Why Do Migrants Return to Poor Countries? Evidence from Philippine Migrants' Responses to Exchange Rate Shocks

Dean Yang*
Gerald R. Ford School of Public Policy
and Department of Economics,
University of Michigan

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Abstract

Why would migrant workers in rich countries ever return to poorer countries of origin? In a model of migration and household investment, with borrowing constraints and minimum investment thresholds, return migration occurs for either *target-earnings* or *life-cycle* reasons. This paper exploits a unique quasi-experiment to distinguish between these potential explanations for return migration. I examine how the return decisions of Philippine migrants respond to major and unexpected exchange rate shocks (due to the 1997 Asian financial crisis). Overall, the evidence favors the life-cycle explanation: more favorable exchange rate shocks lead to fewer migrant returns. A 10% improvement in the exchange rate reduces the 12-month return rate by 1.4 percentage points. However, there is evidence that some migrants are motivated by target-earnings considerations: for households with intermediate levels of foreign earnings, more favorable exchange rate shocks have the least effect on return migration, but lead to increases in entrepreneurial income, real property purchases, and vehicle ownership. Overall, the findings are at odds with a model with relaxed constraints on borrowing for household investment.

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* Assistant Professor, Gerald R. Ford School of Public Policy and Department of Economics, University of Michigan, 440 Lorch Hall, 611 Tappan Street, Ann Arbor, MI 48109. Email: deanyang@umich.edu. I have valued the advice of Caroline Hoxby, Larry Katz, Michael Kremer, and Dani Rodrik. HwaJung Choi provided excellent research assistance. Research funding was provided by the Social Science Research Council's Program in Applied Economics, the MacArthur Network on the Effects of Inequality on Economic Performance, and a University of Michigan Rackham junior faculty fellowship.

1 Introduction

Between 1975 and the year 2000, the number of individuals living outside their countries of birth more than doubled to 175 million, or 2.9% of world population (United Nations (2002)).[1] While migration flows from poor to rich countries gain the most attention, return flows of migrants to their countries of origin are substantial. Borjas and Bratsberg (1996) estimate that 17.5% of immigrants who arrived in the United States between January 1, 1975 and April 1, 1980 had left the country by the end of that period. Jasso and Rosenzweig (1982) estimate an upper bound of 50% for the remigration rate of the 1971 US immigrant cohort by January 1979.[2]

Why would migrant workers in rich countries ever return to poorer countries of origin? In the face of substantial wage differentials, return migration is a puzzle for exclusively income-maximizing models of migration (as in Sjastaad (1962) and Harris and Todaro (1970)). Return migration becomes sensible in the context of household utility maximization over a finite life-cycle, when migrants prefer consumption in the home country to consumption overseas (as in Hill (1987) and Djajic and Milbourne (1988)). Temporary stays overseas are used to accumulate resources for later use in the home country, either for consumption or investment.

In current research on return migration, there is so far no consensus on the extent to which the durations of migrants' stays overseas are determined primarily by straightforward *life-cycle* considerations, as opposed to being driven by the need to reach *target-earnings* levels. By 'life-cycle' considerations, I mean simply that households choose the length of stay overseas that balances the marginal benefit from higher savings overseas (and thus higher lifetime consumption) against the marginal utility cost of overseas work (as in Stark, Helmenstein, and Yegorov (1997) and Dustmann (2003)). On the other hand, when households face borrowing constraints and minimum investment levels, lengths of stay overseas can be determined by the amount of time needed to accumulate a 'target-earnings' level, as in Piore (1979) and Mesnard (2004).[3]

Distinguishing between the two alternative motivations for return migration is important, because the return decisions of 'life-cycle' migrants and 'target-earners' can respond very differently to changes in overseas economic conditions. For 'life-cycle' migrants, improved economic

[1] By contrast, world population grew by just 49% over the same time period (U.S. Bureau of the Census 2002).

[2] Outflows of migrants from Europe have also been large (see Dustmann (1996)). Return migration is not just a recent phenomenon: US departure statistics indicate that almost one-third (4.8 million) of the 15.7 million US immigrants who arrived between 1907 and 1957 had departed by the latter year (LaLonde and Topel (1997)). Chiswick and Hatton (2003) note that return migration exceeded immigration to the US during the 1930s.

[3] Empirical tests of 'target-earnings' models of intertemporal labor supply in the U.S. include Camerer, et al. (1997) and Farber (2003).

conditions in host countries—say, increased wages—can lead to longer overseas stays (as long as substitution effects dominate any income effects).[4] For 'target-earners', on the other hand, improved economic conditions should lead to *shorter* overseas stays, as migrants reach their earnings goals more quickly.

This paper begins by discussing migration and household investment in theory. When finitely-lived households face borrowing constraints and minimum investment thresholds, both potential reasons for return migration emerge. The main theoretical prediction is that 'life-cycle' migrants are those at the lowest and highest ends of the foreign wage distribution, while migrants with intermediate foreign wages are 'target-earners'. In essence, 'target-earners' are those for whom the minimum investment threshold is *just* binding: they prefer investing at the minimum threshold to not investing at all, but if possible would have preferred lower investment levels (and shorter stays overseas). They therefore stay overseas only until their savings reach the minimum investment threshold. By contrast, the foreign wages of 'life-cycle' migrants are either too low to ever consider investing, or high enough that they choose above-minimum investment levels.

Empirically, attempts to distinguish between the two alternatives typically examine the correlation between return migration and migrants' overseas earnings. The evidence has been inconclusive. Borjas (1989) finds among the foreign-born in the US that higher earnings are associated with less return migration. By contrast, Dustmann (2003) documents, among immigrants in Germany, that higher migrant wages (instrumented by parental education) are associated with more return migration (shorter overseas stays). Constant and Massey (2002) find no statistically significant relationship between earnings and migrant returns in the same German dataset, although migrants who are unemployed or marginally employed are more likely to return.[5]

Other studies have sought evidence that migrants are target-earners by examining correlations among migrant earnings, return migration, and entrepreneurship. In a sample of Tunisian return migrants, Mesnard (2004) documents that migrants were more likely to become entrepreneurs upon return if they had accumulated higher savings overseas. Dustmann and Kirchkamp (2002) find that higher migrant earnings are associated with shorter migration durations for Turkish migrants who become entrepreneurs upon return.

[4] Stark, Helmenstein, and Yegorov (1997) and Dustmann (2003) discuss the opposing substitution and income effects of foreign wage changes.

[5] Other work on the correlates of return migration includes DaVanzo (1983), Merkle and Zimmermann (1992), and Borjas and Bratsberg (1996). Fox and Stark (1987) use retrospective data in the Mexican Migration Project dataset for 1982-83 to document a positive correlation between hours worked by Mexicans in the US (conditional on being in the US) and the US-Mexican exchange rate, but do not examine return migration.

A central methodological concern with existing empirical work on this topic is that the independent variable of interest—foreign earnings—is not randomly assigned across migrants, so any observed relationship between foreign earnings and return migration may simply be caused by unobserved third factors. For example, a finding that migrants with higher earnings have shorter lengths of stay overseas need not imply that higher earnings *cause* shorter migration durations. Rather, higher-wage migrants could simply have other characteristics that make early return attractive (such as better job prospects at home, or stronger family ties).[6]

This paper exploits a unique quasi-experiment that generated sudden changes in migrant economic conditions, making possible a causal estimate of the effect of migrant economic conditions on return migration. In so doing, it also sheds light on the relative importance of life-cycle versus target-earnings explanations for return migration.

In June 1997, 6% of Philippine households had one or more members working overseas. These overseas members were working in dozens of foreign countries, many of which experienced sudden changes in exchange rates due to the 1997 Asian financial crisis. Crucially for the empirical analysis, there was substantial variation in the size of the exchange rate shock experienced by migrants. Between July 1997 and June 1998, the US dollar and currencies in the Middle Eastern destinations of Filipino workers rose 40% in value against the Philippine peso. Over the same time period, by contrast, the currencies of Taiwan, Singapore, and Japan rose by only 22%, 24%, and 27%, while those of Malaysia and Korea actually fell slightly against the peso.[7]

The size of exchange rate shocks across differerent migrant location countries was unexpected, and so the causal impact of the exchange rate shock on return migration is identified. I use panel household survey data on Philippine households with members working overseas, and examine migrant returns to these households over a 12-month window immediately following the Asian financial crisis.

The first main finding of this paper is that, on the whole, more favorable exchange rate shocks lead to fewer migrant returns. The regression analysis indicates that a 10% improvement in the exchange rate reduces the 12-month return rate by 1.4 percentage points.[8] Figure 1

[6] Conducting the analysis in a panel setting—where *changes* in foreign earnings can be related to changes in migration duration—should do better at controlling for unobserved heterogeneity, but concerns about causality still arise. For example, family events at home (say, worsening parental health) may lead to shorter overseas stays, and also lead migrants to increase their earnings in the time they have remaining overseas.

[7] I describe the exchange rate index in section 3.1 below.

[8] An increase in the exchange rate simultaneously raises the Philippine-currency value of foreign wages *and* of accumulated savings held overseas. If increases in overseas savings raise return rates (a wealth effect), the negative estimated effect of exchange rate shocks on return rates understates the impact of pure foreign wage changes on return rates.

illustrates the bivariate relationship, displaying the 12-month migrant return rate for households experiencing different exchange rate shocks (higher values of the shock variable are 'better'). While the exchange rate shocks can reasonably be taken as exogenous, I present additional tests confirming that the results are not driven either by pre-existing differences in return rates from different countries, or by heterogeneity in the impact of the post-crisis economic downturn on households in the Philippines that might be correlated with pre-crisis migrant locations. In addition, there is little indication that the results are being driven by changes in job terminations correlated with the exchange rate shocks.

Overall, the finding that more favorable exchange rate shocks lead to fewer migrant returns supports the 'life-cycle' explanation for return migration. A positive exchange rate shock raises the marginal benefit of staying overseas (by raising the domestic-currency value of foreign wages), and leads to less return migration on the margin.

The second main finding of this paper is that—even though life-cycle considerations seem to dominate on the whole—migrants from a subset of households appear to be target-earners. The effect of the exchange rate shock on returns is greatest for households with the lowest and highest values of a foreign wage index, and lowest for those with intermediate values of the index. In households with intermediate values of the foreign wage index, the exchange rate shocks lead to increases in variables associated with household investment (entrepreneurial income, real property purchases, and vehicle ownership), but the effect on investment is not statistically significant for other households. These results are consistent with the theoretical prediction that the migrants most likely to be target-earners are those in the middle of the foreign wage distribution: positive exchange rate shocks make target-earners more likely to return home *and* to invest (because they become more likely to have reached the minimum investment threshold).

Aside from contributing to research on international migration, this paper is also related to an important body of research that examines the impact of financial market imperfections on entrepreneurship in developing countries.[9] This paper's finding that some migrants are target-earners suggests that credit constraints in developing countries have effects far beyond their borders.

This paper is organized as follows. Section 2 discusses return migration in theory. Section 3 provides an overview of international labor migration from the Philippines, and describes the post-Asian crisis exchange rate shocks. Section 4 outlines the data used and the empirical strategy,

[9] For example, Aghion and Bolton (1996), Banerjee and Newman (1993), and Paulson and Townsend (2001). In the developed-country context, Evans and Jovanovic (1989) and Blanchflower and Oswald (1998) are also relevant.

and presents the empirical results. Section 5 concludes.

2 Return migration in theory

What does economic theory tell us about the determinants of migration durations? How can a quasi-experiment—such as migrants' exchange rate shocks—be used to shed light on the relative importance of potentially diverse reasons for return? I outline here a theoretical model of migration and household investment, and highlight the theoretical impact of favorable exchange rate shocks. The model and results are described qualitatively in this section, while the model is formally presented in the Theory Appendix (subsection 6.1 below).[10]

Assume that finitely-lived households each have two members, one of whom has the option of working overseas for a wage higher than the domestic wage. Households also may invest in an enterprise that allows higher domestic earnings, but face borrowing constraints and a minimum investment threshold. Households prefer consumption at home to consumption overseas, so overseas work is purely intended to accumulate resources for future investment and/or consumption. The only source of heterogeneity across households is their foreign wage per period overseas. Households choose the number of periods they work overseas, the number of periods they save before investing, and savings rates in each period. The model is solved via numerical simulation, assuming a specific parameterization of the model.

Two types of migrants emerge, differentiated on the basis of the primary motivation for return migration. Table 1 provides an overview of the types and their characteristics.

First, there are what might be called *life-cycle migrants*, who make their return decisions on an essentially neoclassical basis: they simply choose the length of stay overseas that balances the marginal benefit from higher savings overseas (and thus higher lifetime consumption) against the marginal utility cost of overseas work. Life-cycle migrants are divided into two sub-types, which I call 'unconstrained investors' and 'non-investors'. 'Unconstrained investors' are households whose migrants have the *highest* foreign wages. Their lifetime earnings are high enough that entrepreneurial investment occurs relatively early in the lifetime. After the investment is made, these migrants may continue to accumulate savings overseas for some time. 'Non-investors', on the other hand, have lifetime earnings that are too low to ever contemplate making a household

[10] The model has basic similarities with Stark, et al (1997), Dustmann (2003), and Mesnard (2004). The model is closest to Mesnard (2004), with the primary differences being that I assume a minimum investment level instead of a sunk investment cost, and allow the period of migration to differ from the period of savings prior to enterprise investment.

entrepreneurial investment (because of the minimum investment threshold). These are households whose migrants have the *lowest* values of the foreign wage. What unconstrained investors and non-investors have in common is that they both are staying overseas on the margin solely to accumulate savings that help raise future consumption levels. In other words, life-cycle migrants return in order to *consume*.

The second general type of migrant is the *target-earner*. Target-earners are migrants who choose to make an entrepreneurial investment at the minimum investment level. In a neoclassical world without a minimum investment level, these migrants would have preferred a shorter migration duration and a smaller entrepreneurial investment, but they prefer investing at the minimum investment level to not investing at all. Target-earners work overseas only until they have saved the minimum investment level, after which they return immediately and the household invests in the entrepreneurial enterprise (return migration and entrepreneurial investment are simultaneous). These households have migrants with *intermediate* values of foreign earnings: if their foreign earnings were much lower they would choose not to invest at all (and be 'non-investors'), and at substantially higher foreign earnings they would invest more than the minimum (and be 'unconstrained investors'). Unlike life-cycle migrants, therefore, target-earners return in order to *invest*.

The model predicts that the impact of a favorable exchange rate shock (effectively, a simultaneous increase in the foreign wage and the value of savings held overseas) can differ for life-cycle migrants and target-earners. A favorable exchange rate shock *reduces* return rates for life-cycle migrants: migrants from both unconstrained-investor and non-investor households remain overseas on the margin purely to accumulate savings for future consumption, and the exchange rate shock raises the marginal value of staying overseas.[11] But favorable exchange rate shocks *increase* return rates for target-earners, because the exchange rate shock can lead them to reach their target earnings level more quickly.

A positive exchange rate shock also has the highest positive impact on household investment for target-earners. Target-earners respond this way to the shock because their migration and investment decisions are linked: they remain overseas only until they have accumulated the minimum investment threshold, and then simultaneously return home and invest.

In terms of the empirical analysis, these theoretical predictions suggest that the *overall* impact

[11] Of course, the substitution effect of the effective foreign wage increase must dominate the income effect, which is the case in the parameterization used in the numerical simulation. In a more general model the income effect could dominate the substitution effect, so that exchange rate shocks could raise return migration for life-cycle migrants (as in Dustmann (2003) and Stark, et al (1997)).

of the exchange rate shock on migrant return rates can shed light on the relative importance of 'life-cycle' versus 'target-earnings' motivations for return migration. If more favorable exchange rate shocks *reduce* return migration, this would be evidence that life-cycle motivations dominate on the whole. On the other hand, a finding that such shocks *raise* return migration would suggest that target-earnings motivations are more important on average.

It is worth mentioning that the estimated overall impact of the exchange rate shock on return rates should be *more positive* than the impact of a similarly-sized *pure foreign wage change*. The exchange rate shock is a joint shock to the domestic-currency value of the foreign wage *and* to overseas savings. The positive wealth shock associated with the increase in the domestic-currency value of overseas savings should *raise* households' demand for migrant returns (a wealth effect), so that the estimated impact of the exchange rate shock should be more positive than a similarly-sized pure wage shock (one that is not accompanied by a change in assets).[12]

The second implication of the theory for the empirical analysis is that, when pre-shock foreign wages are heterogeneous across migrants, the impact of a favorable exchange rate shock: 1) is most negative on migrant return rates for households with the lowest and highest foreign wages (life-cycle migrants), and 2) is most positive on household investment rates for households with intermediate foreign wages (target-earners). In practice, these predictions mean that the impact of favorable exchange rate shocks on migrant return rates and on household investment should be inverted-U shapes in the foreign wage.

The theoretical predictions contrast sharply with those of a model that relaxes the credit constraint and allows households to borrow for investment. In such a model, the impact of a favorable exchange rate shock: 1) is most negative on migrant return rates for households with the lowest foreign wages, with the effect declining in absolute value as the foreign wage increases, and 2) is zero on household investment rates for all households.

3 International labor migration from the Philippines

To help ameliorate rising unemployment and aggregate balance of payments problems, in 1974 the Philippine government initiated an 'Overseas Employment Program' to facilitate the placement of Filipino workers in overseas jobs. At the outset, the government directly managed the placement

[12] To anticipate the empirical results, positive exchange rate movements have a negative impact on return rates on average. Therefore, the impact of proportional foreign wage changes on returns is likely to be *more negative* than the estimated impact of exchange rate shocks.

of workers with employers overseas, but soon yielded the function to private recruitment agencies and assumed a more limited oversight role. The annual number of Filipinos going overseas on officially-processed work contracts rose six-fold from 36,035 to 214,590 between 1975 and 1980, and more than tripled again by 1997 to 701,272.[13] Today, the government authorizes some 1,300 private recruitment agencies to place place Filipinos in overseas jobs (Diamond (2002)). Contracts for most overseas positions are typically of two years' initial duration, and are usually open to renewal. For the vast majority of positions, overseas workers cannot bring family members with them, and must go alone.

The central role in Philippine migration of temporary, legal contract work makes it distinctive. Migration for temporary contract work is a type of international labor flow that is likely to become more and more important in coming years.

In June 1997 (immediately prior to the Asian financial crisis), 5.9% of Philippine households had one or more household members overseas, in a wide variety of foreign countries.[14] Table 2 displays the distribution of household members working overseas by country in that month.[15] Filipino workers are remarkably dispersed worldwide. Saudi Arabia is the largest single destination, with 29% of the total, and Hong Kong comes in second with roughly 12%. But no other destination accounts for more than 10% of the total. The only other countries accounting for 6% or more are Taiwan, Japan, Singapore, and the United States. The top 20 destinations listed in the table account for 93.6% of overseas Filipino workers; the remainder are distributed among 38 other identified countries or have an unspecified location.

Table 3 displays summary statistics on the characteristics of overseas Filipino workers in the same survey. 1,794 overseas workers were overseas in June 1997 in the households included in the empirical analysis (see the Data Appendix for details on the construction of the household sample). The overseas workers have a mean age of 34.4 years. 38% are single, and 53% are male. 'Production and related workers' and 'domestic servants' are the two largest occupational

[13] The source for these data is *Philippine Yearbook 2001*, Table 15.4. These figures do not include Filipinos who go overseas without the help of government-authorized recruitment agencies. By all accounts (e.g., Cariño (1998) and others), there was a dramatic rise in the number of Filipinos going overseas in this period, so the figures should not reflect merely the collection of new data on previously undocumented worker departures.

[14] This statistic, and those in the following two paragraphs, are as reported in the 1997 Survey on Overseas Filipinos and 1997 Labor Force Survey. I describe these surveys in Section 4 below.

[15] For 90% of individuals in the SOF, their location overseas in that month is reported explicitly. For the remainder, a few reasonable assumptions must be made to determine their June 1997 location. See the Data Appendix for the procedure used to determine the locations of overseas Filipinos in the SOF. Tables 2 and 3 include the exact migrants whose households were included in the empirical analysis, and so a small number of migrants were excluded due to lack of complete data on all variables used in the analysis. This exclusion makes next to no difference to the summary statistics.

categories, each accounting for 31% of the total. 31% of overseas workers in the sample have achieved some college education, and a further 30% have a college degree. In terms of position in the household, the most common categories are male heads of household and daughters of the head, each accounting for 28% of overseas workers; sons of head account for 15%, female heads or spouses of heads 12%, and other relations 16% of overseas workers. As of June 1997, the bulk of overseas workers had been away for relatively short periods: 30% had been overseas for just 0-11 months, 24% for 12-23 months, and 15% for 24-35 months, 15% for 36-47 months, and 16% for 48 months or more.

Unsurprisingly, migrants are typically located in countries substantially richer than the Philippines: the mean 1996 per capita income of migrant's location countries is $16,946.[16] 19% of overseas workers were located in countries that might be considered 'immigration destinations': Japan, the USA (including Pacific territories such as Guam, Marshall Islands and Northern Marianas Islands), Canada, Australia, the United Kingdom, and Germany.[17]

3.1 Shocks generated by the Asian financial crisis

The geographic dispersion of overseas Filipinos meant that there was considerable variety in the shocks they experienced in the wake of the Asian financial crisis, starting in July 1997. The devaluation of the Thai baht in that month set off a wave of speculative attacks on national currencies, primarily (but not exclusively) in East and Southeast Asia.

Figure 2 displays monthly exchange rates for selected major locations of overseas Filipinos (expressed in Philippine pesos per unit of foreign currency, normalized to 1 in July 1996).[18] The sharp trend shift for nearly all countries after July 1997 is the most striking feature of this graph. An increase in a particular country's exchange rate should be considered a favorable shock to an overseas household member in that country. (As noted in the theoretical section, positive exchange rate shocks raise the domestic-currency value of both households' foreign earnings and overseas savings.)

For each country j, I construct the following measure of the exchange rate change between the

[16] Figures in 1995 US dollars, and are as reported by World Development Indicators 2002. In comparison, Philippine per capita GDP in 1996 was $1,122.

[17] Immigration destinations are defined as countries with 5,000 or more permanent Philippine residents in 1997, as tabulated by the Philippine government's Commission on Filipinos Overseas (CFO).

[18] The exchange rates are as of the end of each month, and were obtained from Bloomberg L.P.

year preceding July 1997 and the year preceding June 1998:

$$ERCHANGE_j = \frac{\text{Average country } j \text{ exchange rate from Jul. 1997 to Jun. 1998}}{\text{Average country } j \text{ exchange rate from Jul. 1996 to Jun. 1997}} - 1. \quad (1)$$

A 10% improvement would be expressed as 0.1, a 10% decline as -0.1. Exchange rate changes for the 20 major destinations of Filipino workers are listed in the last column of Table 2. The changes for the United States, Hong Kong, and Middle Eastern countries were all at least 0.40. By contrast, the exchange rate shocks for Taiwan, Singapore, and Japan were 0.22, 0.24, and 0.27, while for Malaysia and Korea they were actually negative: -0.01 and -0.02, respectively. Among workers in the sample, those in Indonesia experienced the worst exchange rate change over the period (-0.39), while those in Syria experienced the most favorable change (0.43) (not shown in table).

Unfortunately, the survey data to be used in the empirical analysis only allows migrants' origin households (not individual migrants) to be tracked over panel years. So the empirical analysis examines migration return rates at the household level. I therefore construct a household-level exchange rate shock variable as follows. Let the countries in the world where overseas Filipinos work be indexed by $j \in \{1, 2, ..., J\}$. Let n_{ij} indicate the number of overseas workers a household i has in a particular country j in June 1997 (so that $\sum_{j=1}^{J} n_{ij}$ is its total number of household workers overseas in that month). The exchange rate shock measure for household i is:

$$ERSHOCK_i = \frac{\sum_{j=1}^{J} n_{ij} ERCHANGE_j}{\sum_{j=1}^{J} n_{ij}} \quad (2)$$

In other words, for a household with just one worker overseas in a country j in June 1997, the exchange rate shock associated with that household is simply $ERCHANGE_j$. For households with workers in more than one foreign country in June 1997, the exchange rate shock associated with that household is the *weighted average* exchange rate change across those countries, with each country's exchange rate weighted by the number of household workers in that country.[19] Because the question of interest is the impact of shocks experienced by migrants on return migration, the sample for analysis is restricted to households with one or more members working overseas prior to the Asian financial crisis (in June 1997).

In addition, the Philippine economy experienced a decline in economic growth after the onset

[19] Of the 1,615 households included in the analysis, 1,455 (90.1%) had just one member working overseas in June 1997. 139 households (8.6%) had two, 18 households (1.1%) had three, and three households (0.2%) had four members working overseas in that month.

of the crisis. Annual real GDP contracted by 0.8% in 1998, as compared to growth of 5.2% in 1997 and 5.8% in 1996 (World Bank 2002). The urban unemployment rate (unemployed as a share of total labor force) rose from 9.5% to 10.8% between 1997 and 1998, while the rural unemployment rate went from 5.2% to 6.9% over the same period (Philippine Yearbook (2001), Table 15.1). Any effects of the domestic economic downturn common to all sample households (as well as effects of the crisis that differ according to households' observed pre-crisis characteristics) will be accounted for in the empirical analysis, as described in the next section.

4 Impact of exchange rate shocks on return migration

The primary goal of the empirical analysis is to determine whether migrant return rates are positively or negatively associated with the exchange rate shock. Positive exchange rate shocks should lead to lower return rates if 'life-cycle' migrants predominate. On the other hand, exchange rate shocks should lead to *higher* return rates if migrants are primarily 'target-earners'. In addition, the empirical analysis will test specific implications of the model of migration and household investment, when households face borrowing constraints and minimum investment thresholds (as described above in section 2).

In the following subsections, I describe the data and sample construction, the characteristics of sample households, the regression specification and some empirical issues, and then present empirical results.

4.1 Data and sample construction

The empirical analysis uses data from four linked household surveys conducted by the National Statistics Office of the Philippine government, covering a nationally-representative household sample: the Labor Force Survey (LFS), the Survey on Overseas Filipinos (SOF), the Family Income and Expenditure Survey (FIES), and the Annual Poverty Indicators Survey (APIS).

The LFS is administered quarterly to inhabitants of a rotating panel of dwellings in January, April, July, and October, and the other three surveys are administered with lower frequency as riders to the LFS. Usually, one-fourth of dwellings are rotated out of the sample in each quarter, but the rotation was postponed for five quarters starting in July 1997, so that three-quarters of dwellings included in the July 1997 round were still in the sample in October 1998 (one-fourth of the dwellings had just been rotated out of the sample). The analysis of this paper takes advantage

of this fortuitous postponement of the rotation schedule to examine changes in households between 1997 and 1998.

Survey enumerators note whether the household currently living in the dwelling is the same as the household surveyed in the previous round; only dwellings inhabited continuously by the same household from July 1997 to October 1998 are included in the sample for analysis.[20] Households are only included in the sample for empirical analysis if they reported having one or more members overseas in June 1997 (immediately prior to the Asian financial crisis). See the Data Appendix for details regarding the contents of the surveys and the construction of the sample for analysis.

4.2 Characteristics of sample households

Table 4 presents summary statistics for the 1,615 households used in the empirical analysis. The top row displays summary statistics for the exchange rate shock. The mean change in the shock index was 0.32, with a standard deviation of 0.13.

The main dependent variable in the analysis is the '12-month migrant return rate,' the number of household migrant workers who returned between July 1997 and June 1998 divided by the number of household members working overseas in June 1997. The mean of this variable is 0.08.

The mean number of household overseas workers in June 1997 is 1.11. The median cash receipts from overseas was 25,000 pesos (US$962) in Jan-Jun 1997.[21] Pre-crisis cash receipts from overseas were substantial as a share of household income, with a median of 0.39.

Households in the sample tend to be wealthier than other Philippine households in terms of their initial (Jan-Jun 1997) income per capita. 51% of sample households are in the top quartile of the national household income per capita distribution, and 28% are in the next-highest quartile. Median pre-crisis income per capita in the household is 15,194 pesos (US$584). Mean pre-crisis household size is 6.17 members (including overseas members).[22] 68% of sample households are urban, compared to the national figure of 59%.

[20] As discussed in Yang (2004), there is no evidence that attrition from the sample between 1997 and 1998 is correlated with a household's exchange rate shock.

[21] Philippine pesos are converted to US dollars at the first-half 1997 exchange rate of roughly 26 pesos per US$1.

[22] The corresponding pre-crisis (Jan-Jun 1997) national median of income per capita for all households is 7,944 pesos. The national mean household size in July 1997 was 5.27.

4.3 Regression specification

In investigating the impact of exchange rate shocks on changes in the migrant return rate between 1997 and 1998, the basic regression equation is:

$$RET_{it} = \beta_0 + \beta_1 (ERSHOCK_{it}) + \varepsilon_{it} \tag{3}$$

Let $t = 1998$. For household i, RET_{it} is the migrant return rate in the 12 months leading up to June 1998. $ERSHOCK_{it}$ is the exchange rate shock for household i in the year leading up to June 1998, as defined above in (2). ε_{it} is a mean-zero error term. Standard errors are clustered according to the June 1997 location of the household's overseas worker(s).[23]

The constant term, β_0, accounts for the average change in outcomes across all households in the sample. This accounts for the shared impact on migrant returns of the decline in Philippine economic growth after the onset of the crisis.

The coefficient of interest is β_1, the impact of the exchange rate shock on the migrant return rate. The identification assumption is that if exchange rates in the locations of overseas Filipino workers had remained unchanged from 1997 through 1998, then migrant return rates would not have varied systematically across households on the basis of their overseas workers' locations. While this identification assumption is not possible to test directly, it is possible to conduct three partial tests for different types of violations of the identification assumption (potential threats to causal inference).

A first potential violation of the identification assumption would be if migrant return rates *prior* to the Asian financial crisis are correlated with the (*future*) exchange rate shocks that were to occur in their overseas location countries after July 1997. For example, if countries that were to experience the most favorable exchange rate shocks in the wake of the Asian crisis (such as the US, Hong Kong, and the Gulf states) in general always had the lowest migrant return rates (even *prior* to the crisis), the coefficient on $ERSHOCK_{it}$ in equation (3) would be biased in a negative direction. Differences in the survey rotation schedule in prior years make it impossible to conduct exactly the same analysis of return rates prior to 1997 (household panels cannot be constructed that span successive rounds of the Survey of Overseas Filipinos.) However, an imperfect (but likely still informative) return rate analysis can be conducted using retrospective questions on migrant locations in the cross-sectional rounds of the SOF for prior years. The Empirical Appendix

[23] For households that had more than one overseas worker overseas in June 1997, the household is clustered according to the location of the *eldest* overseas worker. This results in 50 clusters.

(subsection 6.3 below) describes this exercise, and finds no evidence that return rates in prior 12-month periods (July 1995-June 1996, and July 1996-June 1997) are correlated with *future* exchange rate shocks occuring in migrant location countries after July 1997.

The second potential violation of the identification assumption is an omitted variable problem: variation in post-Asian crisis migrant returns could be driven by changes in migrant *job termination* in the countries affected by the Asian financial crisis (which are likely to be correlated with the exchange rate shocks), and not by the exchange rate shocks *per se*. If so, the regression results would not necessarily shed light on the theoretical model of return migration, in which migrants decide for themselves when to return home.

A third potential violation of the identification assumption is the possibility that the domestic Philippine economic downturn in 1997-1998 had heterogeneous effects on households in the Philippines in a manner correlated with the locations of their overseas members (also an omitted variable problem). This is a potential concern because households whose migrants experienced more favorable exchange rate shocks do differ along a number of *pre*-crisis characteristics from households whose migrants experienced less-favorable shocks. Appendix Table 1 presents coefficient estimates from a regression of the household's exchange rate shock on a number of pre-shock characteristics of households and their overseas workers. Several individual variables are statistically significantly different from zero, indicating that households experienced more favorable exchange rate shocks if they had fewer members, heads who were more educated, less educated migrants, and migrants who had been away for longer periods prior to the crisis.[24] If these pre-crisis characteristics *also* help predict the impact of the *domestic* 1997-1998 Philippine economic downturn on households, there may be an omitted variable problem: migrant return rates may be responding to changes in the domestic economic conditions of their origin households, and not the exchange rate shocks they experience overseas.

Tests for the second and third types of potential violations of the identification assumption involve checking whether the coefficient β_1 on the exchange rate shock changes when one includes two types of right-hand-side control variables in the regression equation. The expanded regression equation is:

$$RET_{it} = \beta_0 + \beta_1 (ERSHOCK_{it}) + \beta_2 (MIGSHOCK_{it}) + \boldsymbol{\delta}' (\mathbf{X}_{it-1}) + \varepsilon_{it} \tag{4}$$

[24] Also, F-tests reject the null that some subgroups of variables are jointly equal to zero: indicators for household per capita income percentiles; indicators for household head's education level; indicators for household geographic location in the Philippines; overseas workers' months away variables; overseas workers' education variables; and overseas workers' occupation variables.

$MIGSHOCK_{it}$ is an indicator variable equal to 1 if the household reports that an overseas worker from the household experienced a job loss in the year preceding October 1998, and is 0 otherwise.[25] Inclusion of $MIGSHOCK_{it}$ in the regression controls for changes in migrant return rates due to job termination.

$\mathbf{X}_{it-1}$ includes household geographic indicators and a range of pre-crisis household and migrant characteristics.[26] Inclusion of $\mathbf{X}_{it-1}$ controls for variation in migrant return rates explained by households' pre-crisis characteristics, and should indirectly account for heterogeneity in the impact of the domestic 1997-1998 Philippine economic downturn across households (to the extent that the latter type of heterogeneity is related to the same set of $\mathbf{X}_{it-1}$ variables).[27]

4.4 Regression results

This subsection describes the impact of exchange rate shocks on return migration at the household level. I first describe the mean impact of the exchange rate shocks across households, and then examines heterogeneity in the effect of the shock on return migration. Lastly, I examine heterogeneity in the impact of the exchange rate shocks on investment-related outcomes.

4.4.1 Overall impact of exchange rate shock on return migration

Table 5 presents coefficient estimates from estimating equations (3) and (4). The first column presents the coefficient estimate (β_1) on the exchange rate shock when no other right-hand-side variables are included in the regression, while the second column includes household location indicators and the control variables for pre-crisis household and migrant characteristics. The

[25] As reported in the Annual Poverty Indicators Survey of October 1998. This variable was not collected in prior years.

[26] Household geographic controls are 16 indicators for regions within the Philippines and their interactions with an indicator for urban location. Household-level controls are as follows. Income variables as reported in Jan-Jun 1997: log of per capita household income; indicators for being in 2nd, 3rd, and top quartile of the sample distribution of household per capita income. Demographic and occupational variables as reported in July 1997: number of household members (including overseas members); five indicators for head's highest level of education completed (elementary, some high school, high school, some college, and college or more; less than elementary omitted); head's age; indicator for 'head's marital status is single'; six indicators for head's occupation (professional, clerical, service, production, other, not working; agricultural omitted).

Migrant controls are means of the following variables across household's overseas workers away in June 1997: indicators for months away as of June 1997 (12-23, 24-35, 36-47, 48 or more; 0-11 omitted); indicators for highest education level completed (high school, some college, college or more; less than high school omitted); occupation indicators (domestic servant, ship's officer or crew, professional, clerical, other service, other occupation; production omitted); relationship to household head (female head or spouse of head, daughter, son, other relation; male head omitted); indicator for single marital status; years of age.

[27] In addition, to the extent that $\mathbf{X}_{it-1}$ includes variables that explain return rates but that are themselves uncorrelated with the exchange rate shocks, their inclusion can reduce residual variation and lead to more precise coefficient estimates on the exchange rate shock.

coefficient estimate is the same in both columns (-0.155) and is highly statistically significant (at the 1% level). The coefficient on the exchange rate shock is unchanged when control variables are added to the regression in column 2, so there is little reason to believe that any bias is being introduced by heterogeneity in the effect of the domestic economic downturn across households in the Philippines (as discused in subsection 4.3 above), or by any other unobserved heterogeneity correlated with the control variables.

The third column of the table includes as a control variable the indicator for a migrant from the household having experienced an overseas job loss in the past year ($MIGSHOCK_{it}$). As one might expect, the coefficient on $MIGSHOCK_{it}$ is positive and highly statistically significant. A migrant job loss in the past year raises a household's return rate by 0.154.

While migrant job losses do lead to higher migrant returns, including $MIGSHOCK_{it}$ in the regression has only a very small effect on the coefficient on the exchange rate shock (reducing it in magnitude from -0.155 to -0.142). The coefficient on the exchange rate shock remains statistically significantly different from zero. There is therefore little indication that the exchange rate shock is having its effect primarily via migrant job losses (the second potential violation of the identification assumption described in subsection 4.3).

The coefficient estimate in column 3 indicates that a 10% improvement (0.10) in the exchange rate is associated with a 0.0142 decline in the 12-month migrant return rate. This is a large effect, equal to nearly one-fifth of the mean 12-month return rate in the sample of 0.08.

In terms of the theoretical model, the fact that favorable exchange rate shocks lead to fewer migrant returns suggests that, on average, life-cycle considerations dominate target-earnings motivations for migrant returns.

Appendix Table 2 presents regression coefficients on the full set of right-hand-side variables from the regression in column 3 of Table 5. Return rates are higher in households whose migrants have spent more months away. Return rates are lower (by 0.053) in households whose migrants are in immigration destinations, and whose household heads are more educated. F-tests reject the null that some subgroups of variables are jointly equal to zero: overseas workers' months away variables; overseas workers' occupation variables; and indicators for household geographic location in the Philippines.

4.4.2 Heterogeneous effect of shock on return migration

The theoretical model predicts that the effect of the exchange rate shock on return rates will be heterogeneous according to a migrant's foreign wage level. While migrants' foreign wages are not reported in the dataset, it is possible to construct a reasonable proxy for foreign wages: *predicted remittances*, as follows.

4.4.2.1 Predicted remittances as a proxy for foreign earnings Start with the plausible assumption that foreign wages are positively correlated with remittances sent home. Remittances sent by the migrant to the sample household are reported in the dataset, so one might consider using remittances directly as a proxy for foreign wages. But this approach would be subject to the following concern: remittances sent home are likely be a very noisy proxy for the migrant's wages. For example, if remittances serve as insurance for migrants' origin households, they could fluctuate substantially from one period to the next depending on whether the origin household has experienced economic shocks, health shocks, and the like. Households may also have intermittent cash requirements (say, for school tuition) that cause remittances to fluctuate from period to period.

Ideally, then, one would capture the portion of remittances that are related to a migrant's usual foreign wages, and not to factors that fluctuate from one period to the next. A straightforward way to do this is to estimate the following auxiliary regression relating remittances sent home (R_{it-1}) to household i in an initial period $t-1$ to variables that are determined prior to the period of analysis (Z_{it-1}):

$$R_{it-1} = \alpha + \gamma Z_{it-1} + \varepsilon_{it-1} \tag{5}$$

The vector of predetermined characteristics Z_{it-1} includes variables that in principle should be correlated with foreign wage earnings of the household's migrants. Then, for each household one can construct predicted remittances $\widehat{R}_{it-1}$ implied by the auxiliary regression:

$$\widehat{R}_{it-1} = \alpha + \gamma Z_{it-1}$$

Appendix Table 3 presents regression results from OLS estimation of equation (5) for the sample households. The dependent variable is total household remittance receipts prior to the crisis (from Jan-June 1997), in thousands of current Philippine pesos. Right-hand-side variables are means of the following variables across the household's migrants away in June 1997: indicators

for highest education level completed (high school, some college, college or more; less than high school omitted); occupation indicators (domestic servant, ship's officer or crew, professional, clerical, other service, other occupation; production omitted); indicator for 'migrant is male'; indicator for location in 'immigration destination'; log of 1996 per capita GDP in migrant's location country (1995 US$). An additional independent variable included is the number of migrants away in June 1997, as this obviously affects total household remittance receipts. The coefficient estimates yield no surprises: households receive more remittances when their migrants are better educated, in professional occupations, male, and working in countries with higher per capita GDP. Households with more migrants also receive more remittances. Predicted remittances range from 6,451 (US$248) to 90,023 pesos (US$3,462), with a mean of 35,945 (US$1,383) and a standard deviation of 15,682 (US$603).

4.4.2.2 Heterogeneity in effect of exchange rate shock, by predicted remittances

Predicted remittances $\widehat{R}_{it-1}$ from the regression in Appendix Table 3 are used as a foreign wage index in the analysis of heterogeneity in the effect of exchange rate shocks on migrant returns. A first step is to include in regression equation (4) an interaction term between predicted remittances $\widehat{R}_{it-1}$ and the exchange rate shock $ERSHOCK_{it}$ (as well as the main effect of $\widehat{R}_{it-1}$). To help ensure that the coefficient on the interaction term does not reflect heterogeneity in the effect of migrant job losses correlated with the exchange rate shock, the regression also includes an interaction term between the $MIGSHOCK_{it}$ variable and $\widehat{R}_{it-1}$.[28]

Column 1 of Table 6 presents regression results. There is no evidence that the impact of the exchange rate shock on the migrant return rate has a simple linear relationship with predicted remittances: the coefficient on $ERSHOCK_{it} * \widehat{R}_{it-1}$ is not statistically significantly different from zero.

The theoretical model predicts that in the presence of borrowing constraints and a minimum investment threshold, the impact of the exchange rate shock on the return rate should be an inverted-U in the foreign wage. To test this prediction, it is useful to add to the right-hand-side of the regression a term for squared predicted remittances, $(\widehat{R}_{it-1})^2$, and its interaction with the exchange rate shock. The regression results (in column 2 of the table) suggests there is fact such an inverted-U shape: the interaction between the exchange rate shock and predicted remittances $(ERSHOCK_{it} * \widehat{R}_{it-1})$ is positive in sign, the interaction with squared predicted remittances

[28] All other specifications in this table also include as control variables the appropriate interaction terms between predicted remittance variables and $MIGSHOCK_{it}$.

$(ERSHOCK_{it} * \left(\widehat{R}_{it-1}\right)^2)$ is negative in sign, and both terms are statistically significantly different from zero.

The inverted-U-shape of the impact of the exchange rate shock on migrant returns also appears when the sample of households is divided into thirds on the basis of predicted remittances. Column 3 of the table presents coefficient estimates on the exchange rate shock interacted with indicators for the household being in the bottom third, middle third, and top third of predicted remittances in the sample. The coefficients on the interaction terms for the bottom and top thirds of $\widehat{R}_{it-1}$ are both negative and highly statistically significantly different from zero, while the coefficient on the interaction term for the middle third of $\widehat{R}_{it-1}$ is closer to zero and is not statistically significant. In other words, the effect of the exchange rate shock on migrant returns is most negative for households in the bottom and top third of predicted remittances.

Columns 4, 5, and 6 of the table present regression results similar to those in columns 1-3, but where predicted remittances $\widehat{R}_{it-1}$ is replaced by *actual* remittances, R_{it-1}, as the foreign wage index. While some coefficients fail to achieve the same levels of statistical significance, the results are qualitatively similar to those in columns 1-3.

4.4.2.3 Heterogeneity in effect of shock on investment-related outcomes The fact that the effect of the exchange rate shock on returns has an inverted-U-shaped relationship with a proxy for foreign wages (predicted remittances) confirms the first prediction of the theoretical model in the presence of borrowing constraints and a minimum investment threshold. There is also evidence for the second prediction: that the impact of the exchange rate shock on *household investment behavior* should also show an inverted-U-shaped relationship with the foreign wage proxy.

Household investments in entrepreneurial enterprises are not explicitly reported in the dataset, so the analysis must focus on outcomes plausibly related to such investment activity. A natural proxy for household entrepreneurial investment is the change in household entrepreneurial income. Changes in entrepreneurial income should be reflective of underlying entrepreneurial investments to the extent that such investments are prerequisites for first-time entry into entrepreneurship, or entry into new types of entrepreneurship.

Column 1 of Table 7 presents regression results analogous to column 3 of Table 5, but where the dependent variable is the change in household entrepreneurial income from before to after the

crisis (Jan-Jun 1997 to Apr-Sep 1998), divided by pre-crisis (Jan-Jun 1997) household income.[29] On average, there is no evidence that the exchange rate shock is associated with changes in the entrepreneurial income of migrants' origin households.

However, this average effect obscures heterogeneity with respect to predicted remittances, $\widehat{R}_{it-1}$. Columns 2 and 3 of Table 7 present regressions analogous to columns 2 and 3 of Table 6, but where the dependent variable is the change in entrepreneurial income. In column 2, the interaction between the exchange rate shock and predicted remittances ($ERSHOCK_{it} * \widehat{R}_{it-1}$) is positive in sign, the interaction with squared predicted remittances ($ERSHOCK_{it} * \left(\widehat{R}_{it-1}\right)^2$) is negative in sign, and both terms are highly statistically significantly different from zero. In column 3, the coefficient on the exchange rate shock interacted with the indicator for the middle third of predicted remittances is positive and statistically significantly different from zero, while the interactions with the indicators for the bottom and top thirds of predicted remittances are both close to zero and not statistically significant. The impact of the exchange rate shock on changes in entrepreneurial income does in fact show an inverted-U-shape in the foreign wage proxy.

Because the change in entrepreneurial income is likely to be an imperfect proxy for unobserved entrepreneurial investment, it is important to examine other outcomes that are also plausibly related to such investments. Columns 4-6 of Table 7 present regression results similar to those of columns 1-3, but where the dependent variable is the change in purchases of *real property* (land and buildings) from before to after the crisis (Jan-Jun 1997 to Apr-Sep 1998), divided by pre-crisis (Jan-Jun 1997) household income. In columns 7-9, in turn, the outcome variable is the change in an indicator for the household owning any vehicles (car, jeep, or motorcycle), which takes on the values -1, 0, and 1.[30] To the extent that real property and vehicles make up part of the starting capital of an entrepreneurial enterprise, these outcomes should also capture changes in household entrepreneurial investments.

The regression results indicate that the impact of exchange rate shocks on these latter two outcomes is also an inverted-U-shape in predicted remittances, $\widehat{R}_{it-1}$. For both outcomes, the coefficient on the interaction between the exchange rate shock and predicted remittances is pos-

[29] Dividing by pre-crisis household income allows coefficient estimates to be interpreted as fractions of initial household income. This specification is preferred to the change in *log* entrepreneurial income because many households report zero entrepreneurial income in one of the two periods.

[30] As described in the Data Appendix, vehicle ownership data were not recorded in July 1997, so the change in this ownership indicator is between January 1998 and October 1998. If vehicle ownership changed by January 1998 in response to the July-December 1997 exchange rate shocks, the coefficient estimates should be lower bounds of the true effects.

itive in sign, the interaction with squared predicted remittances is negative in sign (columns 5 and 8), and for the change in real property purchases (column 5) both terms are statistically significantly different from zero. In addition, for both outcomes the coefficient on the exchange rate shock interacted with the indicator for the middle third of predicted remittances is positive and statistically significantly different from zero, while the interactions with the indicators for the bottom and top thirds of predicted remittances are both smaller in magnitude and are not statistically significant (columns 6 and 9).

5 Conclusion

This paper takes advantage of an unusual quasi-experiment—large exchange rate shocks generated by the Asian financial crisis—to shed light on the economics of return migration. Overall, Philippine migrants are less likely to return home when they experience more positive exchange rate shocks, suggesting that straightforward 'life-cycle' motivations dominate 'target-earnings' explanations for return migration. However, a subset of migrants are likely to be 'target-earners': for households with intermediate levels of a foreign earnings index, more favorable exchange rate shocks have the least effect on return migration, but lead to increases in variables associated with household investment. These empirical results are consistent with a model where migration helps households accumulate resources for investment, in the face of credit constraints and minimum investment levels.

On average, a 10% improvement in the exchange rate reduces the 12-month migrant return rate by 1.4 percentage points. This is a large effect, amounting to nearly one-fifth of the mean 12-month return rate in the sample. Positive exchange rate shocks for migrants simultaneously raise the Philippine-currency value of foreign wages *and* of accumulated savings held overseas. If increases in overseas savings lead to higher return rates (a wealth effect), the negative estimated effect of exchange rate shocks on return rates is likely to understate the impact of pure foreign wage changes on return rates.

For these results to have implications for the design of policies encouraging return migration from developed countries, the question of generalizability must be considered. This paper has examined the economics of return migration for a particular type of international labor flow: temporary labor migration by Filipinos, most of which is likely to be formal and in accordance with the immigration laws of host countries. This type of international migration has become a large phenomenon in the post-World War II period, when European countries established 'guest-

worker' programs, and oil-rich Gulf states initiated massive labor importation (Chiswick and Hatton (2003)). Recognition of the potential benefits for developing countries motivates current WTO negotiations on liberalization of temporary labor movement (Winters, et al (2002)) and other proposals for developed countries to provide temporary labor permits to workers from developing countries (such as Rodrik (2002)).[31] The success of such initiatives hinges on migrants eventually returning to their origin countries, but past attempts to explicitly encourage return migration have had mixed outcomes (see Zimmermann (1994)). This paper's results therefore apply to a particular but increasingly prominent type of international labor flow.

In combination with a companion paper, Yang (2004), this paper also demonstrates the possibility of exploring the impact of international migration on households in developing countries using existing datasets collected by national governments. The Philippines is not likely to be the only country whose national household survey includes questions on international migration, and so valuable future work could seek evidence in other countries of the impacts of economic shocks faced by migrants on return migration, entrepreneurship, and other outcomes in the migrants' source households.

6 Appendices

Three appendices follow below: the Theory Appendix, the Data Appendix, and the Empirical Appendix.

6.1 Theory Appendix: A model of migration and household investment

This section presents the model of migration and household investment described in qualitative terms in Section 2 above.

Let each household live for T discrete periods, and have two working members. Household members supply labor inelastically: one unit is supplied per period by each member. Each household member can supply labor in the domestic labor market (at wage d). One household member has the option of working overseas in each period, at a wage $f > d$; the second household member is restricted to domestic labor. (We can imagine that at least one spouse must stay at home to care for children, or that regulations governing temporary contract work overseas prohibit migration of entire families.)

Households also have the option of investing an amount I in a household enterprise, in which case one (and only one) household member can choose to work in the enterprise and generate profits rI per period. If the household member works in the enterprise, she may not provide wage

[31] The Bush administration also recently proposed to provide temporary employment visas to undocumented U.S. workers (Bumiller (2004)).

labor, either domestically or overseas.[32] In addition, there is a minimum investment threshold m, below which an investment may not be made (it must be the case that $I \geq m$).[33] Further, let per period profits from entrepreneurship always exceed the domestic wage, even at the minimum investment level ($rm > d$). To keep the analysis tractable, impose the condition that the capital invested in the enterprise, I, may not be subsequently raised. (Say there are very high capital adjustment costs.)

A crucial assumption is that credit markets for uncollateralized loans do not exist, so households must save the amount of desired enterprise capital before investing. But allow *collateralized* lending, so that households can consume the capital invested in the enterprise. In other words, households are allowed to take out a loan once the enterprise has been established, for the amount I. For simplicity, assume that the interest rate on collateralized loans and the depreciation rate of invested capital are zero. So repayment of the collateralized enterprise loan simply means the enterprise is turned over to the lender at the end of life.[34] Households may save (transfer income from the current period to future periods) at a zero interest rate.

Households maximize lifetime utility subject to within-period budget constraints and the prohibition against uncollateralized borrowing. Household utility is additively separable across the T discrete time periods of life. Utility in period t is a strictly concave function of household consumption C_t (utility is $U(C_t)$, with $U' > 0$ and $U'' < 0$). Normalize the price of consumption to unity, and let the household time discount rate be zero.

A simple way to generate a desire for migrants to return to the home country is for consumption overseas to yield less utility than consumption at home (as first proposed by Hill (1987)). I make the simplifying assumption that consumption overseas yields *zero* household utility: overseas work is a pure hardship, and is done exclusively for benefit of future raised consumption in the home country.[35] In addition to consumption on the part of the overseas worker yielding zero household utility, overseas work by a household member also exacts a cost on the household as a whole. We can imagine this stemming from disutility due to family separation. So let utility in periods when a member is overseas be multiplied by a factor $0 < \gamma < 1$.

6.1.1 Describing the household's decision problem

Consider distinct periods a and b, where $b > a$ (b comes after a). Let the non-migrant's earnings be w_a in period a, and w_b in period b. Consider the choice between having the member work overseas in either period a or period b, and domestically in the other period.

Lemma 1 *Let $w_b \geq w_a$ (the income of the domestic household member either stays constant or rises over time). If a household has the choice of supplying labor overseas in either period a or*

[32] Because only one person can work in the household enterprise, a household member returning from overseas after the enterprise has been established works for domestic wage labor while the other household member works in the enterprise. In this case, per-period household earnings will be $d + rI$.

[33] This latter condition is reasonable: most investments are likely to be lumpy in this sense. For example, if the household wishes to provide taxi or bus services, there is a minimum cost to purchase a vehicle.

[34] In other words, a household may not take out a loan *before* starting the enterprise. Simply imagine monitoring problems in the time between provision of the loan and actual establishment of the enterprise, during which the household could abscond with the funds and establish the enterprise in another location (unknown to the lender). But once the enterprise has been established (and physical assets are identifiable), the lender can establish a legal right to the enterprise's assets at the end of the household's life.

[35] We can simply think of migrants needing some subsistence level of consumption overseas, that costs a certain amount c. Then think of the foreign wage f as 'disposable foreign income', or total foreign wages net of the amount spent for overseas subsistence, c. This allows me to simply refer to the foreign wage f from now on.

b (but not both), lifetime utility is maximized when overseas work occurs in the earlier of the two periods (period a).

Proof. *When overseas work occurs in period b, utility is* $U(d+w_a)+\gamma U(f+w_b)$. *When overseas work occurs in period a, utility across the two periods is* $\gamma U(f+w_a)+U(d+w_b)$. *Proof requires showing that* $\gamma U(f+w_a)+U(d+w_b) \geq U(d+w_a)+\gamma U(f+w_b)$. *Because of diminishing marginal utility of consumption, because* $f>d$, *and because* $w_b \geq w_a$, *it must be true that*

$$U(d+w_b)-U(d+w_a) \geq U(f+w_b)-U(f+w_a).$$

Because $0<\gamma<1$, *it must also be true that*

$$U(d+w_b)-U(d+w_a) \geq \gamma\left(U(f+w_b)-U(f+w_a)\right).$$

Expanding and rearranging obtains the required condition:

$$\gamma U(f+w_a)+U(d+w_b) \geq U(d+w_a)+\gamma U(f+w_b).$$

■

It should be clear that because entrepreneurial profits are always larger than domestic wages, a household member will never return to domestic wage labor if investment in the household enterprise has already occurred. So the income of a domestic household member does in fact stay constant or rise over time. This fact, combined with Lemma 1, implies that whenever the household chooses to supply any labor overseas, it must be optimal for every period with migration to precede every period without migration. In other words, there will be a single migration interval starting at the beginning of life, and the household migrant either returns home once or not at all.

Let the number of periods of overseas labor supply be denoted t_m, and let the number of periods of household saving prior to investment in the enterprise be denoted t_s. In other words, t_m is the last period overseas, and in period t_m+1 the formerly overseas member works domestically; similarly, t_s is the last period of saving, and in t_s+1 is the first period in which the enterprise generates profits. Let the convention be that if $t_m=0$ indicates the household never supplies labor overseas, $t_s=0$ means the household invests at the very start of life and earns profits starting in period 1, $t_m=T$ means the household supplies labor overseas for the entire lifetime, and $t_s=T$ means the household never invests in the enterprise.

The household's choice of t_m and t_s divides the household's lifetime into three **intervals** (some of which may collapse to zero length), defined as follows:[36]

1. The *first interval*, from period 1 to $min[t_m,t_s]$: one household member is overseas and one is at home, and per-period household earnings are $f+d$.

2. The *second interval*, from period $min[t_m,t_s]+1$ to $max[t_m,t_s]$, when there are two possibilities for household earnings:

a) If $t_m>t_s$ (return migration follows investment), per-period household earnings are $f+rI$.

b) If $t_s>t_m$ (investment follows return migration), per-period household earnings are $2d$.

3. The *third interval*, from period $max[t_m,t_s]+1$ to period T: both household members are at home, and per-period household earnings are $d+rI$.

In the second interval, case a), the household also has at its disposal the amount of the collateralized enterprise loan I, which it also can either consume or save. In the third interval, it

[36] Let the second interval be nonexistent when $t_m=t_s$.

has at its disposal any savings carried over from the second interval and any remaining amount of the collateralized enterprise loan.

The amount invested in the enterprise is exactly the amount of savings accumulated by the end of period t_s. Because investment profits rise in the investment, and uninvested savings do not earn interest, it is never optimal to invest less than total accumulated assets once the household decides to invest.

In general, households may choose to save from earlier periods to consume or invest in later periods, but cannot transfer resources from later to earlier periods due to the borrowing constraint. Now consider two periods a and b, that are each within the same defined interval.

Lemma 2 *Lifetime utility maximization requires consumption to be same in any two periods that are within the same 'interval'.*

Proof. Periods a and b are in the same interval, and so the within-period utility functions are identical in periods a and b. Because of diminishing marginal utility of consumption, maximization of lifetime utility therefore requires that consumption in periods a and b also be identical. ■

Lemma 2 suggests that a useful way to express household consumption in a particular period within interval i is as follows. First, 'spread' the value of assets accumulated by the end of the previous interval across all periods within the current interval, and add this to each period's earnings within the interval to create a measure of household per-period 'resources' within the interval, R_i. For example, in the second period, case a), we have

$$R_2 = f + rI + \frac{I}{t_m - t_s},$$

where the first two terms on the right-hand-side are household per-period earnings and the third term is the value of the collateralized enterprise loan spread over the number of periods in the interval.

Second, express household consumption C_i in each period within the interval as the interval's per-period resources R_i multiplied by one minus the savings rate within the interval, s_i:

$$C_i = (1 - s_i) R_i$$

So the household's optimization problem involves deciding on a savings rate out of each period's resources that is the same across all periods within the same interval. It should also be clear that savings will be zero in the third interval ($s_3 = 0$), because there are no subsequent intervals after period T.

To summarize, the household's decision problem simply involves choosing the following to maximize household utility:

1. the number of periods of overseas work, t_m,
2. the number of periods of saving for investment, t_s,
3. the savings rate in the first interval, s_1, and
4. the savings rate in the second interval, s_2.

Let the lifetime-utility-maximizing values of the household's choice variables be denoted t_m^*, t_s^*, s_1^*, and s_2^*.

6.1.2 Utility functions for given t_m, t_s, s_1, and s_2

Expressions for household lifetime utility when the choice variables take on the (not necessarily optimal) values $\widetilde{t_m}$, $\widetilde{t_s}$, $\widetilde{s_1}$, and $\widetilde{s_2}$ are as follows.

If the savings for investment ends before the migrant returns home ($0 \leq \widetilde{t_s} \leq \widetilde{t_m} \leq T$) so that case a) of interval 2 applies, lifetime utility is:

$$\widetilde{t_s}\gamma U\left(\left(1-\widetilde{s_1}\right)[f+d]\right)+\left(\widetilde{t_m}-\widetilde{t_s}\right)\gamma U\left(\left(1-\widetilde{s_2}\right)\left[f+r\widetilde{I}+\frac{\widetilde{I}}{\widetilde{t_m}-\widetilde{t_s}}\right]\right)$$
$$+\left(T-\widetilde{t_m}\right)U\left(d+r\widetilde{I}+\frac{\widetilde{s_2}\left[f+r\widetilde{I}+\frac{\widetilde{I}}{\widetilde{t_m}-\widetilde{t_s}}\right]\left(\widetilde{t_m}-\widetilde{t_s}\right)}{T-\widetilde{t_m}}\right)$$

where $\widetilde{I}=\widetilde{s_1}\,[f+d]\,\widetilde{t_s}$.

If, on the other hand, savings for investment ends after the migrant returns home ($0 \leq \widetilde{t_m} \leq \widetilde{t_s} \leq T$) so that case b) of interval 2 applies, lifetime utility is:

$$\widetilde{t_m}\gamma U\left(\left(1-\widetilde{s_1}\right)[f+d]\right)+\left(\widetilde{t_s}-\widetilde{t_m}\right)U\left(\left(1-\widetilde{s_2}\right)\left(2d+\frac{\widetilde{s_1}\,[f+d]\,\widetilde{t_m}}{\widetilde{t_s}-\widetilde{t_m}}\right)\right)$$
$$+\left(T-\widetilde{t_s}\right)U\left(d+r\widetilde{I}+\frac{\widetilde{I}}{T-\widetilde{t_m}}\right)$$

where $\widetilde{I}=\widetilde{s_2}\left[2d+\frac{\widetilde{s_1}[f+d]\widetilde{t_m}}{\widetilde{t_s}-\widetilde{t_m}}\right]\left(\widetilde{t_s}-\widetilde{t_m}\right)$.

6.1.3 A numerical solution

Further results rely on assuming a specific utility function and finding numerical solutions for given parameter values. Let utility in each period j be given by the power function $U(C_j)=C_j^{\alpha}$ (where $0<\alpha<1$). Set the number of periods, T, at 20.

The household chooses among integer values of t_s and t_m in the range {0,1,...,20}. In the first and second intervals, the household chooses savings rates s_1 and s_2 from a grid-space of savings rates {0, 0.01, 0.02, 0.03, ..., 0.98, 0.99, 1}. 21 possible choices each of t_s and t_m and 101 possible choices each of s_1 and s_2 yield roughly 4.5 million potential combinations of choice variables for a given set of parameter values. From these possible combinations, the household chooses the combination of t_s, t_m , s_1, and s_2 values that maximizes household lifetime utility.

Let the model parameters take on the following values: $\alpha=0.5$, $\gamma=0.75$, $d=1$, $r=0.05$, and $m=40$. The main theoretical analysis examines how household migration and investment decisions depend on the foreign wage, f.

6.1.3.1 Three types of households As the level of the foreign wage (f) varies, it turns out that households can be divided three distinct groups in terms of their lifetime periods overseas, their investment decisions, and the number of periods until investment (if investing at all).

The first type of household is one with a high level of the foreign wage, so that lifetime earnings that are high enough for entrepreneurial investment to occur relatively early in the lifetime. In these households, investment in the household enterprise can occur before the migrant returns from overseas, after which migrants continue to accumulate savings that are simply intended to raise future consumption levels. Such a household's optimal consumption and savings over the life-cycle is illustrated in Appendix Figure 1a (for $f=6$). The dark solid line depicts the household's consumption level over time, while the light dotted line depicts its savings rate. In the first interval (periods 1 to 11) one household member works overseas while the other works for domestic wages. Consumption and savings are therefore constant during these periods (Lemma

2). The first shift in the consumption and savings levels occurs when the household optimally chooses to invest its entire accumulated savings in the household enterprise at the end of period 11 (so that the enterprise first generates profits in period 12, the beginning of the second interval). In the second interval the domestic household member shifts to working in the household enterprise. The household continues to supply labor overseas, accumulating savings for future consumption. Higher resulting domestic earnings, combined with the funds from the collateralized enterprise loan allows the household to raise both its consumption and savings levels. The third interval begins in period 15 (the last period of overseas work was period 14). Savings drops to zero, and in each remaining period of life the household simply consumes its domestic earnings plus an evenly-distributed portion of its accumulated assets.

Because the investment level ($I = 42.35$) of this first type of household is somewhat above the minimum investment threshold ($m = 40$), it is apparent that these households are not bound by the minimum investment threshold in making their investment decisions. So this first type of household is termed an *unconstrained investor*.

A second group of households has a somewhat lower level of the foreign wage; an example of such a household is depicted in Appendix Figure 1b (for $f = 3.5$). For such households, there is only a first interval (a period of overseas work and savings) and a third interval (where enterprise investment has occurred and the overseas worker has returned home); investment in the household enterprise and the return of the overseas worker are simultaneous (both occurring at the end of period 12), so that the second interval is nonexistent. In this example, household invested capital is 40.5, only slightly higher than the minimum investment threshold.[37] If there had been no minimum investment threshold (or if it had been somewhat lower), the household would have preferred to invest a lower amount, and would have ceased supplying labor overseas earlier. But the requirement to invest at least m leads the household to supply labor overseas only until it has saved the minimum investment threshold, after which migrants return immediately and the household simultaneously invests. Because these households supply labor overseas only until they have achieved the investment threshold, these households are termed *target-earners* (as in Piore (1979)).

A third group of households has the lowest level of the foreign wage, and an example of such a household is in Appendix Figure 1c (for $f = 2$). These households would take relatively long (and too many periods overseas) to achieve the minimum investment level, allowing too few periods at the end of life to enjoy the returns from the investment. So they choose not to invest in an enterprise at all. The household simply supplies labor overseas to save for future consumption in the first interval (until the end of period 3 in this example), and each subsequent period it consumes two members' domestic wages plus a portion of accumulated savings from the first interval. I simply term this group of households *non-investors*.

An alternative view of the three groups of households (for a range of values of the foreign wage f) is provided by Appendix Figure 2.[38] The figure depicts optimal periods overseas t_m^* (the solid line) and optimal periods prior to enterprise investment t_s^* (the dotted line), for a range of values of the foreign wage. Up to a value of f slightly less than 2, households prefer not to supply labor overseas at all (the foreign wage is too low; recall the domestic wage d is 1). At higher foreign wages, optimal periods overseas rise in the foreign wage (until f is slightly above 3). These households reach the end of life without having invested ($t_s^* = 20$) indicating they are *non-investors*.

[37] Raising the fine-ness of the numerical simulation's grid-spaces can bring the investment level for such a household arbitrarily close to 40.

[38] To produce this and all subsequent graphs in the Theory Appendix, utility-maximizing values of the choice variables were found for each discrete value of f in the grid-space [1, 1.125, 1.25, 1.375, ..., 7.75, 7.875, 8].

Continuing to higher foreign wages, the solid line dips downward and flattens out for a range (up to between 4 and 5). For these households, return from overseas is simultaneous with enterprise investment (the solid and dotted lines coincide), identifying them as *target-earners*.

At even higher foreign wages, the solid line rises, while the dotted line falls. These households are investing prior to return migration; these households are *unconstrained investors*.

6.1.3.2 Impact of exchange rate shock The empirical analysis examines the impact of exchange rate shocks on return migration and on investment decisions in migrants' source households, so here it is useful to examine the theoretical impact of such shocks. The model predicts that the impact of such shocks varies according to a household's foreign wage, and will contrast starkly with the predictions made by a model with relaxed borrowing constraints.

What exactly is an exchange rate shock in this setting? Denote a household's accumulated savings from foreign earnings at the start of any period j (assumed to be held overseas until the migrant's return) as A_j. Let all monetary variables (f, d, m, I, and A_j) be denominated in households' domestic currency. Now let f and A_j be the exchange rate E (units of domestic currency that can be purchased with every unit of foreign currency) multiplied by these variables denominated in foreign currency ($\widetilde{f}$ and $\widetilde{A_j}$ respectively):

$$\begin{aligned} f &= E\widetilde{f} \\ A_j &= E\widetilde{A_j} \end{aligned}$$

An exchange rate shock is simply a change in the exchange rate (ΔE). As such, it changes the domestic currency value of both the foreign wage and any accumulated savings from foreign earnings. Assume exchange rate shocks are *permanent* changes in the exchange rate, and are known to be so by households.

What assets are held overseas? Assume that when households save, they draw equally across all income sources (foreign wages, domestic wages, and the current period's planned drawdown of the collateralized enterprise loan). Let savings from domestic sources (domestic wages and the collateralized enterprise loan) be held domestically, while foreign savings are held overseas until the migrant returns home.

To examine the impact of an exchange rate shock, the exact timing of events needs to be specified. Consider a given period j, when a household starts with a member working overseas. Let the order of events within period j be as follows:

1. The household observes the exchange rate shock (if any).
2. The household supplies labor in the previously-planned locations (one overseas, one domestic). (Locations of labor supply may not be modified within the same period as an exchange rate shock.)
3. The household saves and consumes. (The savings rate may be modified in response to the exchange rate shock.)
4. The household decides where the overseas member will work (overseas or domestically) for period $j+1$.
5. If the household has not yet established a household enterprise, the household decides whether or not to establish it (invest), so that profits can be earned in period $j+1$ and after. If so, all accumulated savings overseas (A_j) are transferred to the home country and invested (in combination with domestic savings).
6. The household takes out the collateralized enterprise loan.
7. Period $j+1$ begins.

Consider subjecting a subset of households to an exchange rate shock amounting to a 50%

increase in the exchange rate ($\frac{\Delta E}{E} = 0.5$). How does this change overseas workers' return decisions? Because the exchange rate shock should affect households differently depending on their elapsed periods of life, some assumption regarding the distribution of households across periods of life is necessary; simply assume that households are uniformly distributed across periods of life (within each foreign wage level).

First consider households that experience no change in their exchange rate. The solid line in Appendix Figure 3a represents their 1-period return rate: the fraction of households with a member overseas at the start of a given period j whose migrant returns home at the end of that period. Because households are assumed uniformly distributed across periods of life, this return rate is simply $\frac{1}{t_m^*}$, the inverse of the optimal number of periods overseas. The return rate is positive for all values of the foreign wage, and naturally is a mirror image of the solid line in Appendix Figure 2: first falling, moving slightly upwards to a temporary plateau, and then falling again in the foreign wage.

The dotted line in the figure is the 1-period return rate for households that *do* experience an exchange rate shock, and it is starkly different from the solid line. Only migrants with intermediate values of the foreign wage return at all at the end of the shock period, and their return rates are substantially higher than those in households without a shock. For all other households, the return rate is zero.

Appendix Figure 3b displays the difference between the return rates of the unshocked and shocked households (the shocked return rate minus the unshocked return rate, for each value of the foreign wage). For households with the lowest and highest values of the foreign wage, the 1-period return rate is lower for shocked vs. unshocked households. By contrast, for households with intermediate values of the foreign wage, the return rate for shocked households is either higher than or the same as the return rate for unshocked households.

The exchange rate shock apparently has opposite effects on return rates for two groups of households: on the one hand, households with intermediate foreign wages, and, on the other, households with either the lowest or highest foreign wages. The explanation becomes clearer when we also examine the impact of the exchange rate shock on household investment.

Define the '1-period investment rate' as the fraction of households with a migrant overseas who make an enterprise investment at the end of the period of the exchange rate shock (so that an enterprise begins generating profits in the subsequent period).[39] Appendix Figure 4a depicts the 1-period investment rate for households without (the solid line) and with (the dotted line) an exchange rate shock, and Appendix Figure 4b shows the difference in the investment rate between shocked and unshocked households.[40]

In households with the lowest foreign wages, the investment rate is zero for both shocked and unshocked households. These are households who in the unshocked case are 'non-investors'. When experiencing an exchange rate shock, households in this group either remain non-investors (but are encouraged by the higher foreign wages to extend their overseas stays), or decide to become target-earners (and must stay overseas for longer to save for investment). So no migrants from these households return at the end of the period (the return rate goes to zero). The exchange rate shock also has no effect on investment at the end of the period, either: households are either still non-investors, or, if they have decided to be target-earners, they must accumulate assets for somewhat longer before investing.

[39] I restrict attention to households with migrants overseas because the exchange rate shock has no impact on households not supplying labor overseas.

[40] The jaggedness of the dotted line derives from the discreteness of the grid-spaces used in the numerical simulation, particularly the restriction that households choose among integer values for t_m and t_s. Substantially finer grid-spaces would eliminate these jags.

Households with intermediate foreign wages have the highest increase in the investment rate. These households are target-earners, who remain overseas only until they have saved at least the minimum investment threshold m. The exchange rate shock, by raising (in domestic currency terms) both the current period's foreign wage and the accumulated overseas savings, suddenly allows some fraction of these households to exceed the minimum investment threshold in the current period. Thus an exchange rate shock leads to the largest increase in both the return rate and the investment rate for these households.

Households with the highest foreign wages were unconstrained investors prior to the shock. Their return rate falls as they decide on the margin to extend their overseas stays to take advantage of higher foreign wages. The investment rate rises because of the windfall increase in assets, but not by as much as the increase for households with intermediate foreign wages: some fraction of unconstrained investors had *already* invested prior to the shock, and so could not invest again; by contrast, *all* the target-earners were postponing investment until return, and so all had the option to invest sooner in response to the shock.

6.1.3.3 Relaxing the credit constraint To illustrate the importance of the prohibition on non-collateralized borrowing in generating the theoretical results so far, it is useful to consider the impact of an exchange rate shock in a situation where this borrowing constraint is relaxed somewhat. The non-collateralized borrowing constraint was justified earlier by supposing that lenders could not prevent households from absconding with loans before the funds were invested in the enterprise. Now, instead assume that lenders *are* able to prevent such default.

This allows households to borrow and invest in an enterprise at the start of life, so that one household member earns enterprise profits of rI (instead of the domestic wage d) throughout life starting in period 1. (The other member's options remain overseas work at wage f, or domestic work at wage d.)

Without formally modeling the credit market, the ceiling on how much a given household can borrow is arbitrary. Assume simply that a household's credit ceiling is the amount they would have invested at the original (pre-shock) exchange rate when non-collateralized borrowing was prohibited (analyzed in the previous subsections), with the exception that non-investors (who would have invested zero) are allowed to borrow the minimum investment threshold, m. Retain the assumption that the rate of interest and the rate of depreciation of invested capital are zero, so again repayment of the loan simply means turning the enterprise over to the lender at the end of life. Assume that at the minimum credit ceiling per-period enterprise profits exceed the domestic wage, so that all households then borrow and invest their credit ceiling at the start of life.

Maintaining all other assumptions from the previous subsections, Appendix Figures 5a, 5b and 5c illustrate optimal choices for households allowed such non-collateralized borrowing. Appendix Figure 5a shows that the optimal number of periods overseas rises continuously in the foreign wage. There are no target-earners to generate kinks in this curve, unlike in the case depicted in Appendix Figure 2. (Because all households invest at the start of life, Appendix Figure 5a shows no curve for optimal periods prior to investment. For the same reason, the investment rate is not meaningful.)

Appendix Figure 5b depicts the 1-period return rate for households that do (dotted line) and do not (solid line) experience an exchange rate shock. The return rate of unshocked households declines continuously in the foreign wage. For shocked households, the return rate in the period of the shock is zero for households below a certain foreign wage (around 4.5); such households have reoptimized and extended their desired periods of overseas work, and so none return right after the shock. For shocked households with higher foreign wages, the 1-period return rate coincides

with the rate for unshocked households. The fact that periods overseas is unchanged for these households reflects the fact that households with higher wages have on average accumulated more overseas savings at any point in time, and so experience a larger increase in wealth when the exchange rate shock occurs. An increase in wealth raises the desirability of return migration (an income effect), which for these households is large enough to offset the substitution effect of the increase in foreign wages. On net, then, the return rate is unchanged for these households.[41]

All told, then, the change in the 1-period return rate due to the shock declines in the foreign wage (Appendix Figure 5c) in a model with a relaxed borrowing constraint.

6.2 Data Appendix

6.2.1 Data sets

Four linked household surveys were provided by the National Statistics Office of the Philippine government: the Labor Force Survey (LFS), the Survey on Overseas Filipinos (SOF), the Family Income and Expenditure Survey (FIES), and the Annual Poverty Indicators Survey (APIS).

The Labor Force Survey (LFS) collects data on primary activity and demographic characteristics of household members aged 10 or above. These data refer to the household members' activities in the week prior to the survey. The survey defines a household as a group of people who live under the same roof and share common food. The definition also includes people currently overseas if they lived with the household before departure. The Survey on Overseas Filipinos (SOF) is administered in October of each year to households reporting in the LFS that any members left for overseas within the last five years. The SOF collects information on characteristics of the household's overseas members, their overseas locations and lengths of stay overseas, and the value of remittances received by the household from overseas in the last six months (April to September).

In the analysis, I use the July 1997 and October 1998 rounds of the LFS and the October 1997 and October 1998 rounds of the SOF. Because 1997 remittances in the SOF refer to an April-September reporting period, the SOF remittance data cannot be used to determine a household's level of remittances prior to the July 1997 Asian financial crisis. So I obtain initial (Jan-Jun 1997) remittance receipts from the July 1997 round of the Family Income and Expenditure Survey (FIES).

Data on total household income, real property purchases and entrepreneurial income are available for the pre-crisis period (Jan-Jun 1997) from the July 1997 FIES. Data on real property purchases, entrepreneurial income, and vehicle ownership are available for the post-crisis period (Apr-Sep 1998) from the October 1998 Annual Poverty Indicators Survey (APIS). Unfortunately, data on vehicle ownership in the pre-crisis period are unavailable in the July 1997 round of the FIES; these data were only recorded in the January 1998 survey. So analyses of changes in vehicle ownership examine changes from January 1998 (from the FIES) to October 1998 (from the APIS).

Monthly exchange rate data (used in constructing the exchange rate shock variable) were obtained from Bloomberg L.P.

The sample used in the empirical analysis consists of all households meeting the following criteria:

1. *The household is inferred to have one or more members working overseas in June 1997.*

[41] In the model with the non-collateralized borrowing constraint, the wealth increase is in general not large enough to offset the substitution effect of the increase in foreign earnings because high-foreign-wage households hold less in overseas savings on average (many have already invested, and so a large fraction of their assets have been transferred to home country and are not affected by the exchange rate shock).

Using the October 1997 SOF, I identify households that had one or more members working overseas in June 1997, and identify the locations of these overseas members. (See the next subsection for the exact procedure.)

2. *The household's dwelling was also included in the October 1998 LFS/SOF.* As mentioned above, one-quarter of households in the sample in July 1997 had just been rotated out of the sample in October 1998.

3. *The same household has occupied the dwelling between July 1997 and October 1998.* This criterion is necessary because the Labor Force Survey does not attempt to interview households that have changed dwellings. Usefully, the LFS dataset contains a field noting whether the household currently living in the dwelling is the same as the household surveyed in the previous round.

4. *The household has complete data on pre-crisis control and outcome variables (recorded July 1997).*

5. *The household has complete data on post-crisis outcome variables (recorded October 1998).*

Of 30,744 dwellings that the National Statistics Office did not rotate out of the sample between July 1997 and October 1998 (criterion 2), 28,152 (91.6%) contained the same household continuously over that period (criterion 3). Of these households, 27,716 (98.5%) had complete data for all variables used in the analysis (criteria 4 and 5). And of these 27,716, 1,615 (5.8%) had a member overseas in June 1997 (criterion 1). These 1,615 households are the sample used in the empirical analysis.

Constructing the sample on the basis of Criteria 1, 2, and 4 does not threaten the validity of the empirical estimate of the impact of the migrant economic shocks on households. Criteria 1 and 4 are based on pre-shock characteristics of the surveyed households, and criterion 2 comes from the predetermined rotation schedule established by the National Statistics Office.

It is important to check whether sample selection on the basis of Criteria 3 or 5 may have been affected by the independent variable of interest (shocks experienced by migrant members) because household propensities to change dwellings or to misreport information in the survey may have been affected by the shocks. Attrition from the household sample due to these criteria should not generate biased coefficient estimates if such attrition is uncorrelated with the shocks. Yang (2004), which uses essentially the same sample for analysis, finds no evidence that attrition due to Criteria 3 or 5 is associated with the exchange rate shocks, and so allowing these criteria play a role in determining the sample for analysis should not threaten the internal validity of the estimates.

6.2.2 Determining locations of overseas household members

The main outcome variable in the empirical analysis is the 12-month migrant return rate: the number of household migrant workers who returned between July 1997 and June 1998 divided by the number of household members working overseas in June 1997. In this subsection I describe the rules used to determine if a particular individual in the October 1997 Survey on Overseas Filipinos was overseas in June 1997, and if so, what country the person was in. Among other questions, the SOF asks:

1. When did the family member *last* leave for overseas?
2. In what country did the family member intend to stay when he/she *last* left?
3. When did the family member return home from his/her *last* departure (if at all)?

These questions unambiguously identify individuals as being away in June 1997 (and their overseas locations) if they left for overseas in or before that month, and returned afterwards (or have not yet returned). Unfortunately, the survey does not collect information on stays overseas *prior* to the most recent one. So there are individuals who most recently left for overseas between June 1997 and the survey date in October 1997, but who were likely to have been overseas before then as well. Fortunately, there is an additional question in the SOF that is of use:

4. How many months has the family member worked/been working abroad during the last five years?

Using this question, two reasonable assumptions allow me to proceed. First, assume all stays overseas are continuous (except for vacations home in the midst of a stay overseas). Second, assume no household member moves between countries overseas. When making these two assumptions, the questions asked on the SOF are sufficient to identify whether a household had a member in a particular country in June 1997.

For example, a household surveyed in October 1997 might have a household member who *last* left for Saudi Arabia in July 1997 and had not yet returned from that stay overseas. If that household member is reported as having worked overseas for 4 months or more, the first assumption implies the person first left for overseas in or before June 1997. The second assumption implies that the person was in Saudi Arabia.

89.8% of individuals identified as being away in June 1997 (and their overseas locations) were classified as such using just questions 1 to 3 above. The remaining 10.2% of individuals identified as being away in June 1997 (and their locations) relied on question 4 above and the two allocation assumptions just described.

6.3 Empirical Appendix

It is important to investigate whether the empirical results may be biased by pre-existing differences in migrant return rates across households whose migrants are in different countries (as discussed in subsection 4.3). The test described here involves checking whether migrant return rates *prior* to the Asian financial crisis are correlated with the (*future*) exchange rate shocks that were to occur in their overseas location countries after July 1997. In years leading up to 1997, it is not possible to track households between successive waves of the annual Survey of Overseas Filipinos (SOF), because the Labor Force Survey (within which the SOF is adminstered) followed a faster household rotation schedule prior to July 1997. Therefore, it is not possible to calculate migrant return rates as in the main analysis above (the number of migrants who returned between July of year t and June of year $t+1$, divided by the number of migrants who were overseas in June of year t).

However, one can use the cross-sectional SOF to carry out an (admittedly imperfect) analysis of return rates, in the following manner. It is possible to construct migrant return rates using retrospective questions on migrants' previous departures and returns from variables that are included in the cross-sectional SOF. Migrant return rates constructed in this way are imperfect, because the questions in the SOF in some cases do not allow a migrant's past location to be known with certainty, especially for time periods more than a few months in the past.

To make the test comparable to that in the main analysis above, the locations of individual migrants' observed in, say, the October 1996 SOF must be inferred for June 1995. An indicator variable is then constructed that takes the value of 1 if the migrant returned over the subsequent 12-month period, and 0 otherwise. The procedure is identical to that described in Data Appendix subsection 6.2.2. The unit of observation is the migrant (rather than the household), and regressions analogous to equations (3) and (4) are estimated.

The approach of using the retrospective questions in the cross-sectional SOF to construct a return indicator has some other drawbacks. Initial (pre-return) characteristics of migrants and their origin households are not known, only the characteristics at the time of the October SOF. So only variables that can be considered relatively 'immutable' are used as right-hand side controls.[42] In addition, with this approach it is impossible to examine changes in variables associated with household investment (as in subsection 4.4.2.3 above), which require household panel data.

Appendix Table 4 presents regression results. First, Panel A shows that this alternative approach does generate the negative effect of the exchange rate shock on migrant returns in the post-crisis period (July 1997-June 1998). In the first column, no independent variables other than the exchange rate shock are included in the regression, while the second column includes controls for migrant and household characteristics. Both coefficients are negative, roughly the same size, and are statistically significantly different from zero. The coefficients are slightly larger than those in the corresponding columns (1 and 2) of Table 5, but remain well within 95% confidence intervals.

The remaining panels report analogous regression results, but where instead the outcome variables are indicators for migrant return in the 12 months up to June 1997 (Panel B) and the 12 months leading up to June 1996 (Panel C). In each regression the coefficients are smaller in magnitude, and in none are the coefficients statistically significantly different from zero. In Panel B, both coefficients are only one-quarter the size (around -0.05) of the coefficients in Panel A. In Panel C, the coefficient in the specification without control variables (-0.127) is somewhat more than half the magnitude of the corresponding coefficient in Panel A (-0.204), but in when control variables are added it declines in magnitude by more than half (to -0.059).

In sum, this analysis provides no evidence that pre-existing variation in migrant return rates correlated with *future* exchange rate shocks is a likely source of bias in the regression estimates of Table 4.

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[42] These variables are: indicators for migrant's months away as of June of previous year (12-23, 24-35, 36-47, 48 or more; 0-11 omitted); indicators for migrant's highest education level completed (high school, some college, college or more; less than high school omitted); relationship to HH head (female head or spouse of head, daughter, son, other relation; male head omitted); years of age; indicator for location in 'immigration destination'; log of 1996 per capita income in migrant's location country; five indicators for household head's highest level of education completed (elementary, some high school, high school, some college, and college or more; less than elementary omitted).

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Table 1: Types of migrants generated by theoretical model

	Migrant types		
	Life-cycle migrant		Target-earner
Migrant characteristics	Unconstrained investor	Non-investor	
Level of foreign wage	High	Low	Intermediate
Timing of investment	Before return migration	(No investment)	Simultaneous with return migration
How accumulated savings are used upon return	Consumption	Consumption	Investment
Effect of positive exchange rate shock on return migration	Negative*	Negative*	Positive

* Assuming substitution effect dominates income effect

Table 2 Locations of overseas workers from sample households
(June 1997)

Location	Number of overseas workers	% of total	Exchange rate shock (June 1997-Oct 1998)
Saudi Arabia	521	29.0%	0.40
Hong Kong, China	210	11.7%	0.40
Taiwan	148	8.2%	0.22
Singapore	124	6.9%	0.24
Japan	116	6.5%	0.27
United States	116	6.5%	0.40
Malaysia	65	3.6%	-0.01
Italy	52	2.9%	0.27
Kuwait	51	2.8%	0.38
United Arab Emirates	49	2.7%	0.40
Greece	44	2.5%	0.21
Korea, Rep.	36	2.0%	-0.02
Northern Mariana Islands	30	1.7%	0.40
Canada	29	1.6%	0.35
Brunei	22	1.2%	0.24
United Kingdom	15	0.8%	0.42
Norway	14	0.8%	0.25
Australia	14	0.8%	0.21
Bahrain	13	0.7%	0.40
Lebanon	10	0.6%	0.43
Other	115	6.4%	
Total	1,794	100.0%	

NOTES -- Data are from Oct 1997 Survey on Overseas Filipinos. "Other" includes 38 additional countries plus a category for "unspecified" (total 58 countries explicitly reported). Overseas workers in table are those in households included in sample for empirical analysis (see Data Appendix for details on sample definition). Exchange rate shock: Change in Philippine pesos per currency unit where overseas worker was located in Jun 1997. Change is average of 12 months leading to Jun 1998 minus average of 12 months leading to Jun 1997, divided by the latter (e.g., 10% increase is 0.1).

Table 3 **Characteristics of overseas workers from sample households**

	Mean	Std. Dev.	10th pctile	Median	90th pctile
Age	34.44	8.95	24.00	33.00	47.00
Marital status is single (indicator)	0.38				
Gender is male (indicator)	0.53				
Occupation (indicators)					
Production and related workers	0.31				
Domestic servants	0.31				
Ship's officers and crew	0.12				
Professional and technical workers	0.11				
Clerical and related workers	0.04				
Other services	0.10				
Other	0.01				
Highest education level (indicators)					
Less than high school	0.15				
High school	0.24				
Some college	0.31				
College or more	0.30				
Position in household (indicators)					
Male head of household	0.28				
Female head or spouse of head	0.12				
Daughter of head	0.28				
Son of head	0.15				
Other relation to head	0.16				
Months overseas as of Jun 1997 (indicators)					
0-11 months	0.30				
12-23 months	0.24				
24-35 months	0.15				
36-47 months	0.15				
48 months or more	0.16				
Per capita income in location country (US$)	16,946	10,773	6,935	15,132	28,341
Immigration destination (indicator)	0.19				
Number of individuals:					
1,794					

NOTE -- Data source is October 1997 Survey on Overseas Filipinos, National Statistics Office of the Philippines. "Other" occupational category includes "administrative, executive, and managerial workers" and "agricultural workers". Overseas workers in table are those in households included in sample for empirical analysis (see Data Appendix for details on sample definition). "Per capita income in location country" is in 1996 (Source: World Development Indicators 2002, in 1995 US$). "Immigration destination" is a country where permanent immigration by Filipinos is common: Japan, Germany, United Kingdom, United States (including Pacific trust territories), Canada, and Australia.

Table 4 **Summary statistics for sample households**

Num. of obs.: 1,615

	Mean	Std. Dev.	10th pctile	Median	90th pctile
Exchange rate shock	0.32	0.13	0.21	0.40	0.40
12-month migrant return rate	0.08	0.27			
Household financial statistics (Jan-Jun 1997)					
Total expenditures	73,436	66,696	24,507	57,501	132,600
Total income	94,077	93,290	27,917	70,461	174,526
Income per capita in household	20,150	21,486	5,504	15,194	39,076
Cash receipts from overseas	35,945	46,990	0	25,000	86,000
Cash receipts from overseas (as share of hh income)	0.39	0.31	0.00	0.37	0.85
Real property purchases (as share of hh income)	0.01	0.07	0.00	0.00	0.00
Number of HH members working overseas in Jun 1997	1.11	0.37	1	1	1
HH size (including overseas members, Jul 1997)	6.17	2.42	3	6	9
Located in urban area	0.68				
Owns a vehicle (indicator)	0.13				
HH position in national income per capita distribution, Jan- Jun 1997 (indicators)					
Top quartile	0.51				
3rd quartile	0.28				
2nd quartile	0.14				
Bottom quartile	0.07				
HH income sources (Jan-Jun 1997)					
Entrepreneurial income, as share of total	0.17	0.25	0.00	0.00	0.58
Indicator: nonzero entrepreneurial income	0.50				
Household head characteristics (Jul 1997):					
Age	50.0	13.9	32	50	68
Highest education level (indicators)					
Less than elementary	0.17				
Elementary	0.20				
Some high school	0.10				
High school	0.22				
Some college	0.16				
College or more	0.14				
Occupation (indicators)					
Agriculture	0.23				
Professional job	0.08				
Clerical job	0.13				
Service job	0.05				
Production job	0.14				
Other	0.38				
Does not work	0.00				
Marital status is single (indicator)	0.03				

NOTES -- Data source: National Statistics Office, the Philippines. Surveys used: Labor Force Survey (Jul 1997 and Oct 1998), Survey on Overseas Filipinos (Oct 1997 and Oct 1998), 1997 Family Income and Expenditures Survey (for Jan-Jun 1997 income and expenditures), and 1998 Annual Poverty Indicators Survey (for Apr-Sep 1998 income and expenditures). Currency unit: Expenditure, income, and cash receipts from abroad are in Philippine pesos (26 per US$ in Jan-Jun 1997).

Sample definition: Households with a member working overseas in Jun 1996 (according to Oct 1997 Survey of Overseas Filipinos) and that also appear in 1998 Annual Poverty Indicators Survey, and excluding households with incomplete data (see Data Appendix for details). Variable definitions: "Exchange rate shock" is change in Philippine pesos per currency unit where overseas worker was located in Jun 1997. Change is average of 12 months leading to Jun 1998 minus average of 12 months leading to Jun 1997, divided by the latter (e.g., 10% increase is 0.1). If household has more than one overseas worker in Jun 1997, exchange rate shock variable is average change in exchange rate across household's overseas workers. "Migrant return rate" is number of household's migrant workers who returned between Jul 1997 and Jun 1998 divided by number of household members working overseas in Jun 1997. "Owns a vehicle" indicator is as of Jan 1998.

Table 5 **Impact of exchange rate shock on return migration and new departures, 1997 - 1998**

Dependent variable: 12-month migrant return rate (Jul 97 to Jun 98)

	Specifications		
	(1)	(2)	(3)
Exchange rate shock	-0.155	-0.155	-0.142
	(0.071)**	(0.058)***	(0.060)**
Migrant job loss in 1998 (indicator)			0.154
			(0.051)***
Other included independent variables:			
*Region indicators, Region*Urban*	-	Y	Y
Controls for pre-crisis household and migrant characteristics	-	Y	Y
R-squared	0.01	0.06	0.09
Num. of obs. in all columns:	1,615		

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

NOTES -- Each column is a separate OLS regression. Unit of observation is a household. Standard errors in parentheses, clustered by location country of household's eldest overseas worker. See Table 4 for notes on sample definition and definitions of exchange rate shock and migrant return rate. "Migrant job loss in 1998" is an indicator for household reporting (in October 1998) that a migrant member suffered a job loss in the past year (8% of households report such a loss).

Region indicators are for 16 regions within the country. Region*Urban variables are region indicators interacted with an indicator for urban location. Household-level controls are as follows. Income variables as reported in Jan-Jun 1997: log of per capita household income; indicators for being in 2nd, 3rd, and top quartile of sample distribution of household per capita income. Demographic and occupational variables as reported in July 1997: number of household members (including overseas members); five indicators for head's highest level of education completed (elementary, some high school, high school, some college, and college or more; less than elementary omitted); head's age; indicator for "head's marital status is single"; six indicators for head's occupation (professional, clerical, service, production, other, not working; agricultural omitted).

Migrant controls are means of the following variables across HH's overseas workers away in June 1997: indicators for months away (12-23, 24-35, 36-47, 48 or more; 0-11 omitted); indicators for highest education level completed (high school, some college, college or more; less than high school omitted); occupation indicators (domestic servant, ship's officer or crew, professional, clerical, other service, other occupation; production omitted); relationship to HH head (female head or spouse of head, daughter, son, other relation; male head omitted); indicator for single marital status; years of age; indicator for location in "immigration destination" (see note to Table 3 for list of countries); log of 1996 per capita GDP in migrant's location country (1995 US$).

Table 6 **Heterogeneity in impact of exchange rate shock on return migration, 1997 - 1998**

Dependent variable: 12-month migrant return rate

Foreign wage index:	Predicted remittances			Actual remittances		
	(1)	(2)	(3)	(4)	(5)	(6)
Exchange rate shock	-0.0165	-0.4009		-0.0884	-0.1915	
	(0.1101)	(0.1637)**		(0.0363)**	(0.0389)***	
(E. R. shock) * (Foreign wage index)	-0.0037	0.0246		-0.0015	0.0039	
	(0.0037)	(0.0117)**		(0.0018)	(0.0020)*	
(E. R. shock) * (Foreign wage index)^2		-0.0004			-0.00003	
		(0.0002)***			(0.0000)***	
(E. R. shock) * (Bottom third of foreign wage index)			-0.1448			-0.1950
			(0.0422)***			(0.0568)***
(E. R. shock) * (Middle third of foreign wage index)			-0.0623			-0.0805
			(0.1230)			(0.0620)
(E. R. shock) * (Top third of foreign wage index)			-0.2382			-0.1444
			(0.0727)***			(0.1697)
Migrant job loss in 1998	0.1301	-0.1003		0.1912	0.1763	
	(0.0940)	(0.1679)		(0.0809)**	(0.1012)*	
(Migrant job loss) * (Foreign wage index)	0.0007	0.0157		-0.0009	-0.0003	
	(0.0017)	(0.0104)		(0.0011)	(0.0026)	
(Migrant job loss) * (Foreign wage index)^2		-0.0002			0.0000	
		(0.0001)			(0.0001)	
(Migrant job loss) * (Bottom third of foreign wage index)			0.1045			0.1450
			(0.0790)			(0.0760)*
(Migrant job loss) * (Middle third of foreign wage index)			0.1904			0.2196
			(0.1052)*			(0.1249)*
(Migrant job loss) * (Top third of foreign wage index)			0.1741			0.1039
			(0.0551)***			(0.0572)*
Foreign wage index	0.0004	-0.0122		0.0003	-0.0013	
	(0.0014)	(0.0043)***		(0.0005)	(0.0006)**	
(Foreign wage index)^2		-0.0004			0.0000	
		(0.0002)***			(0.0000)***	
Middle third of foreign wage index			-0.0523			-0.0325
			(0.0511)			(0.0426)
Top third of foreign wage index			-0.0016			-0.0348
			(0.0335)			(0.0560)
Other included independent variables:						
*Region indicators, Region*Urban*	Y	Y	Y	Y	Y	Y
Controls for pre-crisis household and migrant characteristics	Y	Y	Y	Y	Y	Y
Num. of obs.	1615	1615	1615	1615	1615	1615
R-squared	0.09	0.09	0.09	0.09	0.09	0.09

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

NOTES -- Each column displays coefficients (standard errors) from an OLS regression where dependent variable is 1997-98 migrant return rate. Standard errors in parentheses, clustered by location country. Unit of observation is a household. See Appendix Table 3 for auxiliary regression used to create predicted remittances. See notes to Tables 4 and 5 for definitions of exchange rate shock and right-hand-side variables.

Table 7 **Heterogeneity in impact of exchange rate shock on investment-related outcomes, 1997 - 1998**

Dependent variables:	Change in entrepreneurial income			Change in real property purchases			Change in vehicle ownership		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exchange rate shock	0.0172	-0.7539		0.0310	-0.3406		0.2165	-0.0920	
	(0.2001)	(0.1827)***		(0.0670)	(0.1832)*		(0.1799)	(0.2621)	
(E. R. shock) * (Predicted remittances)		0.0577			0.0276			0.0233	
		(0.0136)***			(0.0119)**			(0.0193)	
(E. R. shock) * (Predicted remittances)^2		-0.0009			-0.0004			-0.0004	
		(0.0002)***			(0.0002)***			(0.0003)	
(E. R. shock) * (Bottom third of predicted remittances)			-0.0296			0.0064			0.1313
			(0.1407)			(0.0538)			(0.1232)
(E. R. shock) * (Middle third of predicted remittances)			0.1291			0.1417			0.3622
			(0.0507)**			(0.0672)**			(0.0680)***
(E. R. shock) * (Top third of predicted remittances)			-0.0439			-0.0626			0.0380
			(0.0862)			(0.0440)			(0.1563)
Migrant job loss in 1998	-0.1485	-0.1786		0.0063	-0.0137		0.0918	0.3333	
	(0.0853)*	(0.1200)		(0.0145)	(0.0227)		(0.1134)	(0.2696)	
(Migrant job loss) * (Predicted remittances)		0.0058			0.0007			-0.0172	
		(0.0069)			(0.0015)			(0.0156)	
(Migrant job loss) * (Predicted remittances)^2		0.0000			0.0000			0.0002	
		(0.0001)			0.0000			(0.0002)	
(Migrant job loss) * (Bottom third of predicted remittances)			-0.0968			-0.0026			0.0869
			(0.0502)*			(0.0054)			(0.0880)
(Migrant job loss) * (Middle third of predicted remittances)			-0.0131			-0.0019			0.0509
			(0.0253)			(0.0132)			(0.0298)*
(Migrant job loss) * (Top third of predicted remittances)			0.1088			-0.0226			0.0079
			(0.0466)**			(0.0142)			(0.0352)
Predicted remittances		-0.0164			-0.0045			-0.0081	
		(0.0044)***			(0.0033)			(0.0062)	
(Predicted remittances)^2		-0.0009			-0.0004			-0.0004	
		(0.0002)***			(0.0002)***			(0.0003)	
Middle third of predicted remittances			-0.0452			-0.0203			-0.0816
			(0.0463)			(0.0231)			(0.0445)*
Top third of predicted remittances			0.0065			0.0578			0.0007
			(0.0667)			(0.0292)**			(0.0841)
Other included independent variables:									
*Region indicators, Region*Urban*	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls for pre-crisis household and migrant characteristics	Y	Y	Y	Y	Y	Y	Y	Y	Y
Num. of obs.	1615	1615	1615	1615	1615	1615	1615	1615	1615
R-squared	0.08	0.09	0.09	0.05	0.05	0.05	0.05	0.05	0.05

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

NOTES -- Each column displays coefficients (standard errors) from an OLS regression for given dependent variable. Standard errors in parentheses, clustered by location country. Unit of observation is a household. See notes to Tables 4 and 5 for definitions of exchange rate shock and right-hand-side variables. Changes in entrepreneurial income and in real property purchases are between Jan-Jun 1997 and Apr-Sep 1998 reporting periods, and are expressed as fractions of initial (Jan-Jun 1997) household income. "Change in vehicle ownership" is change in an indicator for ownership of any vehicles from Jan 1998 to Oct 1998 (takes on values of -1, 0, and 1).

Appendix Table 1: Determinants of exchange rate shock (July 1997 to June 1998)
(Coefficients from OLS regression)

Dependent variable: Exchange rate shock (Jul 97 to Jun 98)

Num. of obs.	1615
R-squared	0.11

Migrant characteristics

Away 12-23 months	0.012	Domestic servant	0.022	Head is professional	0.003
	(0.008)		(0.034)		(0.011)
Away 24-35 months	0.023	Ship's officer or crew	-0.063	Head is clerical	0.002
	(0.007)***		(0.032)*		(0.009)
Away 36-47 months	0.022	Professional	-0.003	Head is service worker	-0.011
	(0.008)***		(0.027)		(0.018)
Away 48 months or more	0.024	Clerical	0.029	Head is production worker	-0.005
	(0.012)*		(0.029)		(0.007)
		Other service occupation	0.011	Head has other occupation	0
F-stat : joint signif of months away vars.:	*4.352*		(0.015)		(0.008)
P-value:	*0.004*	Other occupation	-0.056	Head does not work	0.051
			(0.036)		(0.042)
Female head or spouse of head	-0.021	*F-stat : joint signif of migrant occup. vars.:*	*3.741*	*F-stat : joint signif of head's occup. vars.:*	*0.862*
	(0.026)	*P-value:*	*0.004*	*P-value:*	*0.529*
Daughter of head	-0.006				
	(0.026)				
Son of head	0	**Household characteristics**		Head's age	0
	(0.016)				(0.000)
Other relation to head	0.001	Head has elementary education	0.015	Head has single marital status	0.011
	(0.017)		(0.009)*		(0.010)
		Head has some high school education	0.016	Household size	-0.004
F-stat : joint signif of hh position vars.:	*0.436*		(0.015)		(0.002)*
P-value:	*0.782*	Head has high school education	0.03		
			(0.010)***		
		Head has some post-secondary educa	0.033		
Has high school education	-0.009		(0.018)*		
	(0.010)	Head has college education or more	0.036	*F-stat : joint signif of*	
Has some post-secondary education	-0.026		(0.021)*	*region, region*urban vars.:*	*11.811*
	(0.016)			*P-value:*	*0.000*
Has college education or more	-0.014	*F-stat : joint signif of head's educ. vars.:*	*2.543*		
	(0.016)	*P-value:*	*0.040*		
F-stat : joint signif of migrant educ. vars.:	*2.274*				
P-value:	*0.092*	Log (per capita income in hh)	-0.002		
			(0.010)		
		2nd quartile of sample pc income	0.022		
Age	0.001		(0.012)*		
	(0.001)	3rd quartile of sample pc income	0.007		
Marital status is single	0.005		(0.013)		
	(0.009)	Top quartile of sample pc income	-0.005		
Immigration destination	0.015		(0.017)		
	(0.048)				
Per capita income in location	0.022	*F-stat : joint signif of hh income vars.:*	*3.425*		
	(0.041)	*P-value:*	*0.015*		

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

NOTES -- Table displays coefficients (standard errors) from a single OLS regression. Standard errors in parentheses, clustered by location country. Unit of observation is a household. Other included independent variables are region indicators and region*urban interactions (coefficients not shown). All independent variables are recorded in July 1997 or before (except "Migrant job loss in 1998" indicator). See notes to Tables 3 and 4 for definitions of exchange rate shock and right-hand-side variables. Omitted indicator variables are: migrant away 0-11 months, migrant is male head of household, migrant has less than high school education, migrant is production worker, household head has less than elementary education, household is in 1st quartile of sample per capita income, household head is agricultural worker.

Appendix Table 2: Determinants of migrant returns, July 1997 - June 1998
(Coefficients from OLS regression)

Dependent variable: 12-month migrant return rate (Jul 97 to Jun 98)

Num. of obs.	1615
R-squared	0.09

Exchange rate shock	-0.142
	(0.060)**
Migrant job loss in 1998	0.154
	(0.051)***

Migrant characteristics

Away 12-23 months	0.033
	(0.012)***
Away 24-35 months	-0.004
	(0.018)
Away 36-47 months	0.035
	(0.017)**
Away 48 months or more	0.044
	(0.018)**
F-stat : joint signif of months away vars.:	*9.312*
P-value:	*0.000*

Domestic servant	-0.025
	(0.017)
Ship's officer or crew	0.026
	(0.021)
Professional	-0.021
	(0.025)
Clerical	-0.052
	(0.022)**
Other service occupation	-0.015
	(0.023)
Other occupation	-0.079
	(0.029)**
F-stat : joint signif of migrant occup. vars.:	*3.525*
P-value:	*0.006*

Head is professional	0.047
	(0.029)
Head is clerical	0.057
	(0.021)***
Head is service worker	-0.012
	(0.034)
Head is production worker	0.011
	(0.025)
Head has other occupation	0.011
	(0.018)
Head does not work	0.163
	(0.081)**
F-stat : joint signif of head's occup. vars.:	*1.691*
P-value:	*0.143*

Female head or spouse of head	-0.026
	(0.022)
Daughter of head	-0.039
	(0.032)
Son of head	-0.045
	(0.034)
Other relation to head	-0.063
	(0.027)**
F-stat : joint signif of hh position vars.:	*1.384*
P-value:	*0.253*

Has high school education	0.035
	(0.020)*
Has some post-secondary education	0.015
	(0.018)
Has college education or more	0.019
	(0.019)
F-stat : joint signif of migrant educ. vars.:	*1.135*
P-value:	*0.344*

Age	0
	(0.001)
Marital status is single	0.002
	(0.015)
Immigration destination	-0.053
	(0.016)***
Log (per capita GDP) in location	0.006
	(0.012)

Household characteristics

Head has elementary education	-0.018
	(0.015)
Head has some high school education	-0.006
	(0.018)
Head has high school education	-0.012
	(0.020)
Head has some post-secondary educa	-0.048
	(0.019)**
Head has college education or more	-0.037
	(0.019)*
F-stat : joint signif of head's educ. vars.:	*1.545*
P-value:	*0.193*

Log (per capita income in hh)	-0.012
	(0.019)
2nd quartile of sample pc income	0.014
	(0.027)
3rd quartile of sample pc income	0.051
	(0.034)
Top quartile of sample pc income	0.037
	(0.040)
F-stat : joint signif of hh income vars.:	*1.336*
P-value:	*0.270*

Head's age	0
	(0.001)
Head has single marital status	0.028
	(0.028)
Household size	-0.003
	(0.002)
*F-stat : joint signif of region, region*urban vars.:*	*64.027*
P-value:	*0.000*

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

NOTES -- Table displays coefficients (standard errors) from a single OLS regression. Standard errors in parentheses, clustered by location country. Unit of observation is a household. Other included independent variables are region indicators and region*urban interactions (coefficients not shown). All independent variables are recorded in July 1997 or before (except "Migrant job loss in 1998" indicator). See notes to Tables 3 and 4 for definitions of independent variables.

Appendix Table 3: Determinants of remittances received by household (Jan-June 1997)
(Coefficients from OLS regression)

Dependent variable: Total household remittance receipts from Jan-June 1997 (000's of Philippine pesos)

Migrant characteristics

Has high school education	3.877	Migrant is male	21.527
	(3.710)		(3.679)**
Has some post-secondary education	3.732		
	(3.635)	Number of migrants away in Jun 1997	15.728
Has college education or more	11.975		(3.044)**
	(3.884)**		
F-stat : joint signif of migrant educ. vars.:	*3.889*		
P-value:	*0.009*	**Location country characteristics**	
		Immigration destination	4.840
			(4.280)
Domestic servant	-3.151		
	(4.319)	1996 per capita GDP	0.457
Ship's officer or crew	-3.352	(000's of 1995 US$)	(0.154)**
	(4.244)		
Professional	11.728		
	(4.580)*		
Clerical	2.317		
	(6.219)		
Other service occupation	-5.683		
	(4.336)		
Other occupation	6.749		
	(10.864)		
F-stat : joint signif of migrant occup. vars.:	*2.544*	Constant	-6.764
P-value:	*0.019*		(6.031)
		Num. of obs.	1615
		R-squared	0.11

* significant at 10%; ** significant at 5%; *** significant at 1%
NOTES -- Table displays coefficients (standard errors) from a single OLS regression. Standard errors in parentheses, clustered by location country. Unit of observation is a household. All independent variables are recorded in July 1997 or before. See notes to Tables 3 and 4 for definitions of exchange rate shock and right-hand-side variables. Omitted migrant characteristics variables are "Has less than high school education" and "Production worker" occupation variable.

Appendix Table 4: Impact of exchange rate shock on migrant returns, 1995-96, 1996-97, and 1997-98
(Using retrospective data in cross-sectional Survey on Overseas Filipinos, 1996, 1997, and 1998)

Panel A: July 1997 - June 1998 returns and current exchange rate shock

Sample: Migrants overseas in June 1997
Dependent variable: Indicator for migrant return by June 1998 (1 if returned, 0 otherwise)

	Specifications	
	(1)	(2)
Exchange rate shock (Jun 97 - Jun 98)	-0.204	-0.222
	(0.091)**	(0.086)***
Other included independent variables:		
Controls for migrant and household characteristics	-	Y
R-squared	0.01	0.05
Num. of obs. in all columns:	2,197	

Panel B: July 1996 - June 1997 returns and *future* exchange rate shock

Sample: Migrants overseas in June 1996
Dependent variable: Indicator for migrant return by June 1997 (1 if returned, 0 otherwise)

	Specifications	
	(1)	(2)
Exchange rate shock (Jun 97 - Jun 98)	-0.055	-0.053
	(0.056)	(0.050)
Other included independent variables:		
Controls for migrant and household characteristics	-	Y
R-squared	0.00	0.04
Num. of obs. in all columns:	2,015	

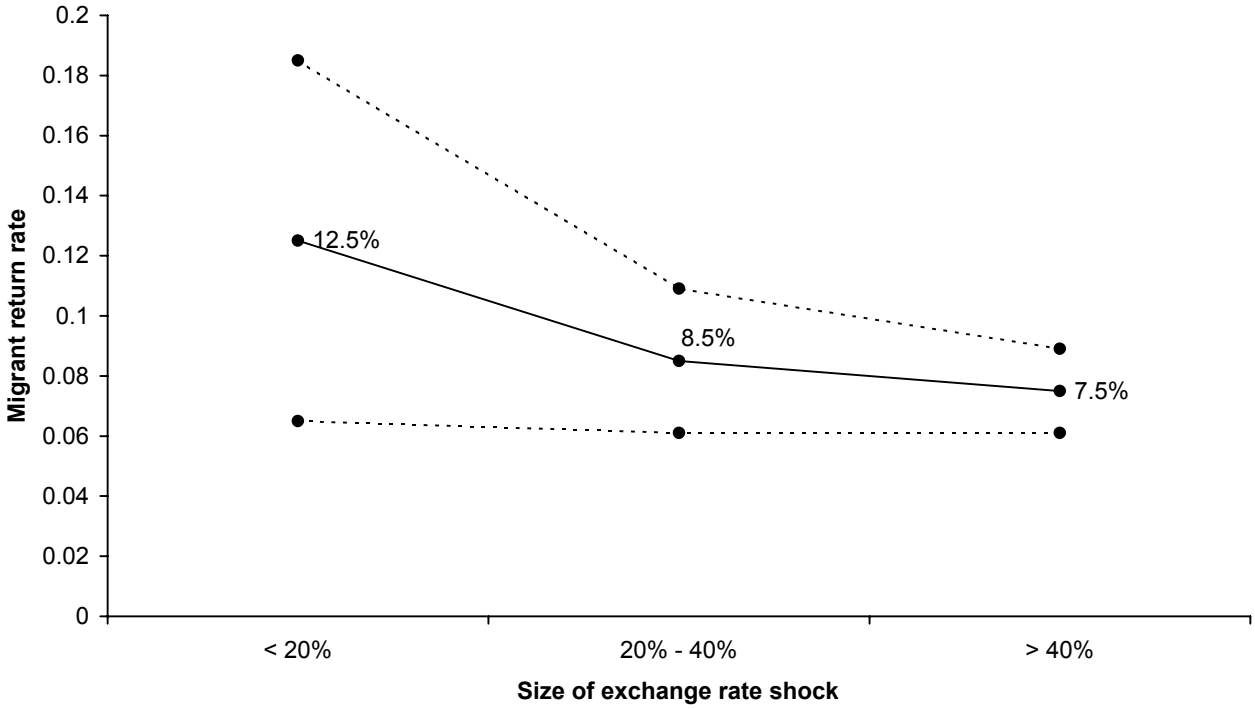
Panel C: July 1995 - June 1996 returns and *future* exchange rate shock

Sample: Migrants overseas in June 1995
Dependent variable: Indicator for migrant return by June 1996 (1 if returned, 0 otherwise)

	Specifications	
	(1)	(2)
Exchange rate shock (Jun 97 - Jun 98)	-0.127	-0.059
	(0.120)	(0.075)
Other included independent variables:		
Controls for migrant and household characteristics	-	Y
R-squared	0.00	0.06
Num. of obs. in all columns:	1,314	

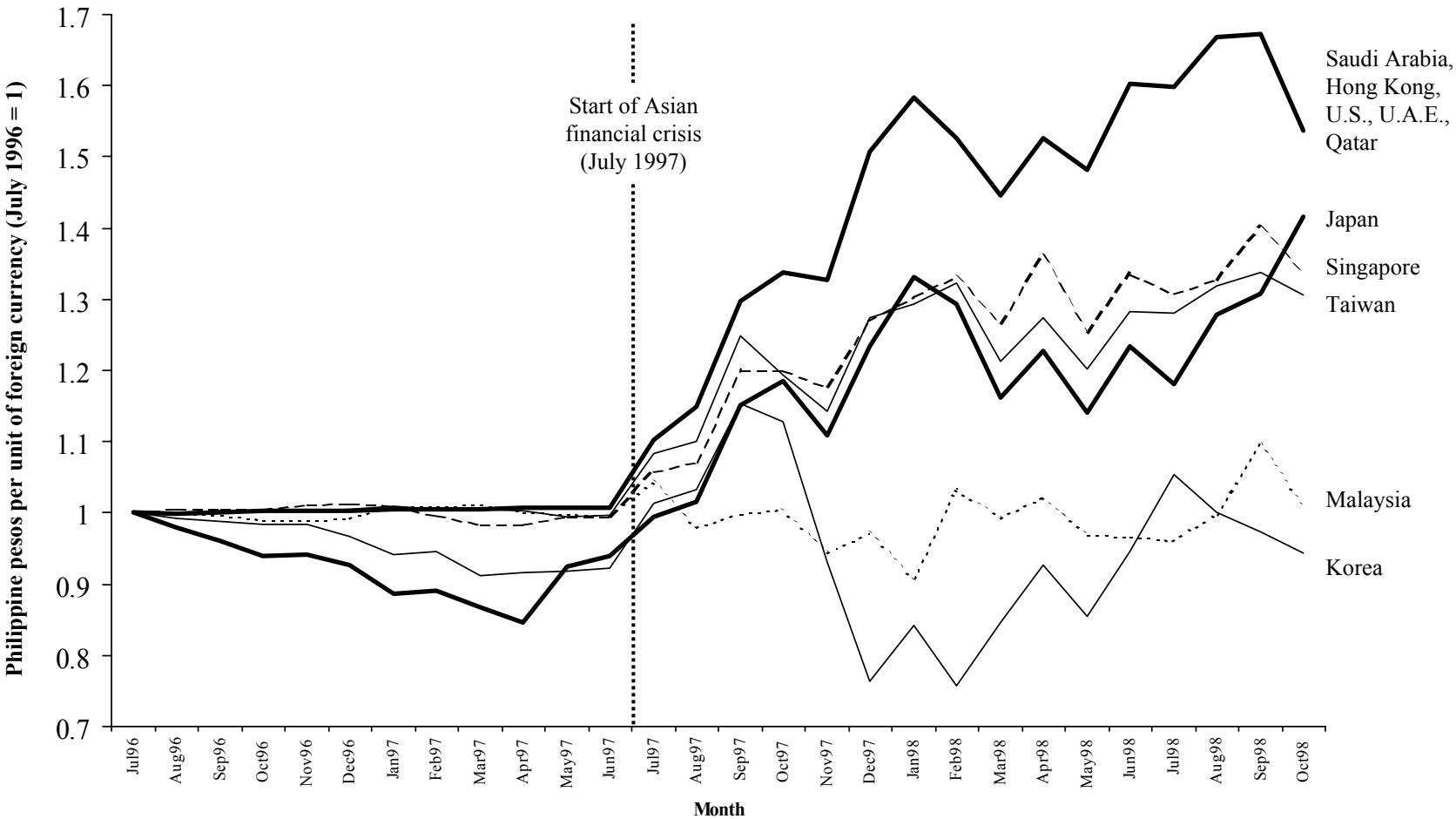
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTES -- Each column of table presents coefficient estimate on exchange rate shock in a separate OLS regression. Standard errors in parentheses, clustered by location country. Unit of observation is an individual migrant inferred as having been overseas in June 1997 (Panel A), June 1996 (Panel B), or June 1995 (Panel C), as reported in Survey on Overseas Filipinos (1998, 1997, and 1996 rounds, respectively); see data appendix for inference rule. Dependent variable equal to 1 if migrant returned from overseas within following 12 months, and 0 otherwise. (Means of dependent variables for 1996, 1997, and 1998 samples are 0.145, 0.098, and 0.106, respectively.) Exchange rate shock is change in Philippine pesos per currency unit where overseas worker was located. Change is average of 12 months leading to Jun 1998 minus average of 12 months leading to Jun 1997, divided by the latter (e.g., 10% increase is 0.1).
"Controls for migrant and household characteristics" are: indicators for months away as of June of previous year (12-23, 24-35, 37 or more; 0-11 omitted); indicators for highest education level completed (high school, some college, college or more; less than high school omitted); relationship to HH head (female head or spouse of head, daughter, son, other relation; male head omitted); years of age; indicator for location in "immigration destination" (see note to Table 2 for list of countries); log of 1996 per capita income in migrant's location country; five indicators for household head's highest level of education completed (elementary, some high school, high school, some college, and college or more; less than elementary omitted).

Figure 1: Mean return rate of migrants from Philippine households, by size of exchange rate shock (Jul 1997 - Jun 1998)



NOTES-- Unit of observation is a household. Sample includes 1,615 Philippine households with a migrant working overseas in June 1997 (see Data Appendix for details on sample construction). Solid line is migrant return rate; dotted lines indicate 95% confidence intervals (standard errors clustered by location of household's eldest overseas worker). "Exchange rate shock" is change in Philippine pesos per currency unit where overseas worker was located in Jun 1997. Change is average of 12 months leading to Jun 1998 minus average of 12 months leading to Jun 1997, divided by the latter (e.g., 10% increase is 0.1). If household has more than one overseas worker in Jun 1997, exchange rate shock variable is average change in exchange rate across household's overseas workers. "Migrant return rate" is number of household's migrant workers who returned between Jul 1997 and Jun 1998 divided by number of household members working overseas in Jun 1997.

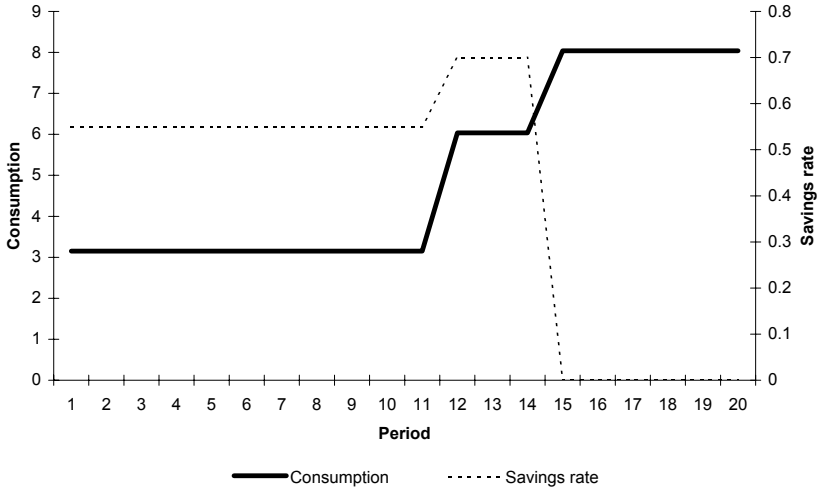
Figure 2: Exchange Rates in Selected Locations of Overseas Filipinos, July 1996 to October 1998 (Philippine pesos per unit of foreign currency, normalized to 1 in July 1996)



NOTES-- Exchange rates are as of last day of each month. Data source is Bloomberg L.P.

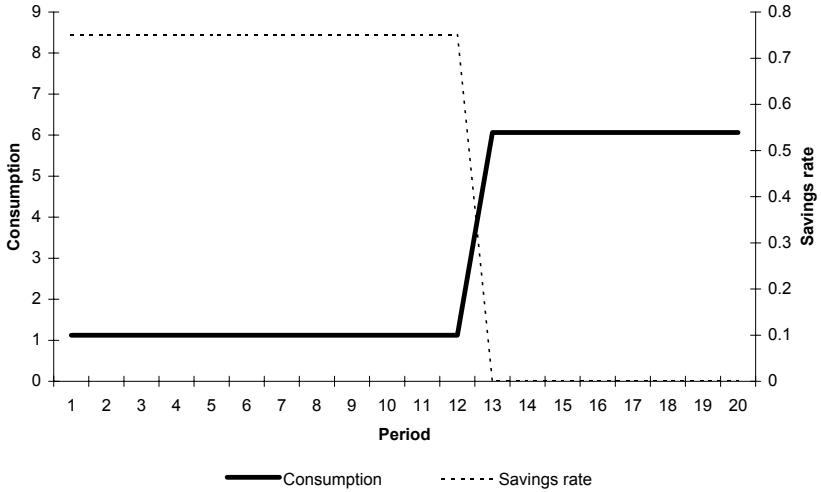
Appendix Figures 1a, 1b, and 1c: Optimal consumption and savings over the life-cycle

1a: Unconstrained investor: f=6



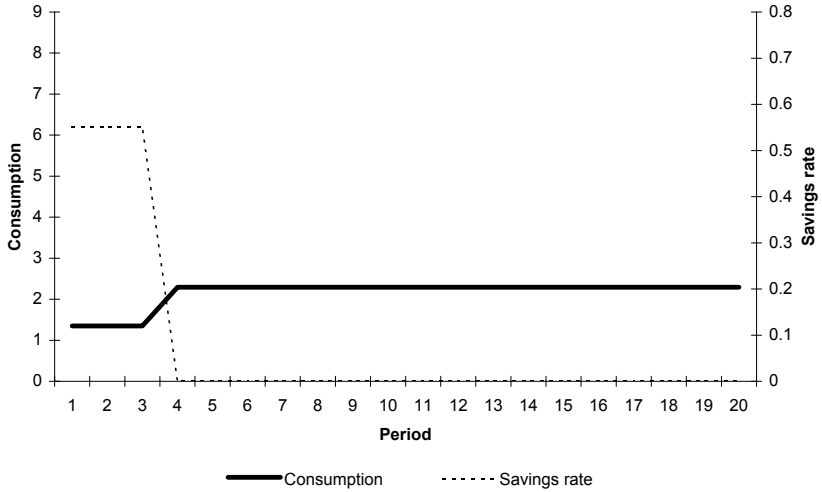
Optimal number of periods of saving before investment (t_s*):	11
Optimal number of periods working overseas (t_m*):	14
Investment in enterprise:	42.35

1b: Target-earner: f=3.5



Optimal number of periods of saving before investment (t_s*):	12
Optimal number of periods working overseas (t_m*):	12
Investment in enterprise:	40.5

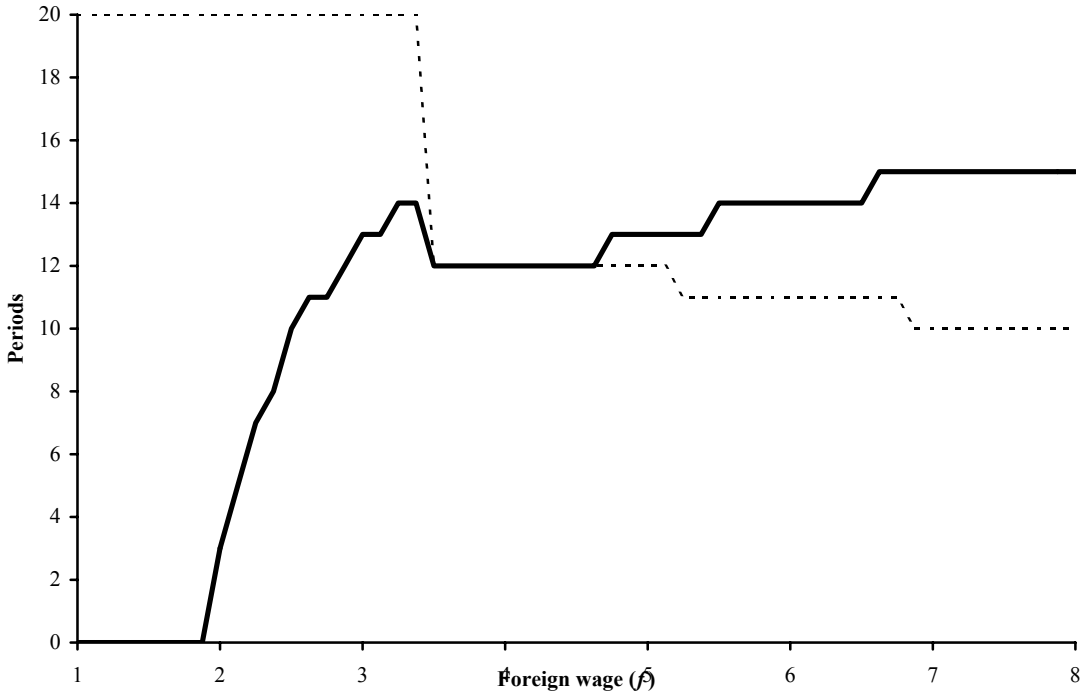
1c: Non-investor: f=2



Optimal number of periods of saving before investment (t_s*):	(No investment)
Optimal number of periods working overseas (t_m*):	3
Investment in enterprise:	(No investment)

NOTES: Optimal values of choice variables chosen from the following sets: t_s, t_m from integers in the range {0,1,…,20}; s_1, s_2 from discrete values in the range {0, 0.01, 0.02, ..., 0.98, 0.99, 1}. Assumes within-period utility function is $U(C)=C^{\alpha}$. Parameter values assumed are: α=0.5, γ=0.75, d=1, T=20, m=40, r=0.05.

Appendix Figure 2: Optimal periods before return migration and household investment by foreign wage level



Legend:

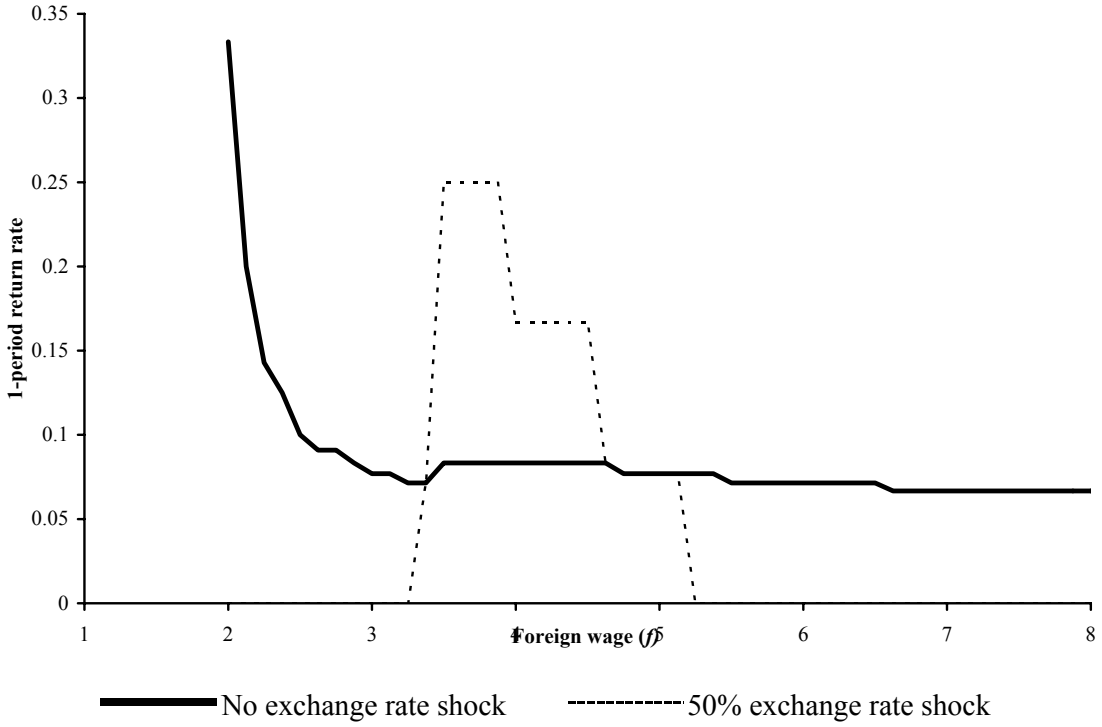
Optimal periods overseas (t_m *)

Optimal periods before investment (t_s *)

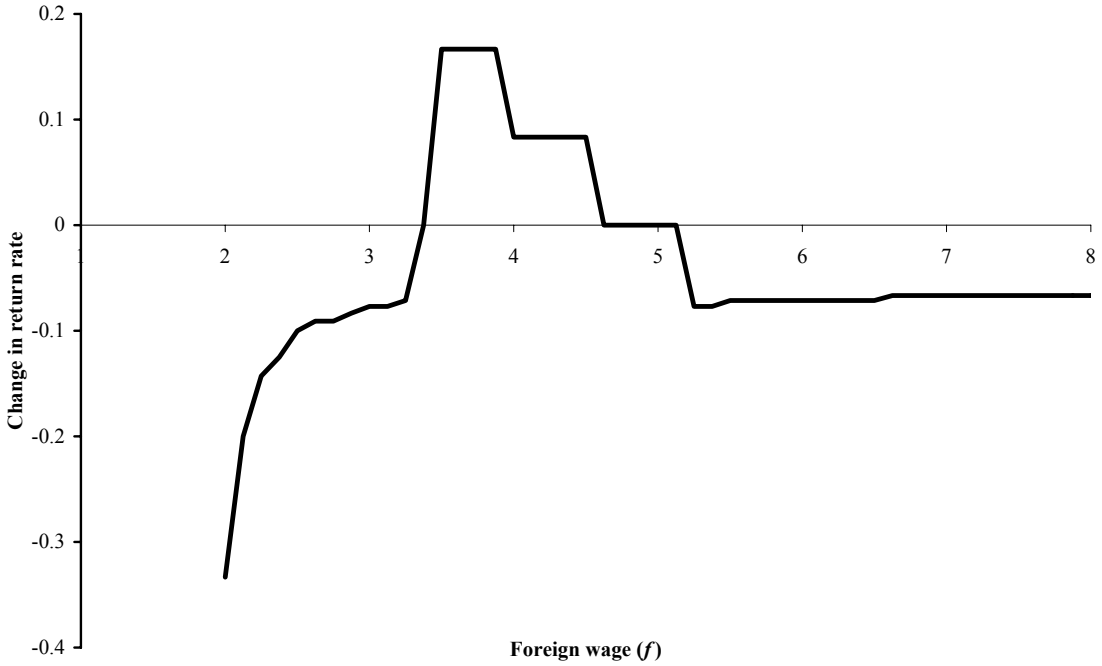
NOTES: Results from numerical simulation; see notes to previous appendix figure for details.

Appendix Figures 3a and 3b: Theoretical impact of exchange rate shock on return migration

3a: 1-period return rate with and without exchange rate shock



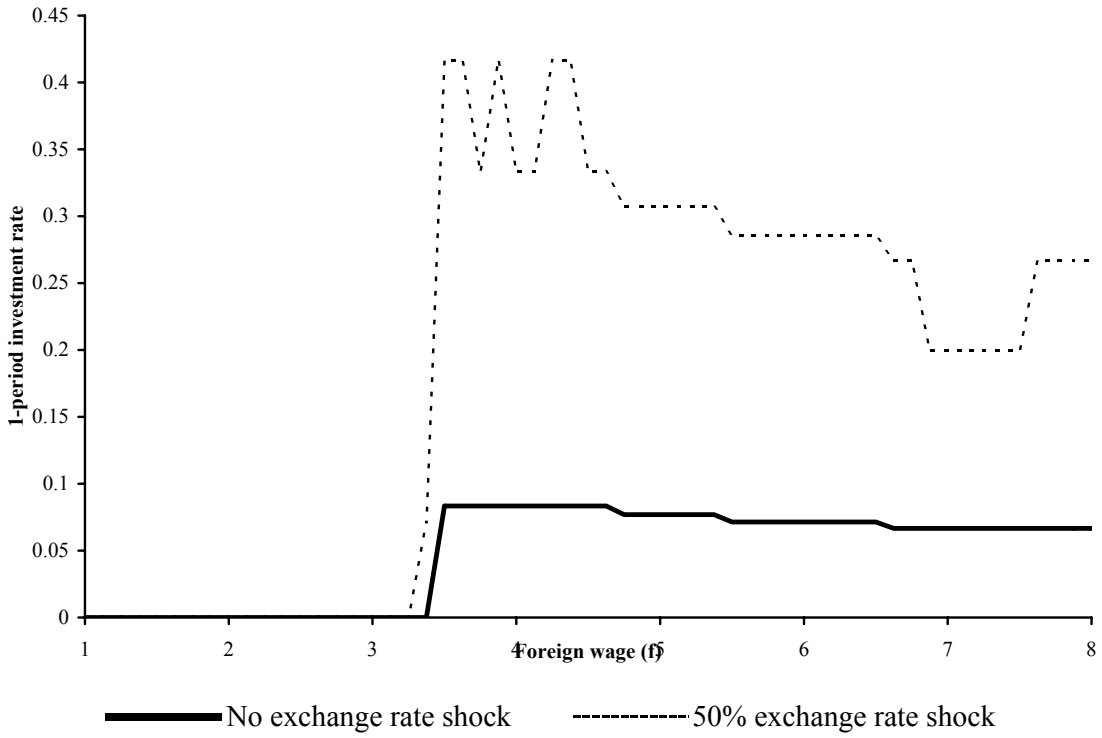
3b: Difference in return rate between households without and with exchange rate shock



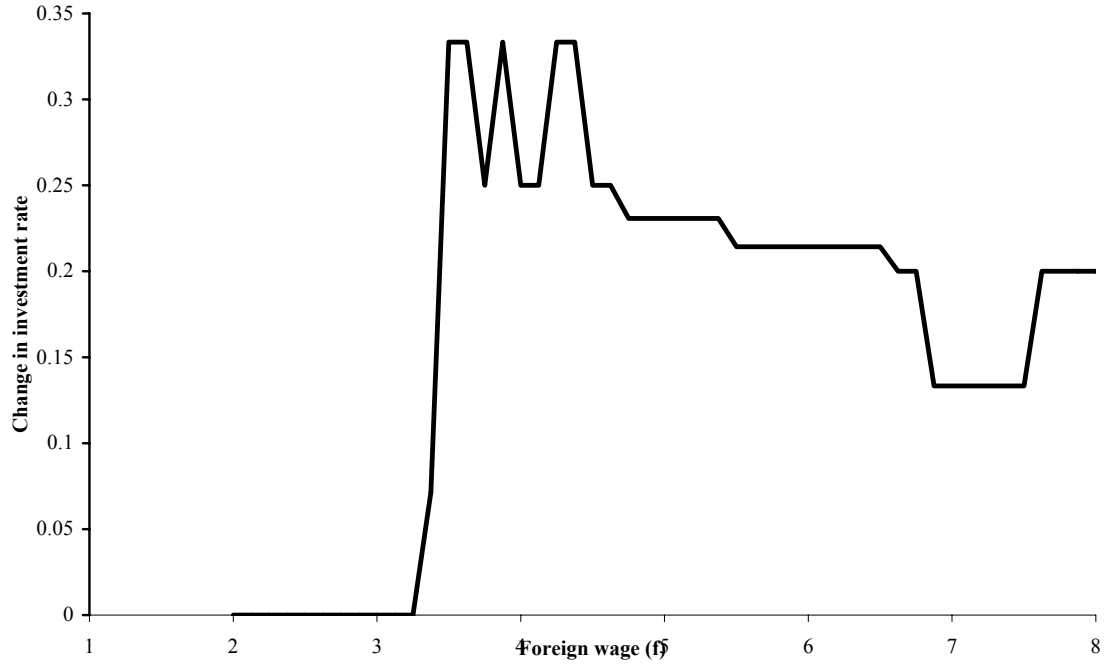
NOTES: Exchange rate shock raises both the foreign wage and accumulated assets held overseas by 50%. Shock assumed to occur at very beginning of a period (period j), with overseas work and enterprise investment decision assumed fixed in period j. "1-period return rate" is fraction of migrants overseas who return immediately after the period of the exchange rate shock (period j), so as to be working domestically in period $j+1$. For each level of the foreign wage, households assumed uniformly distributed across elapsed periods of life. See first appendix figure for other notes.

Appendix Figures 4a and 4b: Theoretical impact of exchange rate shock on household investment

4a: 1-period investment rate, with and without exchange rate shock



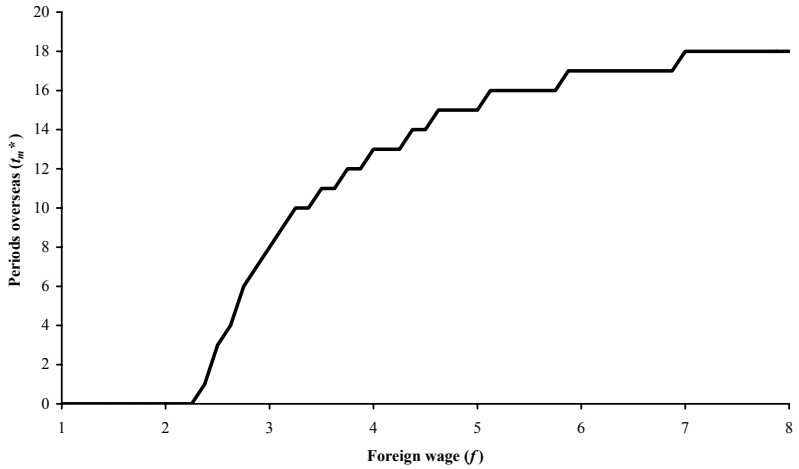
4b: Change in 1-period investment rate



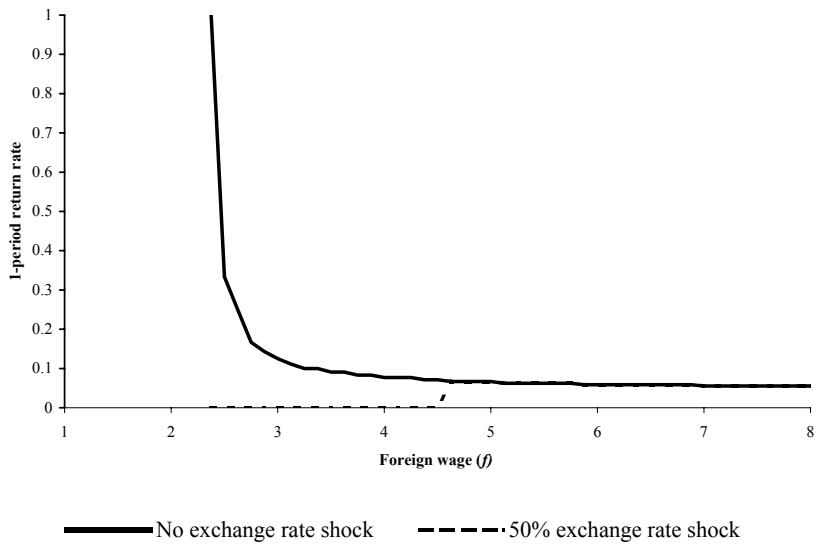
NOTES: Exchange rate shock raises both the foreign wage and accumulated assets held overseas by 50%. Shock assumed to occur at very beginning of a period (period j), with overseas work and enterprise investment decision assumed fixed in period j. "1-period investment rate" is fraction of households making enterprise investment immediately after the period of the exchange rate shock (period j), so enterprise is operating in period $j+1$. For each level of the foreign wage, households assumed uniformly distributed across elapsed periods of life. See first appendix figure for other notes.

Appendix Figures 5a, 5b, and 5c: Theoretical impact of exchange rate shock on return migration (borrowing constraint relaxed)

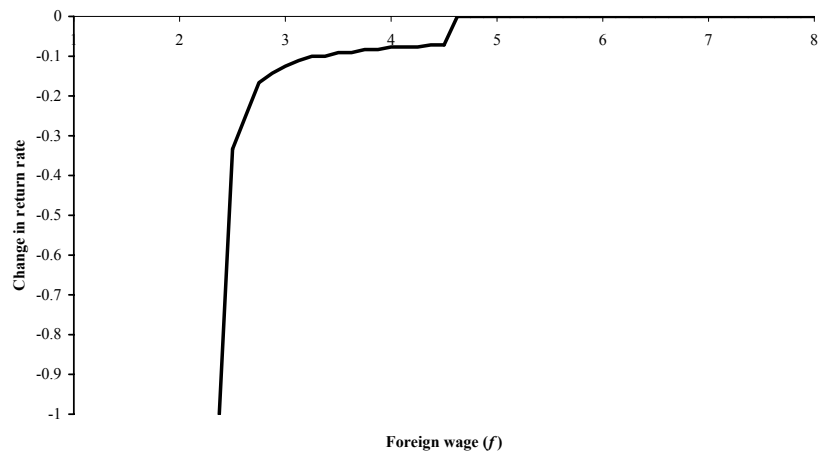
5a: Optimal periods overseas by foreign wage level (average across households)



5b: 1-period return rate with and without exchange rate shock



5c: Change in 1-period return rate



NOTES: Prior to period 1, households assumed able to borrow amount they would have invested in borrowing constraint case (Figure 4), or the minimum investment threshold (m) if a non-investor. Exchange rate shock raises both the foreign wage and accumulated assets held overseas by 50%. Shock assumed to occur at very beginning of a period (period j), with overseas work and enterprise investment decision assumed fixed in period j. "1-period return rate" is fraction of migrants overseas who return immediately after the period of the exchange rate shock (period j), so as to be working domestically in period $j+1$. For each level of the foreign wage, households assumed uniformly distributed across elapsed periods of life. See first appendix figure for other notes.