

Do Immigrants and their Remittances Respond to the Exchange Rate?

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Summary.— This paper uses data from the Legalized Population Survey (LPS) to further our understanding of the determinants of workers' remittances. Taking advantage of the multi-country nature of the population of subjects in the LPS we focus on the effect that exchange-rate changes and exchange-rate volatility have on remittance flows. A theoretical model is developed in which remittances and the exchange rate are related in a utility maximizing framework. Using the LPS, we find that remittances respond positively to home country currency depreciations and negatively to exchange-rate volatility. The paper also confirms that demographic factors affect the level of remittances.

Key words – Remittances, Migration, Exchange Rates

JEL Classification: F22 – International Migration

F31 – Foreign Exchange

1. INTRODUCTION

A great deal of attention is being paid to international remittances, the repatriated earnings of emigrant workers. The increased interest in remittances stems, in part, from their rapid increase over the past decade. In 1990 global remittances amounted to \$31 billion but rose more than six-fold to \$204 billion by 2004 (Migration News, 2005). While this growth rate is impressive, our interest in remittances relates instead to the observation that these flows involve transfers of income and wealth, by immigrants, to family *across* national boundaries. Immigrants who settle in the US earn income in US dollars, but their transfers to family and others back home are usually converted into a foreign currency. Our intent is to understand whether and how remitters respond to variations in the exchange rate. Do remitters vary their remittances with the behavior of the exchange rate?

Economists and policymakers have often inquired into the impact of exchange rates on the international flow of goods and of investment capital. These inquiries have been motivated by the desire to manage and control these flows. Given the large volume of international remittances it is surprising that we have not seen many studies that relate workers' remittances to the exchange rate. An overview of the literature on remittances often describes immigrants and their remitting behavior in an overly simplistic manner. Remitters are presumed to send a set sum home on a periodic basis with little consideration for how international financial variables impact on the sums remitted. This framework seems to originate from a perception that immigrants who are remitting home are unbanked, relatively poor and uneducated and therefore do not or cannot craft the amounts that they send home to financial economic conditions surrounding those

transfers. We take issue with this simplistic view of immigrants and strive to more completely characterize the decisions facing the remitter. A model that describes the remitter as an informed and more complex economic agent is developed. We empirically test a series of propositions that result from this model using data on remittances by US immigrants from over 80 countries. Our empirical results support our claim that in addition to remitting for altruistic reasons, remitters are sophisticated economic agents who respond, in predictable ways, to variations in both the level and volatility of the exchange rate.

While many treatments of the remitting behavior of immigrants are overly simplistic, a limited literature exists claiming that remittances respond to variations in the exchange rate. Using macroeconomic level data for five Mediterranean countries, Faini (1994) provides evidence that exchange-rate depreciation encourages remittance flows to the home country. Along similar lines, Eldabawi and Rocha (1992) and El-Sakka and McNabb (1999) report that growing spreads in the official and black foreign exchange markets, decrease remittances sent by official channels to North Africa and to Egypt. Remitters appear to be responding to wider spreads by diverting transfers to informal exchange markets or by delaying transfers now in anticipation of official depreciation in the near future¹. Evidence that exchange-rate uncertainty (in contrast to exchange rate levels) impacts on the decision to remit is uncovered by Higgins, Hysenbegasi and Pozo (2004). Using macroeconomic level data for fourteen countries they show that remittances respond negatively to increases in exchange-rate uncertainty. These studies, which assign a role to exchange rate levels and exchange rate volatility in explaining

¹ By serving as a gauge of exchange market misalignment, the spread may proxy for anticipated depreciation of the currency.

remittance flows, are in contrast to others where no significant relationship between remittances and the exchange rate is obtained. (Straubhaar (1986) and Swamy (1981)).

While informative, it may be that macroeconomic data is limited, for a variety of reasons, in its ability to uncover the true relationship between remittances and the exchange rate. Increases in the level of remittances following depreciation could be taking place, not because individual immigrants remit more in response to depreciation, but because of an overall exodus from the country arising from unfavorable economic conditions. The unfavorable economic condition induces emigration leading to an increase in the population of potential remitters in the host community. If this is so, then individuals might not be remitting more in response to a change in the exchange rate. It may simply be that a larger emigrant community has arisen due to economic deterioration. Without an accurate accounting of the remitting population, aggregate data do not allow us to separate out the effect of the exchange rate on individual's remittances from the effect of increased migration on aggregate remittances².

Macroeconomic studies may also be suspect on account of concerns regarding the accuracy of the data on aggregate remittances. In the past, little attention was paid to the compilation of remittance series by national statistical agencies. As the magnitude and importance of remittances became evident, however, central banks have been placing more effort into tracking these flows. In fact, the claim is being made that a substantial portion of recent growth in remittances is due simply to increased efforts to account for

² Suppose that aggregate remittances depends on the exchange rate (e) and on the number of migrants:

$$\text{Remit} = \alpha + \beta_1 e + \beta_2 \text{migrants} + \mu$$

Suppose, however, that the variable "migrants" is omitted from the estimation. Given that exchange rate levels and migration flows are likely to be highly correlated (during economic downturns exchange rate depreciation and emigration tend to both take place) the estimated β_1 will be biased if the migration variable is omitted from the equation.

those flows and not due to true growth in the volume of remittances. (Terry, 2005). If so, it is unclear what macroeconomic studies uncover when they find a statistical relationship between one macroeconomic series and remittances.

Finally, it is probable that the effect that exchange rates have on remittances varies from emigrant to emigrant. That is, emigrant characteristics may play an important role in explaining remittances. Different characteristics could easily lead to different motives for remitting and hence different responses to economic variables. For example, Glytsos (1997) finds that exchange-rate depreciation affects remittances sent by permanent emigrants positively, but does not affect remittances sent by temporary emigrants. Characteristics altering the permanency of migration may then also affect remitting behavior.

To overcome the statistical and econometric concerns discussed above, we resort to the use of microeconomic level data. While studies of remitting behavior using microeconomic data have been undertaken for migration originating from a single country, the multi-country nature of our data permit us to include the exchange rate in our estimation and hence further understand how remitters respond to said variable³. Furthermore we investigate two dimensions by which immigrants may respond to exchange rates by incorporating exchange-rate levels *and* exchange-rate volatility. Finally, we use a utility maximizing framework to show how our results can be used to

³ Yang (2006) is also able to explore exchange rate impacts using microeconomic-level data from the Philippines. Individuals in the Philippines, migrate to a large number of countries. Thus, it is possible to match survey data from one home country (Philippines) with exchange rates of many host countries. In our approach we match survey data on immigrants in one host country (US) with exchange rate data for a broad array of home countries. Yang finds that depreciation of the Philippine peso encourages remittances from overseas Filipinos.

provide evidence on competing theories (altruism vs. investment) regarding the main motivation to remit.

2. THEORETICAL BACKGROUND

In order to provide a framework for our empirical analysis, we consider a model in the spirit of Faini (1994). Faini was the first to formally incorporate the exchange rate in models attempting to tackle the determinants of remittances. In Faini's model, however, remittances are sent for household consumption only and there is no uncertainty in the exchange rate. Here we extend his model to allow a fraction of the remittances sent by the emigrant to be invested in the home country. In addition the emigrant makes decisions about remittances under uncertainty as he/she does not know the exchange rate that will prevail in the second period. In contrast to earlier models, we do not assume a functional form for our utility function. Next we obtain testable hypotheses about the response of remittances to various home country variables. We show how the impact of home country variables can change according to whether the motivation for remitting involves altruism or investment. (See Rapoport and Docquier, 2005, for an overview of theoretical remittance models.)

Assume that we have an emigrant who maximizes the expected present value of utility over two periods. The emigrant's utility depends on his/her consumption in the host country during the current period (c) and during the second or future period (c^F). The emigrant's utility is also dependent on the consumption of the *household* in the home community (c^*). (We will use the term "household" to refer to the emigrant's family back home.) Consumption of the household depends positively on household income

(y^*) and remittances (r) with remittances defined in the host currency which we denote as U.S. dollars.

The model allows the emigrant to send remittances for household consumption and for investment in the first or current period with δ denoting the fraction of remittances that is intended to be consumed by the household and the remaining share, $1 - \delta$, sent to accumulate investments on the part of the emigrant. The household can use their share (equivalent to US\$ δr) in any way desired.

The exchange rate, e , defined as the units of home currency per host currency in period 1 (i.e. pesos per dollar), determines the purchasing power of remittances in the home country. Peso depreciation (a rise in e) allows the household to consume more for each dollar of remittances. The exchange rate in the first period (e) is known to the emigrant while its value in period 2 is uncertain. The emigrant, however, makes decisions today based on an expectation about its future value which we denote as e^F . This expectation could be, for example, based on an expected long-run equilibrium value. Given that the future exchange rate is not known with certainty, period 2 investment returns are uncertain.

The emigrant uses his/her income in the current period (y) to consume in the host community and to send remittances.

$$y = c + r \tag{1}$$

The emigrant's consumption in the second period is the sum of two terms, the first term being the emigrant's income in the future period (y^F). The second term includes the investment he/she made with remittances in the home country ($(1 - \delta)r$), plus any peso returns on that investment ($i^*(1 - \delta)r$). This sum is adjusted for exchange rate gains or

losses realized on account of reconverting the sum back into dollars, the host currency.

$$c^F = y^F + [(1 + i^*)(1 - \delta)] \frac{er}{e^F} \quad (2)$$

The emigrant's problem is to choose c (or equivalently r) in period 1 to maximize his/her utility subject to the constraints implied by equations (1) and (2). Letting β represent the discount factor for future consumption, our maximization problem can be written as:

$$\text{Max}_{\{c,r\}} U(c, c^*(\delta re, y^*)) + \beta E(V(c^F))$$

subject to

$$y = c + r$$

$$c^F = y^F + [(1 + i^*)(1 - \delta)] \frac{er}{e^F}$$

We assume that first derivatives are positive, second derivatives are negative, and that utility is additively separable. The first order condition (FOC) for this problem implies that:⁴

$$-U_1 + \delta U_2 c^* e + \beta(1 + i^*)(1 - \delta) e E \left[\frac{V_1}{e^F} \right] = 0 \quad (3)$$

The optimum involves three terms. The first pertains to the remitter's consumption in the current period, the second to the family's consumption in the home country, and the third to future consumption by the remitter due to earnings from home country investments.

In the special case where all remittances are for household consumption, we set $\delta = 1$ and the FOC in (3) reduces to

⁴ U_i is the first derivative with respect to the i th argument in the utility function U . U_{ij} refers to the second derivative-- the derivative of U_i with respect to the j th argument in the utility function U .

$$U_2 c^* e = U_1 \text{ or } \frac{U_1}{U_2} = c^* e. \quad (4)$$

Equation (4) reveals that in conjunction with altruism as a motive, the level of consumption obtained by the family back home figures in the optimum for the remitter. Also note that remittances will be unaffected by the expected future exchange rate. Only today's exchange rate matters. Comparison of FOC (3) and FOC (4) suggests that if we find empirically that remittances are affected by the expected future exchange rate, in the context of this model, remittances are also sent for investment purposes.

Comparative static results for a number of cases of interests are provided in Appendix A. In what follows we provide intuition for some of the more interesting results. Perhaps the most interesting of these is the impact that depreciation of the exchange rate has on the level of remittances. Our results indicate that depreciation can either increase or decrease remittances sent home. To understand this, consider that the remitter is balancing three utility generating activities: i) the remitter's consumption in the host community today, ii) the family's consumption in the home community today, and iii) the remitter's consumption in the host community in the future. A rise in e (a depreciation of the peso) has the effect of increasing the consumption of the home family on account of the greater purchasing power of the peso. The remitter's future consumption is also enhanced due to the expected exchange rate gain. If the remitter does not change his/her allocation of remittances after depreciation, the marginal utility of home country consumption and of future consumption will both fall relative to host country current consumption. Hence, to re-establish an optimum, the remitter *reduces* remittances to increase home country current consumption. At the same time, depreciation of the peso has increased the "lifetime expected wealth" for the remitter and

thus remittances are *increased* to the home community. In the end, it is not certain which of the two effects dominates and hence whether depreciation increases or decreases remittances.

Equation 3 points to these opposing impacts. Both U_2 (marginal utility of family consumption) and V_1 (marginal utility of future consumption) fall relative to U_1 (marginal utility of current consumption) suggesting the need to shift resources toward current consumption (i.e. reducing remittances.) However, the increase in e also raises the second and third terms of (3), in effect raising the wealth of the remitter. This will pull the remitter in the opposite direction, increasing remittances in order to spend more on the family and on his/her future consumption.

We obtain several other interesting results from our model. If remittances are for altruistic purposes ($0 < \delta \leq 1$) then $\partial r / \partial y^* \leq 0$. That is, increases in home country income are likely to decrease remittances since the home family is less in need. If, alternatively, remittances are sent for investment purposes only, ($\delta = 0$) then $\partial r / \partial y^* = 0$, and we should see no effect on remittances after an increase in household income. As we would expect, increases in the emigrant's income are likely to raise remittances; that is ($\partial r / \partial y \geq 0$). If household consumption and future consumption are normal goods, this is what we expect.

If remittances are sent for investment purposes, the impact of an increase in the return to home country investments (an increase in i^*) will combine a positive with a negative impact. As in the exchange rate case, the final effect of changes in the return to home investments will depend on which effect dominates. It is also clear from the model that if remittances are for altruistic purposes only, then changes in the return to

investment in the home country will not affect remittances. The observation that changes in the return to investment in the home country affect remittances is consistent with the notion that emigrants are investing in the home country with remittances.

In conjunction with the results presented above, we venture to conclude that there will be a relationship between remittances and the risk related to home country investments when remittances are sent also for investment purposes. In the empirical estimation we include exchange-rate volatility as a proxy for the risk related to home country investments. Thus, if exchange-rate volatility affects remittances, we have a strong case for arguing that a fraction of remittances are sent to the home community for investment purposes.

3. DATA

To better understand how the exchange rate factors in the decision to remit, we use data from the Immigration Reform and Control Act (IRCA) of 1986. The IRCA gave undocumented immigrants in the U.S. the opportunity to obtain amnesty and become legal permanent residents. The IRCA consisted of two phases. In the first phase about 1.8 million undocumented immigrants applied and qualified for temporary legal residency. One of the requirements to qualify was living in the U.S. prior to the year 1982. Those who qualified were given 18 months to satisfy an English language requirement and to learn U.S. civic matters. The second phase consisted of acquiring legal permanent residency. About 1.6 million from this group successfully completed the second phase.

We take advantage of the extensive survey--the Legalized Population Survey--that was conducted to study the effects of the IRCA on the formally undocumented population. The LPS is reported in two parts; the LPS1 sponsored by the Immigration and

Naturalization Service and administered in 1989, and the 1992 follow-up LPS2 sponsored by the U.S. Department of Labor. The LPS1 includes detailed information about 6,197 formerly undocumented immigrants who qualified for amnesty under the IRCA and hence applied for permanent residency. The LPS2 follow-up consists of re-interviews of 4,012 respondents from the LPS1. There were 1,193 emigrants included in the LPS1 that were not included in the LPS2. Of these, 502 were not in the Legalization Application Processing System by January 1992, 2 were deceased, and 4 had been denied the temporary residency status. The remainder were still in the midst of the legalization process and waiting for a decision⁵. After removing individuals with missing observations ($n = 662$) we ended up with a sample of approximately 3,350 individuals from about 80 countries.

The emigrants interviewed in the LPS report the amount of remittances sent (r_{it}) during 1987 and during 1991. We model remittances as a function of demographic and country specific variables. The equation to be estimated is:

$$r_{it} = f(\mathbf{X}_{it}, \mathbf{N}_{it})$$

The vector \mathbf{X}_{it} denotes the characteristics of the emigrants including income, age, years of education, gender, marital status, an interaction term between marital status and gender, dummies indicating if the emigrant is a parent, has children living abroad, a spouse living abroad, entered the U.S. without a valid visa, and the number of years living in the U.S. \mathbf{N}_{it} represents the vector of country specific variables including the emigrant's home GDP and the currency return with respect to the home currency (j) between the year that remittances were reported (t) and the previous year ($t-1$): $\Delta e_{jt} = \log(e_{jt}) - \log(e_{jt-1})$. We

⁵ See U.S. Department of Justice (1992) and U.S. Department of Labor (1996) for more details on the LPS.

also included a measure of volatility in the exchange rate, defined as the sum of the squares of the currency returns for the years in which remittances were reported. This is:⁶

$$\sigma_{e,t} = \sum_{m=1}^{12} (\Delta e_{jm})^2 \quad m = 1, \dots, 12.$$

As a proxy for home country economic condition we use the growth rate of GDP per capita of the home country (GDP). The growth rate is taken between the year in which remittances were reported and the previous year. This variable can be indicative of household income, as some may argue that the economic situation of the household should be positively correlated with home country GDP⁷. On the other hand, an increase in GDP can be taken to signify a better investment climate in the home country. All home country variables are in real terms. Table 1 describes the variables used in the estimation, along with their expected impact on the level of remittances.

4. METHODOLOGY

We cannot estimate the determinants of remittances using ordinary least squares (OLS) because our remittance variable is censored downward at zero. If, for example, an emigrant is receiving monetary assistance from the family who still resides in the home country, remittances would be negative. But in our data remittances are set equal to zero. Also, given that about 40% of the emigrants in the sample did not remit, our remittances variable is a mixture of a discrete and of a continuous variable. It is necessary to account for these statistical situations.

One of the most common solutions to this problem is to use the Tobit model, where the observed response is $r = \max(0, r^*)$ and r^* is the latent variable. Since r^*

⁶ Andersen and Bollerslev (1998) show that this estimator is consistent for a general conditional variance specification.

⁷ Still this variable does not provide us with information about the income distribution inside the country.

satisfies the classical linear model assumptions we can use maximum likelihood estimation on the following model.

$$r^* = a + b_i X_{it} + c_i N_{it} + u_{it}$$

One possible problem with the Tobit estimation, however, is that it assumes that there are no differences in the factors affecting the decision to send remittances and the factors affecting the amount of remittances sent. It is not clear whether this assumption is always appropriate.

A second solution to the censoring/selection problem is to use Heckman's two-step procedure. In the first step a probit model is estimated where the dependant variable is a dummy variable equal to one if remittances are positive and zero if not. This first step provides information about the determinants of the decision to remit. Then in a second step we use those emigrants with positive remittances to model the determinants of the level of remittances. Since, emigrants with positive remittances constitute a non-random sub-sample of all emigrants, a correction for sample selection is necessary. In this case we estimate an OLS equation with a Heckman (1979) sample selection correction.

When using the two-step Heckman procedure the decision to remit is separate from the decision of how much to remit. The problem with this methodology is that it is sensitive to identification exclusions. It is necessary to specify variables that affect the decision of whether or not to remit, but that do not affect how much the individual remits. This is problematic in the remittances literature where the factors that affect the decision to remit and the amount of remittances have not been clearly differentiated. Given the

concern of adopting one or the other approach to account for the censored dependent variable, in this paper we use both techniques⁸.

Results From The Tobit Estimation: The results using the Tobit model are presented in Table 2. A major objective of this analysis is to discern how specific home country financial variables affect remittances. Specifically, how do measures of return and risk influence the decision to send money home? To this end we specify several versions of a remitting equation. Panel A of Table 2 includes the rate of depreciation of the exchange rate as the home country financial variable. Panel B substitutes volatility of the exchange rate as the home country financial variable, while Panel C reports the estimates when we use the growth in GDP per capita of the home country instead. Panel D includes all three home country economic variables.

Before examining how home economy financial variables impact remittances, we first review how the emigrant's characteristics affect remittances. The various specifications in Table 2 reveal that, as we would expect, higher levels of income increase the level of remittances. Older immigrants, more highly educated immigrants, female immigrants and immigrants with children (i.e. parents), all remit less to the home community. In contrast, immigrants with children back home and those with spouses in the home community, who presumably have a stronger attachment to the household, remit more. The length of stay in the U.S. has a negative impact on remittances falling by about \$45 per additional year away from home. The effect of the length of stay is significant in all equations. This is consistent with the remittances-decay hypothesis (Brown, 1997) where it is argued that the longer the stay of the emigrant in the host

⁸ Given the panel nature of the data a random effects Tobit estimation was also implemented. The results did not differ and are available from the authors upon request.

country, the smaller the level of remittances he/she sends back home. If the emigrant is remitting for altruistic purposes, we presume that attachment to the household is decreasing with time. Interestingly, while being female is negatively related to sending remittances and being married is not significant, the interaction term between being married and female is positive. In fact, according to our estimations, a married female will send, on average, about 300 dollars more of remittances per year relative to a non-married female.

One of our primary objectives, however, is to discern the impact of currency depreciation on remittances as our model suggests that it is possible for depreciation to either increase or decrease remittances depending on the relative impacts of two opposing effects. In this estimation, according to Panel A, we find that the positive impact overrides the negative effect with home currency depreciation increasing the level of remittances. The increased wealth enjoyed by the immigrant induces greater spending on the family and on investments in the home community via remittances.

The results in Panel B inform us on the impact of exchange rate volatility on remittances. The results coincide with our supposition of immigrant behavior toward exchange risk. Increases in the volatility of the exchange rate negatively and significantly impact remittances. Increases in the volatility of the exchange rate increase the uncertainty about the return to investments in the home country with emigrants decreasing remittances in response to that risk. In this case the emigrant may decide to invest in the host country where there is no foreign exchange risk. In Panel C we see that the GDP of the home country does not appear to impact the level of remittances. Panel D incorporates all 3 home country “financial” variables in one empirical model. Our results

remain as before; exchange rate depreciation encourages remittances while increases in volatility dampen those flows.

Results From The Heckman Two-Step Procedure: The results using Heckman's two-step methodology are reported in Table 3. In order to identify our model we exclude education from the second stage regression while including it in the probit. While education is likely to affect the decision to remit or not, the amount that is remitted is unlikely to be impacted by education once we control for income. Nonetheless, as a check for robustness we also conducted our estimations excluding undocumented entry and excluding time in the U.S. Our major results still hold under these alternative specifications.

Turning first to the demographic determinants of remittances, these estimates are broadly consistent with the results from the Tobit estimation. Older, female, parent immigrants are less likely to remit and they remit less. Immigrants with spouses abroad and immigrants with children abroad remit more. One notable difference in results with respect to the two empirical approaches entails the coefficient on the variable indicating if the emigrant is married. In the Tobit estimation this variable is not significant, but in the Heckman estimation it seems to be increasing the odds of remitting.

In the Tobit estimation, home country per capita GDP growth was not a significant determinant of remittances. Using the results from the Heckman procedure we can offer an explanation for this result. Under the Tobit methodology, the decision to remit and the level of remittances are constrained to be affected by GDP growth in the same direction. In the case of the Heckman model, this constraint is not imposed so a variable can affect the likelihood and level of remittances in different directions. It

appears that with the Heckman estimation, home country GDP affects the likelihood of remitting negatively, but the amount remitted positively. Why may this be the case? Perhaps an increase in GDP growth is associated with better household economic conditions and hence fewer emigrants remit home. On the other hand, an increase in GDP growth can be projecting better investment opportunities in the home country. This may prompt those remitting for investment purposes to remit larger amounts on account of the better investment climate. In conjunction, these results suggests that favorable economic conditions back home, as reflected in positive GDP growth, result in fewer remitters as *altruistic* transfers become less necessary. But those *investing* in the home community expand their stakes back home.

The Tobit and Heckman estimates also differ with respect to exchange rate depreciation. While the Tobit model suggests that depreciation increases the level of remittances, the Heckman estimation suggests a more complex situation. The likelihood of remitting is not impacted (specification 1) or it is negatively impacted (specification 4) by depreciation, while depreciation increases the amounts remitted for those who do remit. This suggest that for those who are already committed to remitting, the “calculus” pushes them into remitting greater amounts. For those who are not remitting (or are at the margin), depreciation causes them to proceed more cautiously, withholding remittances.

With respect to increases in exchange rate volatility, our results are consistent across specifications. The Heckman model continues to affirm that remitters do not like it when the exchange rate becomes more volatile. Remitters shy away from remitting and they remit less when there are increases in exchange rate volatility.

In sum, the Heckman results suggest that there are different factors affecting the amount of remittances sent and the likelihood of remitting. Moreover, the same variable can have different effects with respect to the likelihood and level of remittances sent to the home country a point that has been noted by Funkhouser (1995). Remittances seem to be a two-stage decision and as such bring into question those studies in the remittances literature that use only a Tobit model and implicitly assume that the factors affecting the amount remitted and the likelihood of remitting are the same.

5. CONCLUDING REMARKS

This paper uses data from the Legalized Population Survey (LPS) to study the determinants of workers' remittances. The LPS includes emigrants from different countries who have migrated to the U.S. in different time periods. The beauty of this data is its ability to relate remittances to exchange rates owing to the broad array of countries to which these immigrants remit. We acknowledge one limitation of the LPS -- we are limited to one specific group of immigrants. These are immigrants who were undocumented but were able to gain temporary legal residency during the survey period on account of the amnesty. While this is a select group, we are able, nonetheless, to obtain evidence on patterns of remitting from a sample of individuals from a broad range of countries. This is not available in other samples due to the difficulties of obtaining consistent remitting data on individuals from different countries.

Results from the estimation show that remittances are positively related to the immigrant's income and to the existence of a spouse or child back home. Remittances are negatively related to time spent in the US, age, being female and being a parent. Our primary interest however, is to establish the relationship between remittances and

financial variables in the home country. We use variations in the exchange rate level, in exchange rate volatility, and in home country GDP growth to study how emigrants respond to home country financial variables. The results indicate that a depreciation of the home country currency affects remittances positively. This is evidence that emigrants remit more when the return to remittances increases. After a depreciation of the exchange rate, the purchasing power of remittances in the home country increases for the home country family, and, all else equal, investment returns to placing assets abroad rise.

The results also suggest that exchange rate volatility affects remittances negatively. An increase in the volatility of the exchange rate increases the uncertainty about the returns to remittances sent for investment purposes. This increase in uncertainty may induce the emigrant to invest in the host country where there is no foreign exchange uncertainty from his/her perspective. This finding that exchange rate volatility affects remittances suggests that at least some remittances are sent for investment purposes.

The evidence regarding the relationship between GDP per capita of the home country and remittances is mixed. Growth in GDP per capita affects the likelihood of remitting negatively, but the amount remitted positively. This may suggest that while increases in GDP per capita decrease the number who remit (presumably those who tend to help family members during periods of home country distress), increases in GDP increase the amount that investors choose to invest and place at stake in the home community.

Our results indicate that remittances are strongly influenced by demographic factors. But the results also show that financial factors related to the risk and return of remittances are also important determinants of remittances. Countries wishing to increase

the flow of inward remittances should pursue policies to stabilize their exchange rate. The notion that immigrants are relatively unsophisticated with respect to risk and return variables is not supported by the results of this study. Our data indicate that a sizable number of immigrants do behave as if they track and follow financial variables which, in turn, are reflected in the propensity to remit and in the level of remittances sent home.

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Table 1: Descriptive Statistics for Variables used in the Analysis

Variable	Source	Mean	Standard deviation	Anticipated impact on r
Remittance amount	LPS1 and LPS2	1,244.33	2,155.76	--
Income: intervals from 1 to 9	LPS1 and LPS2	3.97	2.52	+
Age: age of respondent	LPS1 and LPS2	37.01	10.34	?
Gender: female = 1	LPS1 and LPS2	.46	.50	?
Spouse abroad; yes = 1	LPS1 and LPS2	.06	.23	+
Child; yes = 1	LPS1 and LPS2	.76	.43	-
Child abroad; yes = 1	LPS1 and LPS2	.18	.38	+
Time in US in years	LPS1 and LPS2	11.31	3.84	-
Education in years	LPS1 and LPS2	8.59	4.43	+ or -
Undocumented entry initially	LPS1 and LPS2	.21	.41	+ or -
Married; yes=1	LPS1 and LPS2	.68	.47	+ or -
Δe (computed by authors)	IFS and CBs	.61	1.01	+ or -
σ^e (computed by authors)	IFS and CBs	.04	.19	-
Growth of per capita home GDP	IFS	.04	.94	+ or -

Notes: LPS1 and LPS2 refer to the Legalized Population Survey and its follow-up respectively. IFS refers to International Financial Statistics by the International Monetary Fund and CB refers to the central bank of the corresponding country. Δe is the exchange rate return and σ_e represents exchange rate volatility.

Table 2: Tobit Estimation of the Remitting Equation
Panel A. - Remitting Equation with Currency Return

Variable	Coefficient (t)	Partial Effect on the Probability of Remitting	Partial Effect on the Expected Amount Remitted if Remitting
Individual Specific Variables	Column 1	Column 2	Column 3
Income (0 to 9 Scale)	295.81 (15.14)*	160.04	114.31
Age (Years)	-29.29 (-6.26)*	-15.85	-11.32
Gender (Female = 1)	-600.07 (-3.90)*	-322.88	-231.02
Married (Yes = 1)	166.73 (1.12)	89.48	64.02
Married*Gender	685.69 (3.80)*	383.48	272.57
Spouse Abroad (Yes = 1)	1236.02 (7.15)*	760.15	535.62
Child (Yes = 1)	-1164.02 (-8.93)*	-678.28	-480.15
Child Abroad (Yes = 1)	1813.82 (15.41)*	1119.55	791.60
Time in the U.S. (Years)	-116.22 (-9.77)*	-62.88	-44.91
Years of Education (Years)	-91.43 (-9.03)*	-49.46	-35.33
Undocumented Entry (Yes = 1)	7.84 (0.07)	4.25	3.03
Country Specific Variables			
Δe	73.70 (1.77)**	39.87	28.48
Observations		6,283	
Uncensored Observations		3,779	
LR Chi2		991.60*	
Log Likelihood		-37110.36	

Note: A * signifies significant at the 1 percent, ** signifies significant at the 5 percent, and *** signifies significant at the 10 percent. t statistics are in parentheses.

Panel B. - Remitting Equation with Exchange Rate Volatility

Variable	Coefficient (t)	Partial Effect on the Probability of Remitting	Partial Effect on the Expected Amount Remitted if Remitting
Individual Specific Variables	Column 1	Column 2	Column 3
Income (0 to 9 Scale)	296.52 (15.18)*	160.38	114.57
Age (Years)	-29.48 (-6.33)*	-15.95	-11.39
Gender (Female = 1)	-605.76 (-3.94)*	-325.83	-233.15
Married (Yes = 1)	156.48 (1.05)	84.00	60.09
Married*Gender	700.22 (3.87)*	391.78	278.46
Spouse Abroad (Yes = 1)	1224.33 (7.09)*	752.02	529.91
Child (Yes = 1)	-1194.13 (-9.16)*	-696.95	-493.34
Child Abroad (Yes = 1)	1817.81 (15.46)*	1122.06	793.40
Time in the U.S. (Years)	-118.61 (-10.00)*	-64.15	-45.82
Years of Education (Years)	-89.51 (-8.87)*	-48.41	-34.58
Undocumented Entry (Yes = 1)	11.60 (0.11)	6.28	4.48
Country Specific Variables			
σ_e	-887.54 (-3.89)*	-480.05	-342.908
Observations		6,276	
Uncensored Observations		3,776	
LR Chi2		1003.52*	
Log Likelihood		-37072.67	

Note: A * signifies significant at the 1 percent, ** signifies significant at the 5 percent, and *** signifies significant at the 10 percent. t statistics are in parentheses.

Panel C. - Remitting Equation with GDP Growth

Variable	Coefficient (t)	Partial Effect on the Probability of Remitting	Partial Effect on the Expected Amount Remitted if Remitting
Individual Specific Variables	Column 1	Column 2	Column 3
Income (0 to 9 Scale)	295.53 (15.10)*	159.88	114.20
Age (Years)	-29.72 (-6.39)*	-16.08	-11.49
Gender (Female = 1)	-617.39 (-4.02)*	-332.04	-237.60
Married (Yes = 1)	175.18 (1.18)	93.98	67.24
Married*Gender	692.12 (3.84)*	387.28	275.25
Spouse Abroad (Yes = 1)	1275.57 (7.37)*	786.93	554.49
Child (Yes = 1)	-1173.49 (-9.02)*	-683.64	-483.97
Child Abroad (Yes = 1)	1827.72 (15.51)*	1128.38	797.87
Time in the U.S. (Years)	-117.35 (-9.84)*	-63.49	-45.35
Years of Education (Years)	-93.93 (-9.31)*	-50.82	-36.30
Undocumented Entry (Yes = 1)	5.20 (0.05)	2.81	2.01
Country Specific Variables			
Home Country GDP	-6.54 (-0.16)	-3.54	-2.53
Observations		6,315	
Uncensored Observations		3,795	
LR Chi2		997.02*	
Log Likelihood		-37286.05	

Note: A * signifies significant at the 1 percent, ** signifies significant at the 5 percent, and *** signifies significant at the 10 percent. t statistics are in parentheses.

Panel D. - Remitting Equation using all Country Specific Variables

Variable	Coefficient (t)	Partial Effect on the Probability of Remitting	Partial Effect on the Expected Amount Remitted if Remitting
Individual Specific Variables	Column 1	Column 2	Column 3
Income (0 to 9 Scale)	301.29 (15.35)*	163.04	116.45
Age (Years)	-27.80 (-5.91)*	-15.04	-10.75
Gender (Female = 1)	-619.50 (-4.02)*	-333.32	-238.50
Married (Yes = 1)	142.02 (0.95)	76.33	54.59
Married*Gender	722.75 (3.99)*	405.06	287.84
Spouse Abroad (Yes = 1)	1216.40 (7.04)*	746.93	526.31
Child (Yes = 1)	-1184.94 (-9.08)*	-691.57	-489.52
Child Abroad (Yes = 1)	1824.13 (15.47)*	1126.94	796.86
Time in the U.S. (Years)	-117.96 (-9.89)*	-63.84	-45.60
Years of Education (Years)	-86.08 (-8.39)*	-46.58	-33.27
Undocumented Entry (Yes = 1)	-7.17 (-0.07)	-3.88	-2.77
Country Specific Variables			
Δe	111.48 (4.80)*	60.33	43.09
σ_e	-1338.40 (2.47)**	-724.24	-517.29
Home Country GDP	15.15 (0.35)	8.20	0.86
Observations		6,252	
Uncensored Observations		3,764	
LR Chi2		1016.73*	
Log Likelihood		-36947.90	

Note: A * signifies significant at the 1 percent, ** signifies significant at the 5 percent, and *** signifies significant at the 10 percent. t statistics are in parentheses.

Table 3: Estimation of Remitting Equation using the Heckman Approach

Variable	Specification 1		Specification 2		Specification 3		Specification 4	
	Likelihood	Amount Sent	Likelihood	Amount Sent	Likelihood	Amount Sent	Likelihood	Amount Sent
Income	.094 (11.65)*	202.61 (8.52)*	.092 (11.54)*	213.99 (9.10)*	.093 (11.57)*	203.23 (8.85)*	.094 (11.64)*	227.44 (9.46)*
Age	-.013 (-6.80)*	-12.15 (-2.34)**	-.013 (-6.95)*	-11.27 (-2.17)**	-.013 (-6.98)*	-11.62 (-2.24)*	-.013 (-6.89)*	-11.02 (-2.11)**
Gender	-.063 (-0.98)	-731.03 (-4.83)*	-.066 (-1.02)	-714.32 (-4.71)*	-.072 (-1.11)	-725.19 (-4.80)*	-.076 (-1.17)	-725.38 (-4.75)*
Married	.210 (3.22)*	-247.24 (-1.70)**	.212 (3.24)*	-219.30 (-1.50)	.211 (3.26)*	-224.64 (-1.55)	.199 (3.03)*	-196.73 (-1.35)
Gender*Married	.092 (1.21)	792.86 (4.46)*	.090 (1.18)	794.57 (4.48)*	.094 (1.24)	776.24 (4.39)*	.104 (1.36)	821.09 (4.59)*
Spouse Abroad	.266 (3.17)*	1101.75 (6.84)*	.273 (3.25)*	1111.47 (6.89)*	.279 (3.33)*	1140.17 (7.09)*	.267 (3.18)*	1113.82 (6.88)*
Child	-.320 (-5.76)*	-961.22 (-7.05)*	-.313 (-5.63)*	-954.64 (-7.09)*	-.306 (-5.55)*	-967.92 (-7.23)*	-.315 (-5.65)*	-1015.94 (-7.44)*
Child Abroad	.691 (12.80)*	1070.15 (6.26)*	.685 (12.71)*	1138.25 (6.77)*	.690 (12.81)*	1076.72 (6.50)*	.687 (12.67)*	1220.04 (7.14)*
Time in the U.S.	-.050 (-10.32)*	-44.70 (-2.91)*	-.050 (-10.29)*	-43.02 (-2.86)*	-.050 (-10.14)*	-44.92 (-3.01)*	-.051 (-10.36)*	-50.05 (-3.25)*
Years of Education	-.047 (-11.02)*	-	-.049 (-11.42)*	-	-.050 (-11.70)*	-	-.049 (-11.22)*	-
Undocumented Entry	-.033 (-0.73)	146.10 (1.51)	-.029 (-0.64)	107.84 (1.11)	-.031 (-0.67)	130.27 (1.34)	-.033 (-0.72)	88.75 (0.91)
Δe	-.28 (-3.21)*	-568.94 (-2.15)**	-	-	-	-	-.027 (-1.41)	-1058.24 (-3.03)*
σ_e	-	-	-.015 (-0.88)	211.45 (4.41)*	-	-	-.420 (-4.10)*	255.69 (5.17)*
GDP Home	-	-	-	-	-.033 (-1.86)**	67.44 (1.77)**	-.050 (-2.45)**	74.54 (1.90)**
Inverse Mills Ratio		233.95 (0.63)		375.65 (1.04)		238.58 (0.67)		560.37 (1.51)
Observations	6,276		6,283		6,315		6,252	
Uncensored Obs.	3,776		3,779		3,795		3,764	
Wald Chi2 Test	795.07*		809.50*		812.09*		845.52*	

Note: * signifies significantly different from 0 at the 1 percent level; ** signifies significantly different from 0 at the 5 percent, and *** signifies significantly different from 0 at the 10 percent level. t-statistics are in parentheses.

Appendix A: Comparative Static Results

The second order condition (SOC) for the optimization problem is:

$$\frac{U_{11}}{(e)^2} + \delta^2 U_{22} (c_1^*)^2 + \delta^2 U_{2c_{11}} c_{11}^* + \beta(1+i^*)^2(1-\delta)^2 E \left[\frac{V_{11}}{(e^F)^2} \right] \leq 0$$

1. Derivative of remittances with respect to e :

$$\frac{\partial r}{\partial e} = - \left(\frac{U_1 - rU_{11}/e}{(e)^2 (SOC)} \right) \geq 0 \quad (\text{A.1})$$

2. Derivative of remittances with respect to y^* :

- Altruism is a motive ($0 < \delta \leq 1$):

$$\frac{\partial r}{\partial y^*} = \frac{-\delta U_{22} c_2^* c_1^*}{SOC} \leq 0 \quad (\text{A.2})$$

- Investment only case ($\delta = 0$):

$$\frac{\partial r}{\partial y^*} = 0 \quad (\text{A.3})$$

3. Derivative of remittances with respect to y :

$$\frac{\partial r}{\partial y} = \frac{U_{11}}{e(SOC)} \geq 0 \quad (\text{A.4})$$

4. Derivative of remittances with respect to i^* :

- Pure altruism case ($\delta = 1$):

$$\frac{\partial r}{\partial i^*} = 0 \quad (\text{A.5})$$

- Other cases ($0 \leq \delta < 1$):

$$\frac{\partial r}{\partial i^*} = \frac{\beta r(1+i^*)(1-\delta)^2 E[V_{11}/(e^F)^2] + \beta(1-\delta)E[V_1/e^F]}{SOC} \begin{matrix} > \\ < \end{matrix} 0 \quad (\text{A.6})$$