The author attributes this result to the following factors. First, children ages 16–18 may be forced to migrate to obtain work instead of going to school, or to migrate with their parents and, and as a result, drop out of school. Second, future returns to schooling for children who are likely to migrate in the future are lower. Third, lack of parental supervision/presence in families with migrants is likely to lead to poorly supervised students and the need for them to do more household chores than otherwise.

Finally, a number of papers also examine the effect of remittances on labor supply and participation decisions. Amuedo-Dorantes and Pozo (2006a) use a nationally representative income and expenditure survey for Mexico to find that while the overall male labor supply does not vary with remittances, its composition does: remittances reduce formal sector work and self-employment for men in urban areas, but increase informal sector work in both urbanized and rural areas. In contrast to men, remittances result in an overall drop in female labor supply coming mostly from reductions in informal sector and non-paid work in rural areas. Yang (2007) finds that as a result of increases in remittances Filipino households raise hours worked in self-employment, and become more likely to start relatively capital-intensive household enterprises. He also finds that these positive income shocks lead to decreased child labor supply. Acosta (2006) finds support for the disincentive hypothesis behind the remittances, for both men and women.

III. THEORETICAL CONSIDERATIONS

A. Contrast with the Existing Approaches

The model presented here differs from the existing theoretical treatments of remittances in a number of ways. In contrast to the majority of existing models of remittance behavior, we explicitly model the *dynamic strategic* aspects of the interaction between the migrant and the remittance-receiving relative(s). Specifically, we consider a model where in each period the

migrant behaves as a Stackelberg leader by choosing the level of transfers.[11] The migrant's choice of remittance is followed by the migrant and the relative making their respective decisions on consumption and investment. There are many actual situations where this timing is more appropriate than the static representation where remittance choice and other decisions are all made simultaneously. An explicit modeling of the dynamic structure allows us to examine the migrant's strategic incentives to affect the remittance-receiving relative's behavior in future periods. The migrant behaves strategically and recognizes that his remittances change the relative's consumption, leisure, and investment decisions in future periods. The migrant's incentives to remit in the (non-cooperative version of our) model come from two sources. First, the migrant remits for purely altruistic reasons. Second, out of self-interest, the migrant makes transfers to increase the relative's bequest.

Another critical difference between our model and other formalizations of remittance behavior is how we model the two parties' interaction to realize potential gains from exchange. The majority of papers that model the process of arriving at a mutually beneficial outcome utilize the Nash bargaining solution (e.g., Hoddinott, 1994; Cox *et al.,* 1998). In contrast, we assume that the two parties can devise a self-enforcing agreement to implement choices that maximize their total surplus. The self-enforcing contract governs the entire course of the game. Our departure from the traditional Nash bargaining outcome approach has two motivations. First, it is more in line with the existing literature on relational contracts where the contracting parties maximize the total surplus from the long-run relationship (e.g., Baker *et al.*, 1986). Second, as demonstrated by MacLeod and Malcolmson (1993), Chiu (1998), and others, the Nash bargaining outcome relies on a number of restrictive assumptions about the bargaining process (such as sensitivity to interpretations of the roles of the threat points and outside options) which frequently do not reflect the bargaining environment of remittance behavior.

B. The Model

Consider a model with two agents, the migrant (m) and his representative relative (r). The migrant relocates from the home country (h) to the foreign country (f) to gain access to potentially more favorable economic conditions.[12] Both the migrant's and the relative's incomes are generated by the sale of their respective labor to the market. There are two time periods in the model. Timing in period 1 is as follows. First, the migrant remits $R_1 \geq 0$ to the relative. In the second stage of period 1, the migrant and the relative independently and simultaneously make their decisions: the migrant chooses the amount of leisure l_1^m and

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[11] Chami *et al.* (2005) also consider a model where the migrant behaves as a Stackelberg leader. In contrast to the present analysis, they do not model choices made by the migrant after the remittance decision is made. Another distinctive characteristic of our analysis is that we explicitly model overlapping generations and the bequest decision. On the other hand, Chami *et al.* (2005) model certain risks that may characterize the domestic market while we sidestep these considerations.

[12] It is straightforward to extend our model to accommodate the relocation decision by adding an initial stage to our game where the potential migrant chooses between migrating and staying in the home country.

consumption c_1^m, while the relative chooses the level of investment X_1^h in the home country, the amount of leisure l_1^r and consumption c_1^r. It is assumed that the two parties observe each other's choices after they are made. Thus, the migrant behaves as a Stackelberg leader in the first stage of period 1. The migrant's and the relative's budget constraints in period 1 are given respectively by:

$$w_1^f \overline{L} - R_1 = w_1^f l_1^m + c_1^m \tag{1}$$
$$w_1^h \overline{L} + R_1 + iX_0^h = w_1^h l_1^r + c_1^r + X_1^h, \tag{2}$$

where w_1^f is period-1 wage rate in the foreign country, w_1^h is period-1 wage rate in the home country, $\overline{L}$ denotes the total time available to the migrant and the relative, X_0^h is the stock of savings accumulated by the relative, and i denotes one plus the interest rate earned on investments in the home country. The assumption that only the relative makes an investment decision is made for simplicity. Note that we have also assumed, without any loss of generality, that the relative has access only to the home capital market. While most of the remittances literature (e.g., Cox *et al.*, 1998) assume that capital markets are non-existent, we allowed saving (e.g., deposit accumulation) but no borrowing. This reflects the heavily collateralized nature of borrowing in Armenia and other CIS countries.[13] Thus, the relative's additional sources of income in period 1 are the transfers from abroad and the interest earned on her accumulated investments.

The migrant survives through period 2 while the relative does not, because of her older age. In this period, the migrant chooses the amount of leisure l_2^m and consumption c_2^m. The migrant's budget constraint in period 2 is given by:

$$w_2^f \overline{L} + iX_1^h = w_2^f l_2^m + c_2^m \tag{3}$$

where w_2^f is period-2 wage rate in the foreign country. Thus, the relative makes investment X_1^h solely for the purpose of leaving it as a bequest to the migrant. The migrant's and the relative's period-t interdependent utility functions are given by $U^m\left(c_t^m, l_t^m, u^r\left(c_t^r, l_t^r\right)\right)$ and $U^r\left(c_t^r, l_t^r, u^m\left(c_t^m, l_t^m\right)\right)$, respectively. Given our assumption that the relative does not survive through period 2, in what follows c_2^r and l_2^r are restricted to zero. By building in the utility interdependence we allow for altruism on both the migrant's and the relative's parts. To simplify matters and following Rapoport and Docquier (2005), we assume additive separability of the interdependent utility functions:

$$U^m\left(c_t^m, l_t^m, u^r\left(c_t^r, l_t^r\right)\right) = \alpha \cdot u^m\left(c_t^m, l_t^m\right) + (1 - \alpha) \cdot u^r\left(c_t^r, l_t^r\right)$$

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[13] While we do not model the potential use of remittances as collateral (not to unduly complicate the model) we do test for the presence of this relationship in Section IV.

$$U^r\left(c_t^r,l_t^r,u^m\left(c_t^m,l_t^m\right)\right)=\gamma\cdot u^r\left(c_t^r,l_t^r\right)+(1-\gamma)\cdot u^m\left(c_t^m,l_t^m\right)$$

where $u^m\left(c_t^m,l_t^m\right)$ and $u^r\left(c_t^r,l_t^r\right)$ are the migrant's and the relative's private sub-utility functions, respectively, α and $1-\alpha$ are the weights placed by the migrant on herself and the relative, respectively, while γ and $1-\gamma$ are the weights placed by the relative on himself and the migrant, respectively. This system of utilities is "normally benevolent" in the sense of Bergstrom (1999). It is further assumed that:

$$u^m\left(c_t^m,l_t^m\right)=\eta\ln c_t^m+(1-\eta)\ln l_t^m \tag{4}$$
$$u^r\left(c_t^r,l_t^r\right)=\rho\ln c_t^r+(1-\rho)\ln l_t^r \tag{5}$$

where $0<\eta<1$ and $0<\rho<1$. Given these assumptions, the utility functions could be re-written as:

$$U^m\left(c_t^m,l_t^m,u^r\left(c_t^r,l_t^r\right)\right)=\alpha\left[\eta\ln c_t^m+(1-\eta)\ln l_t^m\right]+(1-\alpha)\left[\rho\ln c_t^r+(1-\rho)\ln l_t^r\right] \tag{6}$$
$$U^r\left(c_t^r,l_t^r,u^m\left(c_t^m,l_t^m\right)\right)=\gamma\left[\rho\ln c_t^r+(1-\rho)\ln l_t^r\right]+(1-\gamma)\left[\eta\ln c_t^m+(1-\eta)\ln l_t^m\right] \tag{7}$$

Let β^m and β^r denote the migrant's and the relative's discount factors, respectively. The migrant's and the relative's utilities discounted to period 1 are given by:

$$U^m\left(c_1^m,l_1^m,u^r\left(c_1^r,l_1^r\right)\right)+\beta^m U^m\left(c_2^m,l_2^m,u^r\left(c_2^r,l_2^r\right)\right) \text{ and}$$
$$U^r\left(c_1^r,l_1^r,u^m\left(c_1^m,l_1^m\right)\right)+\beta^r U^r\left(c_2^r=0,l_2^r=0,u^r\left(c_2^m,l_2^m\right)\right),$$

respectively. Thus, both the migrant and the relative derive happiness from increases in their counterpart's utility in each of the two periods in the model.

Non-cooperative solution

Here, the two parties play a three-stage game (i.e., first stage of period 1, second stage of period 1, and period 2) where both parties are perfectly informed about the history of the game at the end of each stage. The migrant's incentives to remit come from two interrelated sources. First, the migrant remits for purely altruistic reasons. The migrant behaves strategically and recognizes that his remittances change the relative's consumption and leisure decisions in the second stage of period 1 which, in turn, enter the migrant's utility function. Second, the migrant also recognizes that her/his remittances positively affect the relative's bequest. This factor enhances the migrant's incentives to remit.[14]

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[14] Note that in this section we have restricted our attention to the case where only the migrant makes transfers to the relative. The focus on the one-sided transfers is mainly motivated by space considerations and the fact that the dominant share of transfers are from migrants to their relatives in the home country. Our analysis changes minimally if we allow for transfers in both directions. In presenting the results of this section we focus on the scenarios where the migrant's remittances are strictly positive. Given our characterization of the subgame perfect equilibrium it should not present any difficulty to derive optimal choices in the case of zero transfers.

(continued…)

Solving the game backward we obtain the following result.

Result 1: The unique subgame perfect equilibrium is given by:

(a) in the first stage of period 1 the migrant chooses remittance

$$R_1 = \left(1 - \frac{\alpha}{1+\alpha\beta^m}\right)w_1^f \overline{L} - \frac{\alpha}{1+\alpha\beta^m}\left(w_1^h \overline{L} + iX_0^h + \frac{w_2^f \overline{L}}{i}\right);$$

(b) for any given R_1, the migrant's and the relative's choices in the second stage of period 1 are given by:

$$l_1^m(R_1) = \frac{(1-\eta)\left(w_1^f \overline{L} - R_1\right)}{w_1^f},$$

$$c_1^m(R_1) = \eta\left(w_1^f \overline{L} - R_1\right),$$

$$l_1^r(R_1) = \frac{(1-\rho)\gamma}{\left(\gamma + (1-\gamma)\beta^r\right)w_1^h}\left(w_1^h \overline{L} + iX_0^h + R_1 + \frac{w_2^f \overline{L}}{i}\right),$$

$$c_1^r(R_1) = \frac{\rho\gamma}{\gamma + (1-\gamma)\beta^r}\left(w_1^h \overline{L} + iX_0^h + R_1 + \frac{w_2^f \overline{L}}{i}\right),$$

$$X_1^h(R_1) = \frac{(1-\gamma)\beta^r\left(w_1^h \overline{L} + iX_0^h + R_1\right) - \gamma\frac{w_2^f \overline{L}}{i}}{\gamma + (1-\gamma)\beta^r}.$$

(c) For any given choice of X_1^h by the relative in the second stage of period 1, the migrant's consumption and leisure choices in period 2 are given by:

$$c_2^m(X_1^h) = \eta\left(w_2^f \overline{L} + iX_1^h\right) \text{ and } l_2^m(X_1^h) = \frac{(1-\eta)\left(w_2^f \overline{L} + iX_1^h\right)}{w_2^f}, \text{ respectively.}$$

Proof: See Appendix I.

The subgame perfect equilibrium path is characterized as follows:

(a) in the first stage of period 1 the migrant chooses remittance

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Finally, note that the variable reflecting whether a transfer (from the migrant to the relative) occurs has the same comparative statics properties as the remittance amount for an interior solution characterized below.

$$\widetilde{R}_1 = \left(1 - \frac{\alpha}{1+\alpha\beta^m}\right)w_1^f \overline{L} - \frac{\alpha}{1+\alpha\beta^m}\left(w_1^h \overline{L} + iX_0^h + \frac{w_2^f \overline{L}}{i}\right);$$

(b) the migrant's and the relative's choices in the second stage of period 1 are:

$$\widetilde{l}_1^m = \frac{\alpha(1-\eta)}{(1+\alpha\beta^m)w_1^f}\left(w_1^f \overline{L} + w_1^h \overline{L} + iX_0^h + \frac{w_2^f \overline{L}}{i}\right);$$

$$\widetilde{c}_1^m = \frac{\alpha\eta}{1+\alpha\beta^m}\left(w_1^f \overline{L} + w_1^h \overline{L} + iX_0^h + \frac{w_2^f \overline{L}}{i}\right);$$

$$\widetilde{l}_1^r = \frac{\gamma(1-\rho)(1+\alpha\beta^m - \alpha)}{(1+\alpha\beta^m)(\gamma+(1-\gamma)\beta^r)w_1^h}\left(w_1^f \overline{L} + w_1^h \overline{L} + iX_0^h + \frac{w_2^f \overline{L}}{i}\right)$$

$$\widetilde{c}_1^r = \frac{\gamma\rho(1+\alpha\beta^m - \alpha)}{(1+\alpha\beta^m)(\gamma+(1-\gamma)\beta^r)}\left(w_1^f \overline{L} + w_1^h \overline{L}^r + iX_0^h + \frac{w_2^f \overline{L}^m}{i}\right)$$

$$\widetilde{X}_1^h = \frac{(1-\gamma)\beta^r(1+\alpha\beta^m - \alpha)\left(w_1^f \overline{L} + w_1^h \overline{L} + iX_0^h\right) - \left(\alpha(1-\gamma)\beta^r + \gamma(1+\alpha\beta^m)\right)\frac{w_2^f \overline{L}}{i}}{(1+\alpha\beta^m)(\gamma+(1-\gamma)\beta^r)}.$$

(c) The migrant's choices in period 2 are given by

$$\widetilde{c}_2^m = \frac{\eta(1-\gamma)\beta^r(1+\alpha\beta^m - \alpha)}{(1+\alpha\beta^m)(\gamma+(1-\gamma)\beta^r)}\left(i\left(w_1^f \overline{L} + w_1^h \overline{L} + iX_0^h\right) + w_2^f \overline{L}\right) \text{ and}$$

$$\widetilde{l}_2^m = \frac{(1-\gamma)\beta^r(1-\eta)(1+\alpha\beta^m - \alpha)}{(1+\alpha\beta^m)(\gamma+(1-\gamma)\beta^r)w_2^f}\left(i\left(w_1^f \overline{L} + w_1^h \overline{L} + iX_0^h\right) + w_2^f \overline{L}\right).$$

Cooperative solution

So far we have considered remittance behavior driven by a mix of altruistic and strategic motives. An alternative motive for remittances is *exchange* (e.g., Barro, 1974; Bernheim *et al.*, 1985; and Cox, 1987). Under this motive the migrant makes remittances expecting that the relative will reciprocate.

Suppose that the migrant and the relative can devise an enforceable agreement to implement choices that maximize their total surplus. The two parties realize that there are gains from adjusting the non-cooperative choices of the previous section to maximize the total surplus of the migrant and the relative. The self-enforcing contract governs the entire course of the game. We leave the modeling of mechanisms that can implement such implicit contracts to future research and focus on the characterization of the optimal choice variables under the (cooperative) arrangement. Note that our modeling is different from the majority of formalizations of the exchange motive where levels of decision variables are determined through Nash bargaining. (e.g., Hoddinott, 1994; and Cox *et al.,* 1998). Note also that in this

section we do not place any sign restrictions on R_1 so that either party can make monetary transfers.

The two parties' optimization problem can be written as:

$$\max_{R_1, l_1^m, l_1^r, X_1^h, l_2^m \geq 0} \left[\begin{array}{l} U^m\left(c_1^m, l_1^m, u^r\left(c_1^r, l_1^r\right)\right) + \beta^m U^m\left(c_2^m, l_2^m, u^r\left(c_2^r, l_2^r\right)\right) \\ + U^r\left(c_1^r, l_1^r, u^m\left(c_1^m, l_1^m\right)\right) + \beta^r U^r\left(c_2^r, l_2^r, u^m\left(c_2^m, l_2^m\right)\right) \end{array} \right]$$
(8)

subject to budget constraints 1–4 above. Substituting the relevant budget constraints and noting that the relative does not survive through the second period, this optimization problem takes the form of:

$$\max_{R_1, l_1^m, l_1^r, X_1^h, l_2^m \geq 0} \left[\begin{array}{l} \left\{ \begin{array}{l} \alpha\left[\eta \ln\left(w_1^f \overline{L} - R_1 - w_1^f l_1^m\right) + (1-\eta)\ln l_1^m + \beta^m\left(\eta \ln\left(w_2^f \overline{L} + iX_1^h - w_2^f l_2^m\right) + (1-\eta)\ln l_2^m\right)\right] \\ + (1-\alpha)\left[\rho \ln\left(w_1^h \overline{L} + iX_0^h + R_1 - w_1^h l_1^r - X_1^h\right) + (1-\rho)\ln l_1^r\right] \end{array} \right\} \\ + \left\{ \begin{array}{l} \gamma\left[\rho \ln\left(w_1^h \overline{L} + iX_0^h + R_1 - w_1^h l_1^r - X_1^h\right) + (1-\rho)\ln l_1^r\right] \\ + (1-\gamma)\left[\eta \ln\left(w_1^f \overline{L} - R_1 - w_1^f l_1^m\right) + (1-\eta)\ln l_1^m + \beta^r\left(\eta \ln\left(w_2^f \overline{L} + iX_1^h - w_2^f l_2^m\right) + (1-\eta)\ln l_2^m\right)\right] \end{array} \right\} \end{array} \right]$$

Solving this leads to the following result.

Result 2: The cooperative levels of endogenous variables are given by:

$$\hat{R}_1 = \frac{\left(1 - \alpha + \gamma + \alpha\beta^m + (1-\gamma)\beta^r\right)w_1^f \overline{L} - (1 - \gamma + \alpha)\left(w_1^h \overline{L} + iX_0^h + \dfrac{w_2^f \overline{L}}{i}\right)}{\left(2 + \alpha\beta^m + (1-\gamma)\beta^r\right)};$$

$$\hat{X}_1^h = \frac{\left(\alpha\beta^m + (1-\gamma)\beta^r\right)\left(w_1^f \overline{L} + w_1^h \overline{L} + iX_0^h\right) - \dfrac{2w_2^f \overline{L}}{i}}{2 + \alpha\beta^m + (1-\gamma)\beta^r};$$

$$\hat{l}_1^m = \frac{(1-\eta)(1 + \alpha - \gamma)}{\left(2 + \alpha\beta^m + (1-\gamma)\beta^r\right)w_1^f}\left(w_1^f \overline{L} + w_1^h \overline{L} + iX_0^h + \dfrac{w_2^f \overline{L}}{i}\right);$$

$$\hat{l}_1^r = \frac{(1-\rho)(1 - \alpha + \gamma)}{\left(2 + \alpha\beta^m + (1-\gamma)\beta^r\right)w_1^h}\left(w_1^f \overline{L} + w_1^h \overline{L} + iX_0^h + \dfrac{w_2^f \overline{L}}{i}\right);$$

$$\hat{l}_2^m = \frac{(1-\eta)\left(\alpha\beta^m + (1-\gamma)\beta^r\right)}{\left(2 + \alpha\beta^m + (1-\gamma)\beta^r\right)w_2^f}\left(i\left(w_1^f \overline{L} + w_1^h \overline{L} + iX_0^h\right) + w_2^f \overline{L}\right).$$

Proof: See Appendix I.

C. Comparative Statics

We now compare the outcomes of the cooperative (i.e., first-best) and non-cooperative (i.e., second-best) equilibrium levels of key variables. For the purposes of this paper, in addition to

the effects of the exogenous parameters, we will be interested in monitoring the impact of remittances on the migrant's and relative's equilibrium allocations of consumption, leisure, and investment. We start with the relationship between the investment and remittances for the cooperative and non-cooperative models, which are given by:

$$\hat{X}_1^h = \frac{\left[\alpha\beta^m + (1-\gamma)\beta^r\right]\left[\hat{R}_1 + w_1^h \overline{L} + iX_0^h\right] - (1-\alpha+\gamma)w_2^f \overline{L}}{(1-\alpha+\gamma)i + \alpha\beta^m + (1-\gamma)\beta^r},{}_{15}$$

$$\widetilde{X}_1^h = \frac{(1-\gamma)\beta^r\left(w_1^h \overline{L} + iX_0^h + \widetilde{R}_1\right) - \gamma \dfrac{w_2^f \overline{L}}{i}}{\gamma + (1-\gamma)\beta^r},$$

respectively.

Due to space considerations, the expressions for the other endogenous variables are omitted, but can be deduced from Results 1–2. Instead, we summarize selected comparative statics results in Table 1. (Recall that signs $\wedge$ and $\sim$ denote the cooperative and non-cooperative levels of variables, respectively).

Table 1. Comparative Statics Under First- and Second-Best Options

on					The impact of:					
	R_1	w_1^f	w_1^h	w_2^f	X_0^h	α	γ	β^m	β^r	i
$\widetilde{R}_1$		+	−	−	−	−	**0**	+	**0**	+ iff $w_2^f \overline{L} > i^2 X_0^h$
$\hat{R}_1$		+	−	−	−	−	+	+	+	+ iff $w_2^f \overline{L} > i^2 X_0^h$
$\widetilde{X}_1^h$	+	+	+	−	+	−	−	+	+	+
$\hat{X}_1^h$	+	+	+	−	+	+	−	+	+	+
$\widetilde{l}_1^r$	+	+	−	+	+	−	+	+	−	+ iff $w_2^f \overline{L} < i^2 X_0^h$
$\hat{l}_1^r$	+	+	−	+	+	−	+	−	−	+ iff $w_2^f \overline{L} < i^2 X_0^h$

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[15] $\hat{X}_1^h$ and $\hat{l}_1^r$ are determined by fixing R_1 and solving problem 8.

Table 1 reveals some interesting similarities and differences across the non-cooperative and cooperative models, some of which can be tested empirically. These are some of the most notable similarities: (1) the level of remittances is decreasing in both the wage and the non-wage income of the relative; (2) the level of remittances is increasing in the migrant's wage in period 1 and decreasing in the migrant's wage in period 2; (3) the level of investment/bequest, the relative's consumption and leisure are all increasing in the level of remittances;[16] (4) the level of investment/bequest is increasing in the migrant's wage in period 1 and decreasing in the migrant's wage in period 2; (5) consistent with the assumption that leisure is a normal good, while the relative's labor income (i.e., the price of leisure) reduces the consumption of leisure, the non-labor income increases the consumption of leisure; and (6) for sufficiently high values of the migrant's expected wage rate in period 2 and sufficiently low rates of interest (both determined via $w_2^f \overline{L} > i^2 X_0^h$), higher interest rates lead to more remittances and more hours supplied to the market by the relative.

Driven by the differences in underlying incentives, the cooperative and non-cooperative solutions also have some important differences. First, changes in the relative's degree of selfishness, γ, and discount factor, β^r, do not affect the non-cooperative remittance level but have a positive effect on the cooperative level of remittances. Second, the migrant's degree of selfishness, α, has a negative effect on the non-cooperative level of investment but a positive effect on the cooperative level. Finally, increases in the migrant's discount rate, β^m, have a positive effect on the non-cooperative leisure but a negative effect on the cooperative leisure.

These results lead to some interesting predictions regarding the dynamics of remittances across time. To the extent that family ties—proxied here by $(1-\alpha)$ and $(1-\gamma)$—fade with time, both models predict a decline in remittances over time. The non-cooperative solution yields an unambiguous reduction in remittances as $\dfrac{\partial \widetilde{R}_1}{\partial(1-\alpha)} = -\dfrac{\partial \widetilde{R}_1}{\partial \alpha} > 0$ and $\dfrac{\partial \widetilde{R}_1}{\partial(1-\gamma)} = -\dfrac{\partial \widetilde{R}_1}{\partial \gamma} = 0$, both per Table 1. In turn, the outcome of the cooperative solution would depend on the magnitude of the relative decline in $(1-\alpha)$ and $(1-\gamma)$ and on the respective rates of time preference. Remittances will, however, unambiguously decline with $(1-\alpha)$, which is likely to be the most relevant determinant of family ties in this context.

Examination of second-order partial derivatives of endogenous variables and remittances also provides interesting insights. For example, the share of remittances used for investment

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[16] It should be noted that the disincentive to work associated with receiving remittances declines with the relative's wage rate. (The partial derivative $\dfrac{\partial(\partial l^r / \partial R_1)}{\partial w^h}$ is negative for both models). Further analysis of this relationship may reveal some insights into the labor supply behavior of the households in response to shocks to home and host country wages.

purposes goes up as both the relative's rate of time preference and weight she places on her own consumption decrease. The signs of the relevant partial derivatives are as follows:

$$\frac{\partial(\partial \widetilde{X}_1^h / \partial \widetilde{R}_1)}{\partial \beta^r} > 0 \text{ and } \frac{\partial(\partial \widetilde{X}_1^h / \partial \widetilde{R}_1)}{\partial \gamma} < 0.$$

Similarly, to see how the impact of the relative's income on remittances is affected by the changes in the migrant's subjective rate of time preference we calculate the derivative of $\frac{\partial \widetilde{R}_1}{\partial w_1^h} = -\frac{\alpha \overline{L}}{1 + \alpha \beta^m}$ with respect to β^m to obtain $\frac{\partial(\partial \widetilde{R} / \partial w_1^h)}{\partial \beta^m} > 0$. Thus, as one would expect, the more weight the migrant places on his current versus the next period's utility (i.e., the smaller β^m), the smaller is the share of his income transferred to the relative.

Comparison of the Cooperative and the Non-cooperative Levels

Comparison of the non-cooperative and cooperative levels of variables of interest yields the following results.

Result 3: The cooperative level of remittance exceeds the non-cooperative level ($\hat{R}_1 > \widetilde{R}_1$) if and only if:

$$(1-\gamma) \le \alpha + \alpha(1-\gamma)(\beta^r - \beta^m).$$

Thus, if the migrant values future consumption sufficiently more than the relative then the non-cooperative level of remittance exceeds the cooperative level.

Result 4: The cooperative level of investment/bequest exceeds the non-cooperative level ($\hat{X}_1^h > \widetilde{X}_1^h$) if and only if:

$$\left[\gamma(1+\alpha\beta^m)(\alpha\beta^m + (1-\gamma)\beta^r) + \alpha(1-\gamma)\beta^r(2+\alpha\beta^m + (1-\gamma)\beta^r) - 2(1-\gamma)\beta^r(1+\alpha\beta^m)\right] \ge 0$$

Result 5: The cooperative level of leisure exceeds the non-cooperative level ($\hat{l}_1^r \ge \widetilde{l}_1^r$) if and only if:

$$\gamma(\alpha+\gamma-1)+(1-\gamma)\beta^r - (\alpha+\gamma)\alpha\beta^m\beta^r - \alpha\gamma(2-\gamma+\alpha\beta^m)(\beta^m - \beta^r) - \alpha\beta^r(1-\beta^m) \ge 0.$$

To provide a more straightforward interpretation of the above results we assumed $\beta^r = \beta^m = \beta$, in which case conditions in results 3, 4, and 5 take the following forms, respectively:

Result 3': $\alpha + \gamma > 1$

Result 4': $(\alpha + \gamma - 1)(\gamma - \beta - \alpha\beta^2) \ge 0$

Result 5': $(\gamma + \alpha\beta)(\alpha + 1 - \gamma) + 2(1-\gamma)(\alpha - 1 - \alpha\beta) \ge 0.$

Figure 1. Difference between Equilibrium Values of Key Endogenous Indicators
Across Two Models as a Function of Selfishness
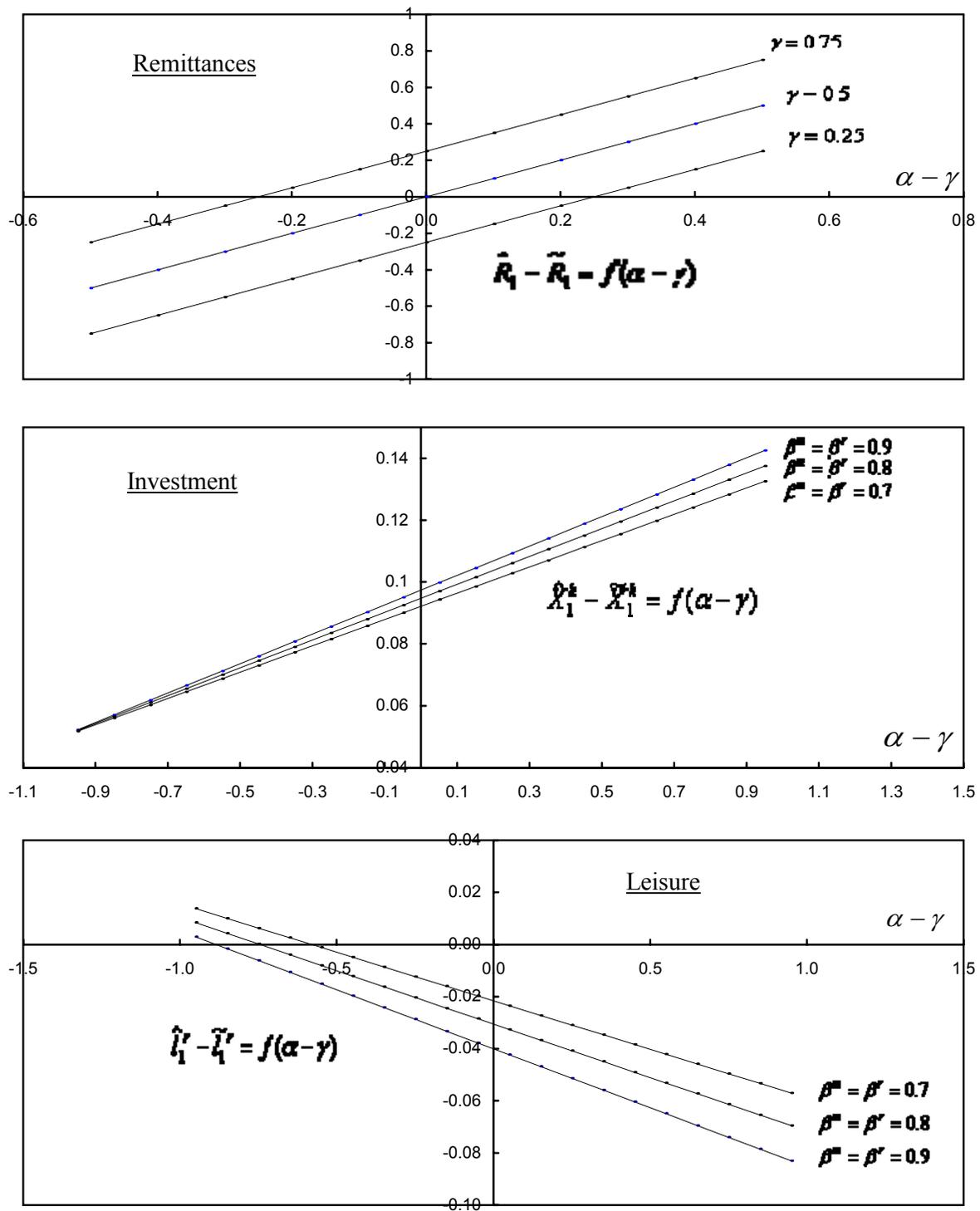
Figure 1 depicts the relationship between the levels of key model variables and parameters α, γ and β. To simplify matters, the relationship between the selected model variables as suggested by both models is shown here as a function of the migrant's relative "selfishness," $\alpha - \gamma$, that is, the weight he places upon his own utility in excess of the weight placed by the relative on her own utility. As shown in Figure 2, for sensible values of parameters α, γ and β, the levels of remittances and investment/bequest are higher while the level of leisure is lower in the cooperative solution compared to the non-cooperative one.

IV. EMPIRICAL ESTIMATION

A. Background and Data Description

Armenia is an interesting, if not extreme, case for studying migration and remittance behavior. A highly industrialized and well-educated society[17] at the dusk of the Soviet Union, Armenia underwent severe economic contractions imposed by the collapse of trade links (following the fall of the Soviet Union) and a full-scale conflict with neighboring Azerbaijan over Nagorno Karabakh during 1991–94.

Although some out-migration took place during the conflict itself, an exodus of the population did not begin until it became clear that the government had not delivered on its promises of economic reform after the war. While GDP grew slightly in 1994, after falling by almost half in 1992–93, and inflation was declining from its triple-digit war levels, social conditions were still severe. Corruption—which began to take root before the war—was spreading rapidly and taking new forms. This was too much to bear for a population that had uniformly endured the hardships of war:[18] given the popular support for the war, hardships during the war were easier to justify than the hardships that followed it. The traditional Armenian diaspora in Western countries and Russia was rapidly 'reinforced' by members of the new diaspora, causing Armenia to become one of the top population-exporting countries in the world (measured as a percent of pre-emigration population). [19] Remittances became a key source of income for many household members and related families left behind in

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[17] The industrialized and educated nature of the society/labor force is a common feature for many transition countries of the former Soviet bloc. This is also a key difference between this group and many of the Latin American countries that are widely studied in the context of migration and remittances.

[18] The uniformity of the hardship is perhaps best described by the fact that no central heating was supplied and electricity was available for only 1–2 hours a day across the country for much of 1992–95. Food rationing was also introduced across the country.

[19] Official statistics report that 18.4 percent of 1989 population emigrated between 1989–2004. The population of Armenia was 3.2 million in 2004 (World Bank, 2006). However, the official population statistics are likely to be overstated allegedly due to national security-related concerns and the opportunities for election manipulation. (For an unofficial estimate of the Armenian population see U.S. Department of State, 2002, and IWPR, 2000.)

Armenia.[20] While generally assumed to be sizable—a sensible assumption in an environment with low wage rates—the underlying incentive effect of remittances on receiving families has not been subject to much research. The question of whether remittances have provided incentives to migrate for those left in Armenia has also not been researched.

In addition to these incentive effects, the underlying migration resulted in a loss of productive labor for the economy. A study by the International Organization of Migration (IOM, 2002) notes that the share of migrants with higher education is double that of the national average, suggesting a drain on average economy-wide knowledge and skills. To the extent that the individuals' ability to succeed (economically and socially) in the host country is correlated with his/her level of education and skills, the probability of returning to Armenia for these migrants is likely to be low. While the actual loss of productivity from migration and brain drain lies beyond the scope of this study, this nevertheless is an important factor to keep in mind in the Armenian context.[21]

For our analysis, we used the 2004 Integrated Living Standards Measurement Survey conducted by the National Statistical Service of Armenia. This is a comprehensive survey covering a wide range of household activities, including migration and remittances. The dataset is nationally representative, containing data for over 28,000 individuals from over 6,800 households.

The dataset reveals peculiarities of remittance flows in the Armenian context. As conjectured above, strong family ties are likely to be the factor behind the remittances going to households of which the migrant is not an immediate member. In addition, remittances in Armenia are also likely to originate from the traditional/old diaspora, members of which remit money to their distant relatives or friends, and not necessarily to immediate family members in Armenia. Indeed, 23 percent of all surveyed households report receiving transfers from abroad, but only 14 percent report having a migrant abroad. Only 37 percent of all remittances are migration-related (i.e., 63 percent comes from out-of-household sources). In terms of their impact on the behavior of the recipients, however, transfers from non-migration-related sources are likely to have similar implications as those related to migration, and so we did not exclude them from the dataset.

One of the peculiarities of the remittance pattern in Armenia is that migration-driven remittances are likely to change with the migrant's time away. Figure 2 depicts the relationship between time away and (the probability as well as the amount of) remittances received by households. The results show that both the propensity to remit and the amounts

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[20] At the macroeconomic level, remittances were welcome by the country's authorities as they provided a boost to aggregate demand and reduced poverty, and as a result helped reduce the urgency of reforms. However, they also created policy challenges in the form of high asset prices and exchange rate appreciation.

[21] It is especially relevant given that since the break-up of the Soviet Union, Armenia's budgetary spending on education has declined to among the lowest in the developing world (as a share of the overall fiscal envelope and GDP).

remitted decline as time passes—after reaching their respective maxima at 5 and 7 years of migration—and are consistent with the remittance decay hypothesis.

Figure 2: Impact of Time Away on Remittance Behavior
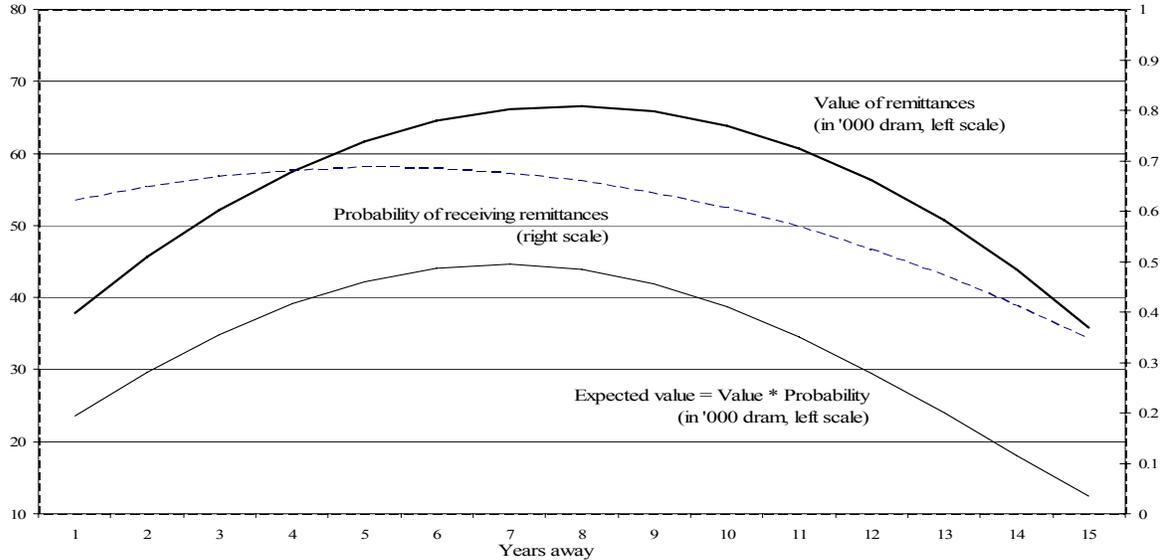
Note: Based on the following regressions: Probability=0.59+0.04*(Time away)-0.004*(Time away)^2 and Value=28.9 +9.57*(Time away)-0.61*(Time away)^2 using only households with migrants. Estimates of other regressors (not reported above) are included in the constant terms at their mean values.

In addition to the existence of the above peculiarities, it is worth noting that migration and remittance indicators may be subject to measurement error. Given that the survey has been conducted by an official agency, households with migrants may underreport remittances to understate their true income. Indeed, only 62 percent of families with migrant members report receiving remittances: while any number below 100 would be consistent with the migration decay hypothesis, this number is likely to be on the low side, given the strong family ties in Armenia. In addition, remittance-receiving households may choose to underreport the number (or existence) of migrants in the household, if the latter left the country, say, to avoid compulsory military service.

Finally, the dataset does not distinguish between pure transfer and investment components of the amount remitted by the migrant to his family. Hence, consistent with the model in Section III, the observed transfer is the sum of altruistic (with potential strategic motives in mind) and return-driven amounts.

While indeed comprehensive, the dataset allows us to test only a limited sub-set of relationships outlined in Table 1. We attempted to test some of the most important relationships, leaving the rest to be tested in the future. With this caveat, we move on to present the econometric model and the estimation results.

B. Baseline Regression

Structural Model

The key issue to tackle when estimating the impact of remittances on economic outcomes is the potential simultaneity of remittances/migration and the economic outcomes in question. Because of certain (unobserved) characteristics, families who send members abroad (and then receive remittances) could also be those who chose to consume more leisure. Similarly, the presence of credit constraints that may prevent families from financing a member's trip abroad, may also limit the amount of health care spending they can afford. Unless one controls for those family characteristics and the variables that may explain the credit constraints (e.g., wealth), one's estimates of the impact of remittances on leisure and health care spending, respectively, would be biased.

To properly capture the motives to migrate and separate the impact of migration from that of remittances, we follow Rozelle and others (1999) by employing a 3-stage structural model to study the behavior of households. In the first stage, an individuals' decision to migrate, M, is determined as follows:

$$M = \alpha_1 + \beta_1 \cdot HH + \gamma_1 \cdot Z_M + \varepsilon \tag{9}$$

where HH is the set of observed household characteristics, and Z_M is a vector of (excluded) instruments to help properly identify M.

In the second stage, given the individual's decision to migrate, the decision to remit, R, will be determined as:

$$R = \alpha_2 + \beta_2 \cdot HH + \gamma_2 \cdot Z_R + \theta_2 \cdot \bar{M} + \sigma \tag{10}$$

where $\bar{M}$ is the fitted value of the migration variable from equation 9, and Z_R is a vector of (excluded) instruments to properly identify R.[22]

Finally, in the third stage, the microeconomic outcomes will be determined as a function of remittances in the following way:

$$Outcome = \alpha_3 + \beta_3 \cdot HH + \gamma_3 \cdot \bar{R} + \theta_3 \cdot \bar{M} + \omega \tag{11}$$

where $\bar{R}$ is the fitted value of the remittance variable from equation 10. Given their developmental impact (and the variables available in the dataset), we chose the following indicators as outcomes: (i) per capita hours worked by the members of the household, (ii) per student expenditures on education, (iii) household savings, and (iv) a dummy variable indicating whether the household members had borrowed from the banking sector during the 12 months preceding the survey. Whereas the first three variables have their direct

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[22] Instrumenting migration and remittances also helps tackle the measurement problems described in the previous section.

counterparts in the model described in Section III, the forth variable does not. It is used to test whether remittances allow households to overcome borrowing constraints by acting as collateral.[23]

It is important to note that the error terms in equations 9 and 10 are likely to be correlated because of, for example, an unobservable factor that could influence both the propensity to migrate and to remit, once the individual has migrated. Therefore, joint estimation of the model equations is preferred (to the stage-by-stage estimation) on the grounds that it will be asymptotically more efficient (Hayashi, 2000, p. 273). We, therefore, applied the 3-Stage Least Squares (3SLS) technique to estimate the full model.

Instruments and Control Variables

The choice of instruments for migration and remittances is critical for properly identifying these variables and avoiding problems of estimation associated with inadequate instruments. We would, therefore, like to discuss our thinking behind the selection of instruments in some detail.

Traditional models of migration behavior may not offer sufficient insight into the choice of meaningful instruments for migration. As Bauer and Zimmerman (1999) note, wage-differential-based economic models fail to adequately explain the variations in migration across countries. Instead, a study by the World Bank (2006) emphasizes the importance of broader quality-of-life considerations and political factors in explaining migration. The study goes on to say that "differences in political stability, human rights situations, and the general rule of law may also affect migration, because these factors serve as proxies for the level of individually perceived insecurity."[24] With this in mind, we included a measure of corruption to proxy for differences in push factors behind migration across regions. Obtained via a nationwide survey conducted in 2000, the variable measures the share of respondents in every region who mentioned corruption and absence of law and order as obstacles for rising living standards (see Appendix II for the source).

In addition, to proxy for pull factors, we used historic region-wide migration rates to capture the ease of migration via the presence of migration networks abroad. This approach is consistent with those used by Hanson and Woodruff (2003), McKenzie (2005), Rozelle and others (1999), and Woodruff and Zenteno (2007), who use the migration pattern in the migrant's area of origin as an instrument for migration.

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[23] We do not deal with total household consumption directly because of: (1) measurement issues (i.e., too many imprecisely estimated components of the consumption basket in the dataset to serve as a basis for aggregation), and (2) the difficulties of determining which elements of consumption have what kind of "productive enhancements," such as spending on housing, which could improve property values, and thus be considered borderline investment.

[24] This is consistent with Ghatak, Levine, and Wheatley Price (1996), who mention the importance of the domestic political situation for migration decisions.

The choice of instruments for remittances was guided by a similar logic. Following Amuedo-Dorantes and Pozo (2006), who used the unemployment rate in the region of Armenia to instrument remittances, we used the region-wide unemployment rate among men as an instrument. In addition, to capture some of the motives behind out-of-household (and to some extent also the migration-driven) remittances, we used the ratio of vulnerable population to the total regional population as an instrument to measure the demand for remittances. To give credibility to these instruments, we formally test for the presence of correlations between the instruments and the dependent variables in equation 11 below.[25]

Interestingly enough, all four region-level indicators described above provide enough variance across regions to enable statistical testing and to produce meaningful results. Identification of migration and remittance indicators comes from the correlation between these indicators and the region-level instruments taken separately and in interaction with the household's average level of education (i.e., percent of household members with post-secondary degrees).[26]

The following household-level control variables are included in the regressions: (i) age of the household head (and its squared value); (ii) average age of working age members of the household (and its squared value); (iii) dummy for male household head; (iv) percent of household members with post-secondary education; (v) percent of household members above 64; (vi) percent of household members under 6; (vii) percent of women in the household; (viii) size of the household; and (ix) dummy variables to distinguish the rural and non-capital urban areas from the capital. All variables used in the analysis as well as their sources are summarized in Appendix II.

To capture the impact of household wealth/assets on (the probability of receiving) remittances and subsequent microeconomic behavior, we also included a set of dummy variables based on a self-assessment of dwelling conditions.[27] A positive relationship between wealth and remittances here would be consistent with self-interest motives, while a negative relationship would be indicative of the presence of altruistic motives. Similarly, we expect this measure of wealth to also have an impact on outcome indicators.

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[25] In addition, to test for robustness, we used the region-wide ratio of non-functioning enterprises to the total number of enterprises as an alternative instrument for remittances. These results are not reported but are available from the authors upon request.

[26] Interaction of regional instruments with household characteristics was used, among others, by Amuedo-Dorantes and Pozo (2006) and Hanson and Woodruff (2003).

[27] In the survey, respondents were asked to evaluate the conditions of their primary residence by choosing between excellent, good, normal, and not good. As a result, three dummy variables were included in equations 9–11, with "excellent" being the left-out category.

Summary of Results—First and Second Stage

The results of the estimation of equations 9 and 10 are presented in Table 2. Some patterns of migration behavior are noteworthy. As predicted, the presence of migration networks encourages migration: the coefficient on past migration from the region is positive and statistically highly significant. However, corruption and rule-of-law-related problems are associated with a lower probability of migration. This is possible either because corruption reduces the ability of households to meet the costs of migration (other things being equal residents of regions with more corruption cannot afford to migrate) or because potential migrants fear leaving behind family members in a corruption-infested environment. It is likely that in cases where corruption is seen as a serious enough threat for the future well-being of the family, the entire family would relocate. Unfortunately, our dataset does not contain information on this category of households, and does not allow us to make a more complete inference regarding this issue.

Age of both the head and the working-age members of the household are associated with more migration. Surprisingly, households with male heads are less likely to have a migrant in the family. Consistent with most of the literature, households with more children and women are less likely to have a migrant while larger households are more likely to have a migrant. The impact of wealth on migration has a peculiar inverted-U shape relationship. Households with average wealth (proxied by "good" and "normal" quality of housing) are more likely to have a migrant than the two extremes (i.e., those with "excellent" and "not good" quality of housing). This is consistent with Hancilova and Minasyan (2005), who, in the Armenian context, argue that the poor cannot afford to send migrants abroad, while the rich do not have the incentives to do so. Finally, it appears that households from urban areas outside of the capital are the most likely ones to have a migrant, followed by rural households, and households in the capital city. In the Armenian context this reflects the pattern of availability of economic opportunities across these areas, with Yerevan having more to offer, followed by rural areas (with opportunities to engage in agricultural activities), leaving the urban dwellers outside of the capital with little private or public sector activity to live off.

The remittances equation too has some interesting insights to offer. As expected, the coefficient on migration is positive and significant: the magnitude of the coefficient (61 percent) is very close to that observed in the (uncontrolled) sample (62 percent, as mentioned above). Both high unemployment and share of vulnerable population discourage remittances, providing strong support for the self-interest-driven nature of these flows. In addition, transfers to more mature families are both smaller in size and less likely than to their younger counterparts. While it is plausible that the per capita remittance flow declines with household size, it is less clear why the probability of receiving remittances would be lower in larger households. It may, however, be because larger households are perceived (by both the migrants as well as the out-of-household remitters) as more secure/less vulnerable, requiring less to sustain their consumption and livelihood. It could also be that the bequest-related motives are weakened as the migrant faces competition from other members of the household for an inheritance. Finally, larger households may have more opportunities to share risks. Therefore, to the extent that remittances are (self-enforceable) contracts to share

risks, larger households will be less likely to receive remittances. All in all, the existence of this relationship provides additional support for the self-interest motive for remittances.

In terms of the age composition of the households, it is interesting to note that while families with more elderly people are just as likely to receive transfers as others, they receive smaller amounts, which most likely reflects their needs (which are typically more modest, compared to those of younger household members). In terms of the gender composition, households with a greater share of women are more likely to receive transfers (and in larger amounts). This could be the result of a higher demand imposed on families by costs associated with the presence of women in families, such as wedding/marriage- or health-related expenditures. Regarding the effect of receiving family's wealth on remittances, there exists a similar inverted U-shaped relationship between the two. Both the probability and the amounts received are greater in households with average housing quality (i.e., "good" and "normal" categories), compared to households with "not good" and "excellent" housing. Interestingly enough, outside of the households with "excellent" housing (representing 9 percent of sample households), this result runs contrary to the impact of initial household wealth, X_0^h, on remittances derived in Section III and provides further evidence in support of the self-interest motive in remittance behavior. Finally, it is interesting to note that households from non-capital urban and rural areas are less likely to receive remittances than people from the capital. However, if viewed in conjunction with the finding that they are also more likely to migrate, this suggests that migrants originally from outside of the capital earn less abroad (and, therefore, remit less *ceteris paribus*) or that they are less likely to return (hence no need to remit as much).

Table 2. Results of the First and Second Stage Regressions

	Migration		Remittances (Yes/No)		Remittances ('000 dram)	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Migration			0.611	[0.189]***	100.628	[30.313]***
Instruments for M						
Corruption	-0.002	[0.001]**				
Emigration	0.012	[0.002]***				
Corruption*Ppostsec	-0.002	[0.003]				
Emigration*Ppostsec	0.005	[0.009]				
Instruments for R						
Unemploy			-0.352	[0.136]***	-62.666	[21.909]***
Vulnerable			-0.001	[0.001]	-0.454	[0.151]***
Unemploy*Ppostsec			-0.361	[0.440]	8.006	[70.156]
Vulnerable*Ppostsec			-0.003	[0.003]	-0.143	[0.437]
Control variables						
Age	0.010	[0.002]***	-0.002	[0.003]	-0.591	[0.480]
Age-sq	0.000	[0.000]***	0.000	[0.000]	0.004	[0.004]
Aveagework	0.004	[0.002]**	-0.006	[0.002]***	-1.558	[0.332]***
Aveagework-sq	0.000	[0.000]***	0.000	[0.000]***	0.028	[0.005]***
HHheadmale	-0.019	[0.011]*	-0.008	[0.013]	-0.653	[2.135]
Ppostsec	-0.024	[0.093]	0.220	[0.213]	8.188	[34.069]
Pelderly	-0.024	[0.031]	-0.035	[0.038]	-11.565	[6.138]*
Pkids	-0.203	[0.039]***	0.003	[0.049]	8.723	[7.941]
Pwomen	-0.128	[0.022]***	0.051	[0.029]*	12.212	[4.776]**
HHsize	0.024	[0.003]***	-0.009	[0.005]*	-4.797	[0.743]***
Timeaway			-0.011	[0.027]	-1.704	[4.309]
Good	0.047	[0.018]**	0.105	[0.022]***	12.369	[3.579]***
Normal	0.026	[0.015]*	0.080	[0.018]***	4.856	[2.849]*
Not good	0.012	[0.016]	0.037	[0.019]**	1.575	[3.017]
Urban (non-capital)	0.067	[0.010]***	-0.010	[0.018]	-9.029	[2.975]***
Rural	0.023	[0.012]*	-0.055	[0.019]***	-11.222	[3.076]***
Constant	-0.363	[0.072]***	0.427	[0.115]***	91.86	[18.532]***
No. of observations	6,816		6,816		6,816	

Standard errors in brackets. ***, **, and * denote significance at 1, 5, and 10 percent confidence levels, respectively.

Table 3. Results of the Third Stage Regressions

	Hours Worked	Education Expenditures	Savings	Banking
Remittances(hat)	-7.677	-355.958	213.0	0.294
	[3.250]**	[70.834]***	[85.889]**	[0.552]
Migration(hat)	1.329	215.365	-95.527	-0.253
	[1.527]	[37.330]***	[40.357]**	[0.259]
Age	-0.062	1.125	-0.017	0.006
	[0.024]***	[0.955]	[0.514]	[0.003]**
Age-sq	0.001	-0.008	0.002	0.000
	[0.000]***	[0.009]	[0.005]	[0.000]**
Aveagework	0.374	-2.703	1.306	0.005
	[0.038]***	[1.780]	[0.613]**	[0.004]
Aveagework-sq	-0.004	0.023	-0.024	0.000
	[0.000]***	[0.024]	[0.010]**	[0.000]
HHheadmale	0.190	3.466	4.576	0.020
	[0.111]*	[4.631]	[2.736]*	[0.015]
Ppostsec	1.531	111.729	3.811	-0.002
	[0.153]***	[7.966]***	[4.113]	[0.023]
Pelderly	1.375	-5.275	4.198	-0.056
	[0.335]***	[20.611]	[8.117]	[0.046]
Pkids	0.782	-61.927	17.152	-0.109
	[0.355]**	[22.633]***	[9.229]*	[0.050]**
Pwomen	0.081	49.867	-7.81	-0.023
	[0.288]	[11.159]***	[6.109]	[0.035]
HHsize	-0.131	-9.019	0.185	0.022
	[0.035]***	[1.497]***	[0.879]	[0.005]***
Good	1.527	52.502	-13.396	-0.129
	[0.408]***	[10.847]***	[10.271]	[0.064]**
Normal	1.167	32.75	-16.043	-0.082
	[0.321]***	[8.207]***	[7.843]**	[0.049]*
Not good	0.558	14.897	-7.967	-0.017
	[0.224]**	[7.114]**	[4.919]	[0.029]
Urban (non-capital)	0.213	-12.842	-10.607	0.107
	[0.175]	[6.481]**	[4.958]**	[0.026]***
Rural	1.275	-32.408	3.787	0.087
	[0.228]***	[8.136]***	[4.562]	[0.042]**
Constant	-2.514	107.37	-42.715	-0.061
	[1.091]**	[38.476]***	[25.725]*	[0.156]
Number of observations	6,164	3,603	6,816	6,816
Anderson-Rubin OR test, $\chi^2(2)$	0.720, p=0.70	1.456, p=0.48	2.104, p=0.35	2.104, p=0.35
Hansen's J-test of OR, $\chi^2(1)$	1.292, p=0.26	0.272, p=0.60	0.317, p=0.57	34.40, p=0.00

Standard errors in brackets. ***, **, and * denote significance at 1, 5, and 10 percent confidence levels, respectively. Regional dummies are included in the regressions (not shown). Anderson-Rubin and Hansen's J-overidentification tests both test the relevance of instruments in equation 10 only.

Summary of Results—Third Stage

Prior to discussing the results of equation 11, a few words in support of the choice of instruments in equation 10 are in order. It turns out that the Anderson-Rubin overidentification test could not be rejected at any reasonable level in any of the four third-stage equations reported in Table 3, suggesting that the instruments pass the exogeneity test. Similarly, Hansen's J statistic is not significant at any level for 3 out of the 4 regressions providing sufficient comfort to proceed.[28] We, therefore, discuss the results reported in Table 3 for each of the four dependent variables.

The impact of remittances on hours supplied to the market (column 2) is as predicted by the model. The coefficient is negative and significant and its magnitude is rather large. Indirectly, this serves a blow to the hypothesis that remittances help relax budget constraints for families staying behind and help expand their production possibilities frontier—to the extent that capital and labor are compliments in the production process, it is not clear why households that invest more (due to remittances) would work fewer hours. Interestingly enough, while insignificant, the coefficient on migration is positive, suggesting perhaps that the absence of a family member tightens the family's discipline, making the remaining household members work harder to attain the same levels of utility and welfare. The magnitude of the coefficient is not large enough, however, to offset the disincentive effect of remittances.

Other findings of this regression are also worth flagging: (i) it appears that women in Armenia supply as many hours to the market as men, if not more; (ii) the presence of both elderly and children in families result in more hours supplied to the market (even though they themselves do not); and (iii) the residents of rural households on average work 1.25 hours more than those in urban locations. Finally, it is interesting to note that even after controlling for the share of elderly and children in the household (because their contribution is zero), larger households supply fewer aggregate hours to the market than smaller households. This supports our earlier conjecture that family size could provide additional benefits (such as insurance against volatility and vulnerability) and, therefore, lead to fewer hours worked.

The impact of remittances on education spending (column 3, Table 3) is perhaps the most controversial of our findings. The negative (and significant) coefficient here could be indicative of two things. First, it is possible that members of remittance-receiving households are likely to later migrate themselves and, therefore, not value the local education as much. Second, because their consumption patterns might be under scrutiny by the remitter, the receiving households may adjust their consumption pattern to look more conservative and be centered around necessities (such as food and public services/utilities, and presumably not

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[28] The J-test, however, suggests that the instruments (i.e., unemployment among men and the share of the vulnerable population) are correlated with the *Banking* variable. It is likely that economic and social development determine the number/availability of commercial bank branches in the regions, thus influencing households' ability to borrow from the banking sector. Given this correlation between the instruments and *Banking*, the results in column 5 of Table 3 should be treated with caution.

education and other types of spending that could be considered unnecessary from the remitter's point of view). To the extent that remittances represent a large share of the receiving family's income, for the same level of disposable income, this tendency to "simplify" the spending pattern could in fact lead to lower spending on education (in nominal terms) out of total income.[29] Interestingly enough, the absence of a family member leads to higher education spending, but not enough to offset the reduction of spending associated with remittances. We also found in this context that households with a higher ratio of members with secondary and post-secondary education and those with a larger share of women spend more on the education of their children.[30]

The results on the effect of remittances and migration on savings (column 4) are as expected: families with remittances accumulate more savings. However, families with migrants report less savings, presumably reflecting the costs of migration (to the extent they migrated within the 12 months prior to the survey, that is, during the same period where the savings are measured). The negative effect of migration is not large enough, however, to offset the accumulation of savings due to remittances.

Finally, it appears that contrary to the remittances-as-collateral hypothesis, remittances in Armenia do not result in more borrowing from commercial banks (column 5). Although it could be argued that remittances cover all the receiving family's needs for additional capital (on top of financing the additional consumption), this would require specific and very limiting assumptions about the household production function and/or the business environment they operate in. Ironically, it appears that the banks subtract as many points for the absence of a productive family member from the household (due to migration) as they add for having the additional collateral (due to remittances) in making their lending decisions: while not statistically significant, the coefficients on remittances and migration have very close absolute values.[31] The impact of collateral on the ability to borrow is, however, evident elsewhere: consistent with one's expectations, households with "excellent" housing quality are more likely to borrow from the banking system than members of all other groups.

V. CONCLUSIONS

We developed an overlapping generations' model of household behavior that incorporates elements of altruistic and self-interest motives behind remittance transfers and explicitly models the *dynamic strategic* aspects of the interaction between the migrant and the remittance-receiving relative(s). In a departure from the traditional Nash bargaining approach

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[29] We owe this insight to Dr. Vahan Grigoryan.

[30] The latter result could either mean that women pay more attention to the education-related needs of children or that female students are more expensive than male students (as they are likely to attend more extra-curricular activities, such as music, arts, etc).

[31] This is also consistent with the coefficient on the size of the household, where smaller households borrow less.

utilized in the literature, we considered the scenario where the two parties can devise a self-enforcing agreement to implement choices that maximize their total surplus. We demonstrated that when the migrant and the home-country relative(s) cooperate to maximize the joint utility of the household, this leads to higher level of remittances as well as investment and hours worked by the relative(s).

We caution against treating the remittance flows in a partial equilibrium setting without accounting for the productivity loss that accompanies migration as well as disincentives to work, study, and remain in the home country. While unable to account for productivity loss, our results do shed some light on other potential drawbacks of remittances in analyzing data from Armenia. It turns out that, consistent with our theoretical predictions, remittance-receiving households in Armenia work fewer hours. They also spend less on the education of their children, perhaps expecting to migrate themselves or are confined to subsistence-type spending pattern by a combination of the remitter's oversight and moral hazard. While saving more, these households are not leveraging their savings to borrow from the banking system to expand their business activities. This provides a rather gloomy picture of the impact of remittances at the microeconomic level in Armenia.

For an environment with rapidly rising real wages, such as Armenia's, and assuming a gradual fading of family ties, our model predicts that remittances will decline over time. We find evidence in support of the remittances decay hypothesis in our data: while rising initially, both the probability of sending and the amount transferred decline over time after reaching their peaks in 5 and 7 years, respectively. Given that the net migration from Armenia has subsided in recent years, this may have macroeconomic implications in the form of reduced remittance flows and, therefore, lower aggregate demand in years to come.

Our analysis covers only the part of migration that took place in Armenia since the early 1990s. It does not deal with families that left Armenia without leaving any household members behind. Anecdotal evidence suggests that this outflow—especially a portion thereof, which is unlikely to ever return—may have dealt a critical blow to Armenia's average level of knowledge and education. Macroeconomic successes of recent years would pale if weighted against the true potential of the economy with its well-educated labor force, which has unfortunately and rather carelessly been left to emigrate. To the extent that this is still possible to reverse, the policies directed at strengthening the rule of law, improving human rights and the business environment will go a long way in bringing back those migrants. A combination of savings and human capital acquired abroad will likely provide a strong impetus for entrepreneurial activities (and even public service) back home and, therefore, development and growth. Attempts should also be made to engage others who may choose to remain abroad but play an active role in the development processes taking place in Armenia. The recent focus of some students of migration and international development institutions on turning the brain drain into a brain gain (see papers included in the World Bank 2006 volume) cannot be more relevant and timely for Armenia.

Our analysis suggests a role for other policy measures in shaping the remittance flows and their impact on the behavior of households. For example, to the extent that policy may influence households' rate of time preference (either directly or via consumption or wealth,

see Epstein and Hynes, 1983; and Kam, 2005), there is scope to mitigate the drawbacks of remittances at the micro level. As suggested by the model, disincentives to work due to remittances are likely to decline as the earnings of those remaining at home increase allowing room for reforms to influence the behavior of remittance-receiving households. In addition, decisions to consume and invest are influenced by interest rates.

The framework developed in the paper could be extended further to capture more of the complexities of remittance flows and their impact. For instance, one could allow borrowing in the model via the use of (the un-consumed part of) remittances as collateral. This may provide the receiving households with additional incentives to spend less and save more in the model. In addition, if the model is enhanced to contain a household production function, remittances (and the additional borrowing that they could help secure) could be directly modeled as part of the production process, thereby influencing the marginal product of labor. Similarly, subject to the availability of data, the empirical part could also be enhanced to enable a richer variety of hypothesis testing. For instance, one could attempt to shed some light on the degree of cooperation between the migrants and their respective households through observing behavioral differences across models as highlighted in Section III. Finally, the reasons behind the impact of remittances on education spending and households' interaction with the banking system—at least in the Armenian context—could be studied further.

Proof of Result 1: In period 2, the migrant chooses c_2^m and l_2^m to maximize his period-2 utility. The migrant will set $c_2^m = \eta\left[w_2^f \overline{L} + iX_1^h\right]$ and $l_2^m = \dfrac{(1-\eta)\left[w_2^f \overline{L} + iX_1^h\right]}{w_2^f}$. Substituting for c_2^m and l_2^m, the migrant's period-2 utility function can be written as:

$$\ln\left[\frac{\eta^{\eta}(1-\eta)^{1-\eta}}{\left(w_2^f\right)^{1-\eta}}\left[w_2^f \overline{L} + iX_1^h\right]\right].$$

In the second stage of period 1 the migrant and the relative simultaneously and independently make their choices; the migrant chooses c_1^m and l_1^m while the relative chooses c_1^r, l_1^r and X_1^h. The migrant's continuation payoff in the beginning of the second stage of period 1 can be written as:

$$\alpha\left[\eta\ln\left(w_1^f\left(\overline{L}-l_1^m\right)-R_1\right)+(1-\eta)\ln l_1^m\right]+(1-\alpha)\left[\rho\ln\left(w_1^h\left(\overline{L}-l_1^r\right)+iX_0^h+R_1-X_1^h\right)+(1-\rho)\ln l_1^r\right]$$
$$+\alpha\beta^m \ln\left[\frac{\eta^{\eta}(1-\eta)^{1-\eta}}{\left(w_1^f\right)^{1-\eta}}\left[w_1^f \overline{L}+iX_1^h\right]\right].$$

Hence, the migrant will set $l_1^m = \dfrac{(1-\eta)\left(w_1^f \overline{L}-R_1\right)}{w_1^f}$ and $c_1^m = \eta\left(w_1^f \overline{L}-R_1\right)$. The relative's continuation payoff in the beginning of the second stage of period 1 is given by:

$$\gamma\left[\rho\ln\left(w_1^h\left(\overline{L}-l_1^r\right)+iX_0^h+R_1-X_1^h\right)+(1-\rho)\ln l_1^r\right]+(1-\gamma)\left[\eta\ln\left(w_1^f\left(\overline{L}-l_1^m\right)-R_1\right)+(1-\eta)\ln l_1^m\right]$$
$$+(1-\gamma)\beta^r \ln\left[\frac{\eta^{\eta}(1-\eta)^{1-\eta}}{\left(w_2^f\right)^{1-\eta}}\left[w_2^f \overline{L}+iX_1^h\right]\right].$$

From the relative's optimization problem we obtain:

$$l_1^r = \frac{\gamma(1-\rho)}{\left(\gamma+(1-\gamma)\beta^r\right)w_1^h}\left[w_1^h \overline{L}+iX_0^h+R_1+\frac{w_2^f \overline{L}}{i}\right];$$

$$c_1^r = \frac{\gamma\rho}{\gamma+(1-\gamma)\beta^r}\left[w_1^h \overline{L}+iX_0^h+R_1+\frac{w_2^f \overline{L}}{i}\right];$$

$$X_1^h = \frac{(1-\gamma)\beta^r\left(w_1^h \overline{L}+iX_0^h+R_1\right)-\gamma\dfrac{w_2^f \overline{L}}{i}}{\gamma+(1-\gamma)\beta^r}.$$

In the first stage of period 1 the migrant chooses remittance R_1 to maximize his continuation payoff:

$$\alpha \ln\left(\frac{\eta^{\eta}(1-\eta)^{1-\eta}}{\left(w_1^f\right)^{-\eta}}\left(w_1^f \overline{L} - R_1\right)\right) + (1-\alpha)\ln\left(\frac{\gamma\rho^{\rho}(1-\rho)^{1-\rho}}{\left(\gamma+\beta^r\right)\left(w_1^h\right)^{1-\rho}}\left[w_1^h\overline{L} + iX_0^h + R_1 + \frac{w_2^f\overline{L}}{i}\right]\right)$$

$$+ \alpha\beta^m \ln\left(\frac{\beta^r\eta^{\eta}(1-\eta)^{1-\eta}}{\left(\gamma+\beta^r\right)\left(w_2^f\right)^{1-\eta}}\left[i\left(w_1^h\overline{L} + iX_0^h + R_1\right) + w_2^f\overline{L}\right]\right)$$

Hence, the migrant will set $R_1 = w_1^f\overline{L} - \dfrac{\alpha}{\left(1+\alpha\beta^m\right)}\left[w_1^f\overline{L} + w_1^h\overline{L} + iX_0^h + \dfrac{w_2^f\overline{L}}{i}\right]$. Substituting

this expression into the above formulas for the choice variables of the migrant and the relative we obtain the result. QED.

Proof of Result 2: The first-order conditions for problem 8 can be written as:

$$l_2^m: \quad w_2^f l_2^m = (1-\eta)\left(w_2^f\overline{L} + iX_1^h\right)$$

$$X_1^h: \quad \frac{\eta\left(\alpha\beta^m + (1-\gamma)\beta^r\right)i}{\left(w_2^f\overline{L} + iX_1^h - w_2^f l_2^m\right)} = \frac{\rho(1-\alpha+\gamma)}{\left(w_1^h\overline{L} + R_1 + iX_0^h - w_1^h l_1^r - X_1^h\right)}$$

$$l_1^m: \quad w_1^f l_1^m = (1-\eta)\left(w_1^f\overline{L} - R_1\right)$$

$$l_1^r: \quad w_1^h l_1^r = (1-\rho)\left(w_1^h\overline{L} + R_1 + iX_0^h - X_1^h\right)$$

$$R_1: \quad \frac{\rho(1-\alpha+\gamma)}{\left(w_1^h\overline{L} + R_1 + iX_0^h - w_1^h l_1^r - X_1^h\right)} = \frac{(1-\gamma+\alpha)\eta}{\left(w_1^f\overline{L} - R_1 - w_1^f l_1^m\right)}$$

These can be equivalently written as

$$l_2^m: \quad w_2^f l_2^m = (1-\eta)\left(w_2^f\overline{L} + iX_1^h\right)$$

$$X_1^h: \quad \frac{\left(\alpha\beta^m + (1-\gamma)\beta^r\right)i}{\left(w_2^f\overline{L} + iX_1^h\right)} = \frac{(1-\alpha+\gamma)}{\left(w_1^h\overline{L} + R_1 + iX_0^h - X_1^h\right)}$$

$$l_1^m: \quad w_1^f l_1^m = (1-\eta)\left(w_1^f\overline{L} - R_1\right)$$

$$l_1^r: \quad w_1^h l_1^r = (1-\rho)\left(w_1^h\overline{L} + R_1 + iX_0^h - X_1^h\right)$$

$$R_1: \quad \frac{(1-\alpha+\gamma)}{\left(w_1^h\overline{L} + R_1 + iX_0^h - X_1^h\right)} = \frac{(1-\gamma+\alpha)}{\left(w_1^f\overline{L} - R_1\right)}$$

Solving the above equalities we obtain the result. QED.

APPENDIX II. DEFINITIONS OF VARIABLES

Variable Names	Description	Source
Hours Worked	Per capita hours supplied to the market by the working-age members of the household. The following number of hours were assumed and aggregated across the household members: 4 for part time, 8 for full time, 10 for overtime, and 0 otherwise.	Integrated Living Standards Measurement Survey (ILSMS)
Education Expenditures	Per student expenditures on education, in 1,000 drams.	ILSMS
Savings	Amount saved by the household during the 12 months preceding the survey, in 1,000 drams.	ILSMS
Banking	Dummy variable taking value of 1 if household members had borrowed from the banking sector during the 12 months preceding the survey, and 0 otherwise.	ILSMS
Age	Age of the household head.	ILSMS
Aveagework	Average age of working-age members of the household.	ILSMS
HHheadmale	Dummy for male household head.	ILSMS
Ppostsec	Percent of household members with post-secondary education.	ILSMS
Pelderly	Percent of household members above 64.	ILSMS
Pkids	Percent of household members under 6.	ILSMS
Pwomen	Percent of women in the household.	ILSMS
HHsize	Number of household members.	ILSMS
Timeaway	Number of years that a migrant has been away.	ILSMS
Good, Normal, Not good	Dummy variables based on household members' assessment of their housing conditions. The left-out category is "Excellent".	ILSMS
Rural, urban	Dummy variables to distinguish the rural and non-capital urban areas from the capital. The left-out category is capital Yerevan.	ILSMS
Corruption	Share of respondents in every region who mentioned corruption and absence of law and order as obstacles for rising living standards.	Yaganyan and Shahnazaryan (2001), Table 5.
Emigration	Ratio of population involved in migration as a share of total population in the region.	Yeganyan and Shahnazaryan (2004), Table 2.3.[32]
Unemployment	Region-wide unemployment rate among men.	Authors' calculations based on ILSMS.
Vulnerable	Ratio of vulnerable population as a share of total population of the region.	Jrbashian (2001), Table 1.
Nonfunctioning	Region-wide ratio of non-functioning enterprises to total number of enterprises.	UNDP (1999), Table 2.5.

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[32] The original survey was contained in "An Overview of External Migration Processes in the Republic of Armenia during 1991-1998" and conducted by the National Statistical Service of Armenia jointly with the TACIS Program and Eurostat.

REFERENCES

Acosta, P., E.K.K. Lartey, and F.S. Mandelman, 2007, "Remittances and the Dutch Disease," *Federal Reserve Bank of Atlanta,* Working Paper 2007–8, Atlanta, GA.

Acosta, P., 2006, "Labor Supply, School Attendance and Remittances from International Migration: The Case of El Salvador." *World Bank Policy Research Working Paper* No. 3903, Washington, D.C.

Adams, R., 1991, "The Effects of International Remittances on Poverty, Inequality, and Development in Rural Egypt," Research Report 86, *International Food Policy Research Institute.*

Adams, Richard H., Jr., 1998, "Remittances, Investment, and Rural Asset Accumulation in Pakistan," *Economic Development and Cultural Change* (October): 155–73.

Alesina, A. and P. Giuliano, 2007, "The Power of the Family," mimeo. Available via the Internet: http://www.economics.harvard.edu/faculty/alesina/papers/powerfamily.pdf

Ahlburg, D., 1991, "Remittances and Their Impact : A Study of Tonga and Western Samoa," Canberra: National Centre for Development Studies, Research School of Pacific Studies, the Australian National University.

Amuedo-Dorantes, C. and S. Pozo, 2006a, "Migration, Remittances, and Male and Female Employment Patterns," *American Economic Review* (AEA Papers and Proceedings), 96(2): 222–226.

Amuedo-Dorantes, C. and S. Pozo, 2006b, "Remittances as insurance: evidence from Mexican immigrants." *Journal of Population Economics* 19: 227–254.

Amuedo-Dorantes, C. and C. Bansak, 2006. "Money Transfers among Banked and Unbanked Mexican Immigrants," *Southern Economic Journal* 2006, 73(2): 374–401.

Banerjee, B., 1984, ''The Probability, Size, and Uses of Remittances from Urban to Rural Areas in India,'' *Journal of Development Economics* 16: 293–311.

Barro, R.J., 1974, "Are Government Bonds Net Wealth?" *Journal of Political Economy* 82(6):1095–1117.

Bauer, T. K, and K. F. Zimmerman, 1999, "Assessment of Possible Migration Pressure and Its Labor Market Impact Following EU Enlargement into Central and Eastern Europe," Research Report 3, IZA, Bonn, Germany.

Becker, G., 1974, "A Theory of Social Interactions," *Journal of Political Economy* 82: 1063–1093.

Bergstrom, T., 1999, "Systems of Benevolent Utility Functions," *Journal of Public Economic Theory* 1(2): 71–100.

Bernheim, B.D., A. Shleifer and L.H. Summers, 1985, "The strategic bequest motive," *Journal of Political Economy*, 93 (6): 1045–1076.

Brown, R.P.C., 1994, "Migrants' Remittances, Savings, and Investment in the South Pacific," *International Labour Review* 133(3): 347–367.

Brown, R.P.C., 1997, "Estimating Remittances Functions for Pacific Island Migrants," *World Development* 25(4): 613–26.

Brown, R.P.C. and D.A. Ahlburg, 1999, "Remittances in the South Pacific," *International Journal of Social Economics* 26(1/2/3): 325–344.

Central Bank of Armenia, 2006, "Analytical Study Based on the Survey on Money Transfers Received From Abroad by the Households in Armenia in 2005."

Chami, R., C. Fullenkamp, and S. Jahjah, 2005. "Are Immigrant Remittance Flows a Source of Capital for Development?" *IMF Staff Papers* 52(1).

Chiu, Y Stephen, 1998, "Noncooperative Bargaining, Hostages, and Optimal Asset Ownership," *American Economic Review* 88(4): 882–901.

Cox, D., 1987, "Motives for Private Transfers," *Journal of Political Economy*, 95(3): 508–46.

Cox Edwards, A. and M. Ureta, 2003, "International Migration, Remittances and Schooling: Evidence from El Salvador," *Journal of Development Economics* 72(2): 429–61.

Cox, D., Z. Eser, and E. Jimenez, 1998, "Motives for private transfers over the life cycle: An analytical framework and evidence for Peru," *Journal of Development Economics*, 55: 57–80.

de la Briere, B., E. Sadoulet, A. de Janvry, and S. Lambert, 2002, ''The Roles of Destination, Gender, and Household Composition in Explaining Remittances: An Analysis for the Dominican Sierra,'' *Journal of Development Studies* 68(2):309–28.

Docquier, F. and H. Rapoport, 1998, "Are migrant minorities strategically self-selected?" *Journal of Population Economics*, 11: 579–88.

Durand, J., W. Kandel, E.A. Parrado, and D.S. Massey, 1996, ''International Migration and Development in Mexican Communities,'' *Demography* 33(2): 249–64.

Dustmann, C. and O. Kirchkamp, 2002, "The optimal migration duration and activity choice after re-migration," *Journal of Development Economics* Vol. 67: 351–372.

Epstein, L. and J. A. Hynes, 1983, "The Rate of Time Preference and Dynamic Economic Analysis," *Journal of Political Economy* 91(4): 611–35.

Faini, R., 2003, "Is the Brain Drain an Unmitigated Blessing?" Discussion Paper 2003/64. Helsinki, UNU/WIDER.

Funkhouser, E., 1995, "Remittances from international migration: a comparison of El Salvador and Nicaragua," *Review of Economics and Statistics*, 77, 1: 137–46.

Ghatak, S., P. Levine, and S. Wheatley Price, 1996, "Migration Theories and Evidence: An Assessment," *Journal of Economic Surveys* 10(2), Cambridge, Massachusetts.

Glytsos, N., 1993, "Measuring the Income Effects of Migrant Remittances: A Methodological Approach Applied to Greece," *Economic Development and Cultural Change* 42(1): 131–68.

Goldfarb, R., O. Havrylyshyn, and S. Magnum, 1984, "Can Remittances Compensate for Manpower Outflows: The Case of Philippine Physicians," *Journal of Development Economics* 15: 1–17.

Grindle, M., 1988, *Searching for Rural Development: Labor Migration and Employment in Mexico.* Ithaca: Cornell University Press.

Hanson G., and C. Woodruff, 2003, "Emigration and Educational Attainment in Mexico," unpublished.

Hancilova, B. and A. Minasyan, 2005. "Labor Migration from Armenia in 2002–05: A Sociological Survey of Households," OSCE Armenia.

Hayashi, F., 2000, *Econometrics*, Princeton University Press, Princeton, NJ.

Hoddinott, J., 1994, "A model of migration and remittances applied to Western Kenya," *Oxford Economic Papers*, 46: 450–75.

Hunte, C.K., 2004, "Workers' Remittances, Remittance Decay and Financial Deepening in Developing Countries," *American Economist* 48(2): 82–94.

International Organization of Migration, 2002, "Irregular Migration and Smuggling of Migrants from Armenia."

Institute for War and Peace Reporting, 2000, "Brain Drain in Armenia." Available via the Internet: http://iwpr.net/?p=crs&s=f&o=162050&apc_state=henicrs2000

Kam, E., 2005, "A Note on Time Preference and the Tobin Effect," *Economics Letters* 89(1): 127–132.

Kireyev, A., 2006, "The Macroeconomics of Remittances: The Case of Tajikistan," *International Monetary Fund Working Paper* 06/02. Washington, DC.

Kule, D., A. Mançellari, H. Papapanagos, S. Qirici, and P. Sanfey, 2002, "The Causes and Consequences of Albanian Emigration During Transition: Evidence from Micro Data," *International Migration Review* 36(1): 229–39.

Johnson, G. and W. Whitelaw, 1974, "Urban-Rural Income Transfers in Rural Kenya: An Estimated Remittance Function," *Economic Development and Cultural Change* 22: 473–79.

Jrbashian, N., 2001, "Representation of Vulnerable and Extremely Poor Population in Marzes and the Communities of RA: Comparative Analysis," an Interim Poverty Reduction Strategy Paper.

Lipton, M., 1980, "Migration from rural areas of poor countries: the impact on rural productivity and income distribution," *World Development* 8(1): 1–24.

Lucas, R.E.B. and O. Stark, 1985, "Motivations to remit: Evidence from Botswana," *Journal of Political Economy*, 93, 5: 901–18.

Lopez Cordoba, E., 2004. "Globalization, Migration, and Development: The Role of Mexican Migrant Remittances," mimeo. The Inter-American Development Bank, Washington, D.C.

Mai, Nick, 2004, "Looking for a More Modern Life...: The Role of Italian Television in the Albanian Migration to Italy," *Westminster Papers in Communication and Culture* 1, 1, 3–22.

MacLeod, B. and J. Malcolmson, 1993, "Investments, Holdup and the Form of Market Contracts," *American Economic Review* 83: 811–837.

Massey, D.S., R. Alarcon, J. Durand, and H. Gonzalez, 1987, "Return to Aztlan: The Social Process of International Migration from Western Mexico," Berkeley: University of California Press.

Massey, D.S. and E.A. Parrado, 1998, "International Migration and Business Formation in Mexico," *Social Science Quarterly* 79(1): 1–19.

McCormick, B. and J. Wahba, 2001, "Overseas Work Experience, Savings and Entrepreneurship Amongst Return Migrants to LDCs," *Scottish Journal of Political Economy* 48(2): 164–178.

Mesnard, A., 2004, "Temporary Migration and Capital Market Imperfections," *Oxford Economic Papers* 56: 242–262.

McKenzie, D., 2005, "Beyond Remittances: The Effects of Migration on Mexican Households," in C. Ozden and M. Schiff (eds) *International Migration, Remittances and the Brain Drain*, The World Bank: Washington D.C.: 123–148.

Muent, H., F. Pissarides, and P. Sanfey, 2001, "Taxes, Competition and Finance for Albanian Enterprises: Evidence from a Field Study," *MOCT-MOST*, 11: 239–51.

Osili, U. O., 2007, "Remittances and Savings from International Migration: Theory and Evidence Using a Matched Sample," *Journal of Development Economics* 83: 446–465.

Poirine, Bemard, 1997, "A Theory of Remittances as an Implicit Family Loan Arrangement," *World Development* 25(4): 589–611.

Rapoport, H. and F. Docquier, 2005, "The Economics of Migrants' Remittances," Discussion Paper No. 1531, Institute for the Study of Labor, Bonn, Germany.

Reichert, J., 1981, "The Migrant Syndrome: Seasonal US Wage Labor and Rural Development in Central Mexico," *Human Organization* 40(1): 56–66.

Rozelle, S., J.E. Taylor, and A. deBrauw, 1999, "Migration, remittances and agricultural productivity in China," *American Economic Review* (AEA Papers and Proceedings), 89(2): 287–91.

Russell, S.S., 1992, "Migrant Remittances and Development," *International Migration Quarterly Review* 30(3/4): 267–87.

Sana, M. and D.S. Massey, 2005, "Household Composition, Family Migration, and Community Context: Migrant Remittances in Four Countries," *Social Science Quarterly* 86(2): 509–528.

Stark, O., 1995, *Altruism and Beyond*, Oxford and Cambridge: Basil Blackwell.

Stark, O. and D. Bloom, 1985, "The New Economics of Labor Migration," *American Economic Review*, 75: 173–178.

Stark, O. and R.E.B. Lucas, 1988, "Migration, remittances and the family," *Economic Development and Cultural Change* 36 (3): 465–481.

Taylor, J.E., 1992, "Remittances and inequality reconsidered: direct, indirect and intertemporal effects," *Journal of Policy Modeling* 14(2): 187–208.

Taylor, J.E., S. Rozelle, and A. de Brauw, 2003, "Migration and Incomes in Source Communities: A New Economics of Migration Perspective from China," *Economic Development and Cultural Change* 52: 75–101.

UNDP, 2002, "Education, Poverty and Economic Activity in Armenia: Situation Analysis Report." Available via the Internet: http://www.undp.am/docs/publications/publicationsarchive/epeas/

UNDP, 1999, Labour Market in Armenia: Analysis and Policy. Available via the Internet: http://www.undp.am/docs/publications/publicationsarchive/labourmarket.pdf

U.S. Department of State, 2002. "Armenia: Country Reports on Human Rights Practices, 2001," Bureau of Democracy, Human Rights, and Labor. Available via the Internet: http://www.state.gov/g/drl/rls/hrrpt/2001/eur/8221.htm

USSR Statistical Handbook, 1988.

van Dalen, H.P., G. Groenewold, and T. Fokkema, 2005, "The effect of remittances on emigration intentions in Egypt, Morocco, and Turkey," *Population Studies* 59(3): 375–392.

World Bank, 2007, "The Caucasian Tiger: Sustaining Economic Growth in Armenia," Washington, DC.

World Bank, 2006, "Diaspora Networks and the International Migration of Skills: How Countries Can Draw on Their Talent Abroad," (ed.) Y. Kuznetsov. Washington, DC.

World Bank, 2005, "Remittances: Development Impact and Future Prospects," (eds.) S. M. Maimbo and D. Ratha. Washington, DC.

Woodruff, C. and R. Zenteno, 2007, "Migration Networks and Microenterprises in Mexico," *Journal of Development Economics* 82, pp. 509–528.

Yeganyan, R. and N. Shahnazaryan, 2004, "Labor Migration from Armenia: An Overview of Literature," Organization for Security and Cooperation in Europe and International Organization for Migration. Yerevan, Armenia.

Yeganyan, R. and N. Shahnazaryan, 2001, "Comparative Analyzes of Social Situation in Marzes of Armenia Based on the Result of Special Surveys," in *Interim Poverty Reduction Strategy Paper*, Yerevan, Armenia.

Yang, D., 2006, "International Migration, Remittances, and Household Investment: Evidence from Philippine Migrants' Exchange Rate Shocks," forthcoming in *Economic Journal*.

Zarate-Hoyos, G.A., 2004, "Consumption and Remittances in Migrant Households: Toward a Productive Use of Remittances," *Contemporary Economic Policy* 22(4): 555–565.