Purchasing-Power-Parity Changes and the Saving Behavior of Temporary Migrants

Alpaslan Akay, Slobodan Djajić[*], Murat G. Kirdar[†], and Alexandra Vinogradova[‡]

1st November 2017

Abstract

This study examines how immigrants' saving behavior responds to changes in the purchasing power parity between the source and host countries. For this purpose, we first build a theoretical model of joint return migration and saving decisions of a temporary migrant, and then test the implications of this model using data from the German Socioeconomic Panel on immigrants from 99 different source countries. In accordance with the implications of the model, the empirical results show that immigrants' saving rate decreases with a rise in the price level of the source country but increases in response to a nominal depreciation of domestic currency. In addition, the responsiveness of the saving rate is found to be higher to both variables, the shorter the period of time between the realization of the price shock and the migrant's retirement date.

Abstract

JEL Classification:
Key Words:

[*]The Graduate Institute, 11A Avenue de la Paix, CH-1211 Geneva, Switzerland. Tel: +41-22-908-5934, Fax: +41-22-733-3049, email: slobodan.djajic@graduateinstitute.ch

[†]Bogazici University, Natuk Birkan Binasi, 2. Kat, Ekonomi Bolumu, Bebek, 34342 Istanbul, Turkey. Tel: +90-212-3594831, email: murat.kirdar@boun.edu.tr

[‡]Center of Economic Research, ETH, Zurich, Switzerland. Tel: +41-44-632-49-49, email: avinogradova@ethz.ch

1 Introduction

An important problem facing temporary migrant workers is that of deciding how much to save while working abroad. In choosing their optimal time profile of consumption and saving, they take into account not only the level of their wages abroad and what they expect to earn after return to the source country, but many other factors, including the relationship between foreign and home prices of consumption goods and the valuation of domestic in terms of foreign currency. The present study examines this problem using both theoretical and empirical analysis. The focus of our theoretical model is on the responsiveness of a temporary migrant's saving rate to changes in the exchange rate and the price level back home. More specifically, we consider the impact of unanticipated changes in these price variables on a migrant's saving behavior in two distinct cases. In one case the migrant finds it optimal to return to the home country *before* the age of retirement and to continue working at home, while also consuming the savings accumulated abroad. We refer to this as an interior solution from the perspective of a temporary migrant's optimal timing of return. The other case is a corner solution, where the migrant returns to the home country only *for the purpose of retiring* and enjoying consumption at a relatively lower cost than abroad. We examine the two cases in some detail within a deterministic framework and analyze how intentions to return to the source country and the timing of the shock to the exchange rate or the price level influence saving behavior.

When an interior solution is optimal, we find that a migrant's saving rate abroad declines with an increase in the source-country price level, but is ambiguously affected by an increase in the exchange rate. In the special case where source-country inflation drives prices and the exchange rate up in the same proportion, the net effect on the saving rate is negative and more so if the increase in prices is greater than the increase in the exchange rate. As we shall see in the empirical part of our paper, this in fact corresponds to the *real* currency appreciation experienced by the principal source countries of migration in our data set. In that case our model predicts that there should be a decline in the saving rate of migrants who

intend to return to their home country before retirement. Moreover, the magnitude of this decline should not be affected by the amount of savings already accumulated by the migrant or by the timing of the price shock within a migrant's period of residence abroad.

These results are somewhat different from the ones we obtain when a migrant finds it optimal to choose the corner solution for the timing of return. We find once again that his saving rate decreases with a rise in the price level of the source country, but now his saving rate unambiguously increases in response to a nominal depreciation of domestic currency under the realistic assumption that the degree of concavity of his utility function is less than unity. Interestingly, unlike in the case of an interior solution, this increase in the saving rate is found to be larger, the shorter the period of time between the realization of the price shock and the migrant's retirement date (which in the case of the corner solution coincides with his return date). Moreover, when the price level and the exchange rate increase in the same proportion, the saving rate decreases. For a given increase in the nominal exchange rate, the decrease in the saving rate is larger if there is a real appreciation of domestic currency.

We test these theoretical implications of our model using the German Socioeconomic Panel (GSOEP) for 2013, which includes annual data on immigrants' monthly savings in the host country from 1992 to 2013, as well as a rich set of information on immigrants' individual-level characteristics. We combine these information for immigrants from 99 different source countries with their source-country level characteristics. A peculiar feature of the GSOEP is that it also includes annual data on immigrants' return intentions. This allows us to test whether the implications of our model are stronger for immigrants with stronger return intentions, as would be expected. Since the question on monthly savings is asked only for non-negative amount of savings, we use Tobit models in the estimation. In particular, we use Tobit random effects model and the Tobit fixed effects model developed by Honore (1992).

The data on return intentions indicate that the majority of immigrants who intend to return in fact intend to return at or around the age of retirement. Hence, the relevant theoretical model that is relevant for testing is the model with corner solution. The empirical

evidence confirms the implications of this model. We find that saving rate increases in the nominal exchange rate but decrease in home country prices. A 10-percent increase in the nominal exchange rate brings about a roughly 11-percent increase in savings. In addition, the absolute magnitudes of both relationships increases as the time that remains until retirement becomes shorter.

2 Related Literature

Our study is not the first to consider the role of price variables in influencing the behavior of temporary migrants. Djajić (1989) examines how wages and prices at home and abroad influence a migrant's pattern of consumption and labor supply in the two economies. Those prices, however, are assumed to remain unchanged throughout a migrant's stay abroad, an assumption used in practically all subsequent theoretical contributions to the literature on the saving behavior of temporary migrants.[1] By contrast, our focus in the present study is on the implications of unanticipated changes in the exchange rate or the price level at a point in time within a migrant's planning horizon when he is already in the foreign country and in the process of accumulating savings for the purpose of financing consumption expenditures after return.

To the best of our knowledge, the existing literature, both theoretical and empirical, has not established a causal relationship between unanticipated exchange-rate or price level shocks experienced by migrants and their saving behavior. There are, nonetheless, a number of studies that address other dimensions of migrants' behavior in response to unanticipated changes in the exchange rate. Two influential papers by Yang (2006, 2008) are prominent examples. Using the 1997 Asian financial crisis as a source of exogenous variation in the exchange rate faced by Philippino migrants in dozens of destination countries, he shows that immigrants' timing of return migration, remitting behavior, and investments in the source country are

[1] See, for example, Dustmann (2001), Djajić (2014), Djajić and Vinogradova (2015), and Vinogradova (2016). See also Galor and Stark (1990, 1991), where Djajić (1989) is extended to an analysis of the case where a temporary migrant's return date is uncertain.

significantly affected by unanticipated changes in the exchange rate.[2]

While migrants in Yang's studies are mostly short-term guest workers residing in dozens of host countries, our data set contains information on immigrants from numerous source countries with a wide range of residence durations in a single host country, Germany. Moreover, Yang's data is on remittance receipts and expenditure patterns of households left behind, while we observe actual earnings outcomes and saving behavior of migrants at the destination. This allows us to examine *directly* the impact of unanticipated exchange-rate changes on their saving rates.

For migrants who intend to return to their country of origin, exchange-rate fluctuations affect the purchasing power of their foreign income as well as of their accumulated foreign-currency savings in terms of both consumption and investment goods back home. As noted by Yang (2006, 2008) the increased valuation of foreign-currency holdings experienced by the majority of Philippino migrants during the Asian financial crisis can potentially trigger investment in entrepreneurial activity back home as it enables the migrant household to overcome liquidity constraints they face in meeting the minimum investment requirement on a project. We focus, instead, on the impact of changes in the exchange rate *and* the source-country price level on a migrant's budget and his optimal time profile of saving. In contrast with previous contributions to this literature, we develop a theoretical framework in which migrants make optimal saving and return-migration decisions in a dynamic setting. This enables us to derive theoretical predictions on how the saving rate can be affected under various conditions by unanticipated movements in the price variables. As our data set contains information on each migrant's age, duration of stay abroad, and intentions to return to the source country, we are able to test empirically our model's predictions on how such factors interact with changes in

[2] Faini (1994) is an earlier study on the relationship between exchange rate shocks and remittance flows. A number of more recent empirical studies focus on various other aspects of remitting behavior of immigrants. Amuedo-Dorantes and Pozo (2006) use data on Mexican immigrants in the USA and find that a higher income risk leads to increased remittances. Merkle and Zimmermann (1992) use German data and find that plans to return migrate are an important determinant of remittances. See also Dustmann and Mestress (2010), Bauer and Sinning (2011), and Sinning (2011) for empirical work on the link between return intentions and remitting behavior.

the exchange or the price level in influencing a migrant's saving behavior. Our theoretical analysis helps facilitate the choice of the most appropriate empirical specification, while also allowing us to interpret the estimation findings in the context of the model's predictions.[3]

As Yang does for the case of Philippino migrants, Kirdar (2009) finds that the real exchange rate affects the return migration hazard rates of immigrants in Germany. The direction of the effect in the two studies, however, is not the same, presumably due to the marked difference between the two studies in terms of immigrants' average duration of residence in the host country. In a follow-up paper, Kirdar (2013) shows that immigrants' return intentions also respond to the changes in the real exchange rate. A study by Abarcar (2013) examines the relationship between exchange-rate shocks and return migration in the case of migrants residing in Australia. By contrast, our focus here is on the response of temporary migrants' *saving behavior* to exchange rate shocks rather than the timing of return.

Two more recent papers, Nekoei (2013) and Nguyen and Duncan (2017), investigate a causal link between migrants' labor-market outcomes and real-exchange-rate shocks. As is the case with other contributions to this literature, they do not examine the implications for a migrant's saving behavior. In fact the simple income-sharing model of Nekoei (2013) is based on the assumption that migrant households consume all of their current income.[4]

In sum, a key distinction between the present study and these earlier contributions is that the latter lack data on migrants' saving rates abroad. This prevents them from testing directly the relationship between unanticipated exchange-rate shocks and migrants' saving. Instead,

[3]Using a structural model of return migration and saving behavior of immigrants in Germany, Kirdar (2012) also uses the variation in ppp across countries to identify the structural parameters of that model—which he uses to examine the fiscal impact of immigrants.

[4]Ngyuyen and Duncan (2017) follow Nekoei (2013) in examining the causal link between migrants' labor-market outcomes and the exchange rate in the Australian context. While the dataset in Nekoei (2013) is cross sectional, Ngyuyen and Duncan (2017) exploit the panel structure of their data, which allows them to account for time-invariant unobserved heterogeneity by using fixed-effects methods. When they do not account for time-invariant unobserved heterogeneity, they find, as Nekoei does, that immigrants reduce their labor supply in response to an appreciation of the host country's currency. Once they account for time-invariant unobserved heterogeneity, however, the negative supply response disappears. This result highlights the importance of accounting for unobserved heterogeneity. We also account for it in our empirical model and find no evidence that exchange-rate shocks change immigrants' labor-supply behavior. In our study this exercise serves merely as a check of a potential mechanism that could possibly affect a migrant's saving rate.

they focus on establishing causal relationships between exchange-rate shocks and certain other dimensions of immigrants' behavior. To the best of our knowledge, the present study is the first to do so with regard to immigrants' saving on the basis of data that are at least as rich, if not richer than those used in previous contributions. Our panel data allow us to account for heterogeneity to a higher degree, our unique data on return intentions allow us to conduct more convincing tests of the implications of our theoretical model, and the rich micro-level data allow us to conduct tests of the underlying mechanisms (through labor supply behavior) of the observed change in saving behavior.[5]

3 Theoretical Framework

The focus of our paper is on the effects of unanticipated changes in the exchange rate and the price level back home on the saving behavior of temporary immigrant workers. In relation to the setting, one can think of immigrants who were recruited to meet labor shortages in Germany during its post-war economic boom. Although their migration was expected to be only temporary, many of these workers chose to stay for decades and even permanently as they were able to renew their residence permits and establish (or reunite with) families in the host country.[6]

It is clear that for immigrants who intend to remain permanently in the host country, the exchange rate and the price level of the source country do not play an important role, unless they are supporting family members back home by sending remittances or plan to return periodically for the purpose of consumption on short visits. By contrast, if migration is intended to be temporary, changes in the exchange rate and the price level can have a

[5]There is also a related literature on the effect of other macroeconomic factors on the behavior of immigrants. McKenzie et al. (2014) show how migrant inflows respond to GDP shocks in destination countries, Djajic et al (2016) examine how emigration flows change with income in source countries, and Akay et al. (forthcoming) assess the impact on the subjective well-being of immigrants in Germany following changes in the macroeconomic conditions at the origin.

[6]For immigrants recruited between 19.. and 19.. for work in Germany, X% chose to return to their countries of origin before the age of retirement, Y% returned at the age of retirement and Z% remained permanently in Germany. **Murat, is there data that can be used to fill in the blanks on this footnote?**

significant impact on a migrant's saving behavior as these price variables affect the purchasing power of savings accumulated abroad as well as the optimal time profile of consumption while abroad and after return to the source country.

We see saving behavior of immigrants and the timing of return to the source country as elements of a solution to their problem of maximizing utility over a planning horizon. In an environment where they are subjected to unanticipated shocks, a stay abroad that is intended to be temporary may well turn out to be permanent and vice versa. In our theoretical analysis below, we refer to temporary (resp. permanent) migrants as those who *intend* to return to their country of origin (resp. remain in the host country). By contrast, our data set undoubtedly contains observations on migrants who intended to return, but ended up staying permanently as well as on migrants who intended to stay permanently, but finally decided to return back home.

3.1 A Temporary Migrant

As in the case of post-war migration to Germany, let us suppose that a migrant's work/residence permit is renewable, enabling him to choose how long to remain in the host country. A migrant's planning horizon is assumed to be from the time of arrival in the host country, defined as $t = 0$, until $t = T + R$, where T is the number of years until retirement and R is the duration of the retirement phase. There are two activities: (i) work and (ii) consumption of a standard basket of commodities and services. After retirement, consumption is assumed to be the only activity.

While working abroad, a migrant receives at time t the wage w_t^*, at home he receives the home-country wage, w_t, and he faces the price level p_t^* abroad and p_t at home when consuming goods. The exchange rate, or the price of one unit of foreign in terms of domestic currency at time t, is denoted by e_t. We shall assume that the cost of consumption in the host country is higher than it is at home (i.e., $e_t p_t^* > p_t$), that the foreign money wage is higher than the home wage (i.e., $e_t w_t^* > w_t$), and that the real wage is higher in the host country (i.e.,

$w_t^*/p_t^* > w_t/p_t$).

Our migrant is assumed to be a single individual, whose problem is to maximize V^M, the lifetime utility from consumption abroad and at home, by choosing the optimal consumption rate at each point in time from time 0 to $T+R$ and the optimal return date, τ. Our focus is on the problem of a migrant who intends to stay temporarily in the host country. There are two possible solutions to a *temporary* migration problem: an interior solution, in the sense that $T > \tau > 0$ and a corner solution, $\tau = T$, whereby a migrant returns to the source country only for the purpose of retiring in that location. Let us begin by considering an interior solution, leaving the analysis of the corner solution for Section 3.2.

To simplify the analysis and the algebra, we assume that the rate of time preference and the rates of interest at home and abroad are equal to zero.[7] Thus the objective is to maximize

$$V^M = \int_0^{\tau} u(c_t^*)dt + \int_{\tau}^{T+R} u(c_t)dt, \tag{1}$$

where c_t^* and c_t are the time-t rates of consumption abroad and after return to the source country, respectively.

While abroad, the migrant saves in order to accumulate assets that later serve to support his consumption in the home country after time τ. Assuming that the wage rates at home and abroad are constant, the stock of assets held abroad evolves over time according to the following differential equation: $\dot{A}_t^* = w^* - p_t^* c_t^*$, where a dot over a variable indicates a time derivative. The stock of savings accumulated by the migrant in the form of foreign currency until the time of return is given by

$$A_{\tau}^* = A_0^* + \int_0^{\tau} (w^* - p_t^* c_t^*)dt, \tag{2}$$

where A_0^* is the initial stock of assets, net of migration costs, assumed to be held in the form of foreign currency.[8]

[7] The role of interest differentials across countries and discrepancies between the rates of interest and the rate of time preference in influencing saving decisions of temporary migrants and the optimal timing of their return to the source country is examined by Djajić (2010). See also Djajić (2014a, 2014b), Djajić and Vinogradova (2016) and Vinogradova (2016).

[8] The case in which savings are continuously remitted to the source country and held in the form of domestic

Let us suppose that the exchange rate and the price levels in both countries are constant over time, unless a shock occurs causing a change in one or more of these variables. The initial values of variables are denoted by the subscript 0, while the post-disturbance values have the subscript 1. We assume that a shock to the exchange rate or a price level is unanticipated by the migrant and that he has static expectations (i.e. any given change in the exchange rate or either of the price levels is expected to be permanent).

Objective function (1) is maximized subject to the constraint that the value of savings accumulated abroad in the form of foreign currency until time τ is equal to the excess of consumption over wage earnings and retirement benefits after return.

$$e_0 A^*_\tau = -\int_\tau^T (w - p_0 c_t)dt - \int_T^{T+R} (e_0 b - p_0 c_t)dt, \tag{3}$$

where b is the foreign-currency-denominated flow of retirement benefits enjoyed by the migrant in the source country. Let us suppose that, as in the case of a migrant who worked in Germany, b is a fraction of his foreign wage, which is increasing in the number of years spent working abroad. For simplicity, we assume that $b = \alpha\tau w^*$, where α is a constant. The budget constraint on the basis of which the migrant makes his decisions at $t = 0$ concerning the optimal consumption path and the return date, τ, can then be written as follows:

$$e_0 \left[A^*_0 + \int_0^\tau (w^* - p^*_0 c^*_t)dt\right] = -\int_\tau^T (w - p_0 c_t)dt - \int_T^{T+R} [e_0 \alpha\tau w^* - p_0 c_t]dt, \tag{4}$$

Defining the Lagrangian associated with the migrant's maximization problem as

$$L = \int_0^\tau u(c^*_t)dt + \int_\tau^{T+R} u(c_t)dt + \\ +\lambda\left\{e_0 A^*_0 + e_0 \int_0^\tau (w^* - p^*_0 c^*_t)dt + \int_\tau^T (w - p_0 c_t)dt + \int_T^{T+R} [e_0 \alpha\tau w^* - p_0 c_t]\, dt\right\},$$

currency is examined in the Appendix, where we show that the results regarding a migrant's saving behavior are qualitatively the same as under the assumption that the savings are held in the form of foreign currency.

the first order conditions are

$$\frac{\partial L}{\partial c_t^*} = u'(c_t^*) - \lambda e_0 p_0^* = 0, \tag{5}$$

$$\frac{\partial L}{\partial c_t} = u'(c_t) - \lambda p_0 = 0, \tag{6}$$

$$\frac{\partial L}{\partial \tau} = u(c_\tau^*) - u(c_\tau) + \lambda[e_0(w^* - p_0^* c_\tau^*) - (w - p_0 c_\tau) + R e_0 \alpha w^*] = 0 \tag{7}$$

and the budget constraint (4). These four equations enable us to solve for c_t, c_t^*, τ and the Lagrange multiplier, λ, as functions of the the exogenous variables affecting the migrant's behavior.

Since $u'(c_t^*)$ and $u'(c_t)$ are constant in eqs. (5) and (6), the corresponding rates of consumption are also constant at c_0^* and c_0, respectively. Having assumed that the price of the standard consumption basket is relatively higher abroad, eqs. (5) and (6) imply that as the migrant returns to the source country at $t = \tau$, his consumption jumps to a higher rate, while $u'(c_0)/p_0 = u'(c_0^*)/e_0 p_0^*$, so that the marginal utility per unit of a given currency spent on consumption is the same over the two phases of the planning horizon. To be able to derive explicit solutions in what follows, let us assume that the utility function takes the CRRA form $u(x) = \frac{x^{1-\theta}}{1-\theta}$, where θ is a measure of the degree of concavity of the utility function. In line with the available empirical evidence, our focus in what follows will be on the case of $0 < \theta < 1$.[9] Using (5) and (6), we can write

$$c_0 = c_0^* \left(\frac{e_0 p_0^*}{p_0} \right)^{1/\theta} = c_0^* \Pi_0^{1/\theta} > c_0^*, \tag{8}$$

where $\Pi_0 = \frac{e_0 p_0^*}{p_0}$ defines the PPP relationship at the beginning of the planning horizon.

With the aid of (8), eq. (7) can be solved for c_0^* as a function of wages and prices that the migrant faces in the two economies and the degree of concavity of his utility function.

$$c_0^* = \left(\frac{1-\theta}{\theta} \right) \frac{e_0 w^*(1 + \alpha R) - w}{p_0 \left(\Pi_0^{1/\theta} - \Pi_0 \right)}. \tag{9}$$

[9] Estimates of θ vary significantly, depending on the data used and the empirical strategy. Chetty (2006) examines some of the factors that explain this wide range of estimates. He reports that the mean estimate in the literature is $\theta = 0.71$, while noting that studies which combine the benefits of exogenous variation with the structural lifecycle approach, such as Blundell, Duncan, and Meghir (1998), with its estimate of $\theta = 0.93$, provide perhaps the most credible microeconomic estimates.

Note that when a migrant's pension is increasing in the number of years of employment in the foreign country (i.e., $\alpha > 0$), the benefit of staying for an additional unit of time abroad also increases, as can be seen in eq. (7). This implies a higher optimal consumption rate abroad in eq. (9) and a correspondingly lower saving rate in comparison with the case where the relationship between the duration of stay abroad and the magnitude of retirement benefits is not taken into account (see Djajić and Milbourne, 1988). Also note that in the case where an interior solution is optimal (i.e., $\tau < T$), asset holdings do not affect a migrant's optimal consumption rates in the two economies. As we shall see just below, initial assets influence only the optimal duration of stay abroad.

Using (8), we can also write the budget constraint (4) as

$$e_0 A_0^* + \tau e_0(w^* - p_0^* c_0^*) + (T - \tau)\left(w - p_0 c_0^* \Pi_0^{1/\theta}\right) + R\left[e_0 \alpha \tau w^* - p_0 c_0^* \Pi_0^{1/\theta}\right] = 0, \qquad (10)$$

which yields the solution for τ as a function of the consumption rate abroad and the parameters of the model, including the initial stock of assets, A_0:

$$\tau = \frac{p_0 c_0^* \Pi_0^{1/\theta}(T + R) - Tw - Re_0 \alpha w^* - e_0 A_0^*}{e_0(w^* - p_0^* c_0^*) - \left(w - p_0 c_0^* \Pi_0^{1/\theta}\right)}. \qquad (11)$$

We restrict the parameters to the range which ensures that $\tau \in (0, T)$. It then simply remains to introduce the optimal c_0^* from eq. (9) into (11) to determine the value of τ that is just sufficient to enable the migrant to cover the cost of his optimal consumption program.

3.1.1 An Unanticipated Change in PPP

Our objective is to study the impact of an unanticipated change in the purchasing-power-parity relationship between the two countries on a migrant's pattern of consumption and asset accumulation. Since Yang (2006) is the first to analyze the impact of an unanticipated exchange-rate shock on a migrant's behavior, it is useful to compare at this point the purpose of our model and that of the one presented in the Theory Appendix of Yang (2006). While we are concerned with a migrant's time profile of consumption and saving in the host country, Yang's focus is on the implications of exchange-rate shocks for the timing of return and propensity

to invest in entrepreneurial activity at home. He does not analyze the consumption behavior of migrant workers or the implied saving behavior as his data set does not contain direct information on these variables, but rather on the flow of remittances and the expenditure pattern of the households left behind. In fact Yang assumes "that consumption overseas yields zero household utility: overseas work is a pure hardship and is done exclusively for the benefit of future raised consumption in the home country" (p.2 of the Theory Appendix). While this is a plausible assumption when modeling the behavior of Philippino guest workers on relatively short-term contracts abroad, our framework pertains to foreign workers in Germany, most of whom returned to their source country only after decades of work abroad. Moreover, as we have data on their saving rates abroad, it is important for us to consider explicitly their optimal time profile of consumption. Another important difference is that Yang has prices of consumption goods normalized to unity while we consider explicitly the effects of changes in p and p^*. Moreover, in contrast with Yang (2006), the effects of an exchange-rate shock on the optimal migration duration is not our main focus and we therefore relegate the derivation and discussion of that behavior to the appendix.

In our investigation of impacts of an unanticipated change in the purchasing-power-parity relationship between the two countries, we assume that at $t = \phi < \tau$, while the migrant is still working abroad, there is a change in the exchange rate and/or one of the price levels that alters Π. We then examine how this affects the migrant's optimal consumption profile and the implied rate of asset accumulation.

Not expecting any change in the exchange rate or price levels, the migrant follows his optimal consumption path characterized by eq. (9) and plans to return to the source country at $t = \tau$, as given in eq. (11). By the time an unanticipated change in the PPP relationship occurs at time ϕ, the migrant will have accumulated $\phi(w^* - p_0^* c_0^*)$ units of foreign currency. His problem at $t = \phi$, when the shock to PPP is realized, is to recalculate his optimal consumption program from time ϕ to $T + R$ and the optimal return date, given his asset holdings at that moment.

As can be seen in eq. (9), the stock of assets held by the migrant and the amount of time remaining within the planning horizon do not affect the optimal consumption rate c_0^*.[10] We can then determine the impact of an unanticipated change in e, p, or p^* on saving and consumption rates abroad by simply differentiating (9) with respect to the relevant price variable. We also consider the implications of an unanticipated change in w, as the wage in the source country may change along with the price level and the exchange rate if the economy is experiencing inflation that puts upward pressure on both prices and wages.

$$\frac{d(p_0^*c_0^*)}{de_0}\frac{e_0}{p_0^*c_0^*} = \frac{w}{ew^*(1+R\alpha')-w} - \left(\frac{1-\theta}{\theta}\right)\frac{\Pi_0^{1/\theta-1}}{\Pi_0^{1/\theta-1}-1}, \tag{12}$$

$$\frac{d(p_0^*c_0^*)}{dp_0^*}\frac{p_0^*}{p_0^*c_0^*} = 1 - \frac{\frac{1}{\theta}\Pi_0^{1/\theta-1}-1}{\Pi_0^{1/\theta-1}-1} \gtrless 0 \Leftrightarrow \theta \gtrless 1, \tag{13}$$

$$\frac{d(p_0^*c_0^*)}{dp_0}\frac{p_0}{p_0^*c_0^*} = \left(\frac{1-\theta}{\theta}\right)\frac{\Pi_0^{1/\theta-1}}{\Pi_0^{1/\theta-1}-1} \gtrless 0 \Leftrightarrow \theta \lesseqgtr 1, \tag{14}$$

$$\frac{d(p_0^*c_0^*)}{dw}\frac{w}{p_0^*c_0^*} = -\frac{w}{ew^*(1+R\alpha)-w} < 0, \tag{15}$$

These results concerning the migrant's consumption spending abroad imply that his saving rate declines with an increase in p, but increases with an increase in p^* in the empirically relevant range of $\theta < 1$. In addition, it is ambiguously affected by an increase in the exchange rate and increases with an increase in w. In the special case where source-country inflation drives p and e up in the same proportion, it can be ascertained by adding the results from eqs. (12) and (14) that the net effect on p^*c^* is positive (on the saving rate negative) and even more so if the increase in p is greater than a given increase in e. As we shall see in the empirical part of the paper, this in fact corresponds to the behavior of the exchange rate and the price level in the principal source countries of migration in our data set. We should therefore expect that in such cases of real appreciation of source-country currency the saving rate of migrants who intend to return to their home country before retirement will tend to

[10] Note that our focus is on an environment in which the migrant chooses an interior solution for τ. In that case initial asset holdings affect the optimal return date, but not the optimal rates of consumption, which are determined by conditions (5)-(7). By contrast, asset holdings will clearly have an effect on c^* when we consider parameters of the model for which the migrant chooses to return to the source country for the purpose of retirement (i.e., $\tau = T$). We examine that case in the next section.

decline. Note, in addition, that if the increase in p, e, and w is in the same proportion, leaving the PPP relationship and the real wage at home unaffected, this has no impact on a migrant's saving rate (i.e., the sum of expressions in eqs. (12), (14), and (15) is zero).

3.2 Return for Retirement Only

Conditions in the labor and goods markets at home and abroad may be such that it does not pay to return to the source country before time T. This can well be the case if a worker migrates late in the planning horizon (small T) or if the international wage differential in favor of the host country is large, while the price-level differential offers a considerable advantage to a migrant who consumes at home rather than abroad over the retirement phase of the planning horizon. More specifically, a temporary migrant chooses the corner solution when the value of c^* that satisfies condition (9) and the corresponding rate of consumption after return to the source country (as given by condition (8)) are not attainable within the migrant's budget even if he spends the rest of his working life abroad. Then he must choose a lower time profile of consumption, as dictated by conditions (5) and (6) and the budget constraint (4) (with the duration of stay abroad set at $\tau = T$).

Our data set contains information on the intentions to return, revealing that x% of migrants in our sample indicate at least once that they intend to return to their country of origin, while y% indicate more then 50% of the time that they intend to return. The advanced age at the point of return for the majority of migrants (see Table...), suggests that the planned return was simply for the purpose of retiring in the source country. **(Murat, can you fill in the values for X and Y at the beginning of the paragraph and perhaps introduce a table referred to above if you think it is appropriate.)** In that case the migrant's optimization program, with the return date at $t = T$, is as follows:

$$V^M = \int_0^T u(c_t^*)dt + \int_T^{T+R} u(c_t)dt, \tag{16}$$

subject to the budget constraint

$$e_0\left[A_0^* + \int_0^T (w^* - p_0^* c_t^*)dt\right] = -\int_T^{T+R} (e_0 \alpha T w^* - p_t c_t)dt, \tag{17}$$

where αT is the fraction of the foreign wage that the migrant expects to receive in the form of pension benefits after having worked abroad for T years. The solution to this problem yields the constant optimal consumption rate abroad prior to any shock to the PPP relationship between the two countries:

$$c_0^* = \frac{e_0 A_0^* + T(1+R\alpha)e_0 w^*}{T e_0 p_0^* + R p_0 \Pi_0^{1/\theta}}, \tag{18}$$

The solution for the constant consumption rate at home over the retirement phase of the planning horizon is, as in the previous section, $c_0 = c_0^* \Pi_0^{1/\theta} > c_0^*$.

If there is an unanticipated change in PPP at $t = \phi < T$, a migrant will adjust his optimal consumption rates at home and abroad in response to this change in the environment. Denoting once again the pre-disturbance values of variables by the subscript 0 and the post-disturbance values by the subscript 1, a migrant's optimal consumption rate after return to the home country is $c_1 = c_1^* \Pi_1^{1/\theta} > c_1^*$, while the optimal consumption rate abroad is the solution for c_1^* that satisfies the following budget constraint.

$$e_1[A_0^* + \phi(w^* - p_0^* c_0^*)] + (T-\phi)e_1(w^* - p_1^* c_1^*) + R[\alpha T e_1 w^* - \Pi_1^{1/\theta} p_1 c_1^*] = 0. \tag{19}$$

We thus have

$$p_1^* c_1^* = \frac{A_0^* + \phi(w^* - p_0^* c_0^*) + [T - \phi + R\alpha T]w^*}{\left(T - \phi + R\Pi_1^{1/\theta - 1}\right)}. \tag{20}$$

To examine the sensitivity of c_1^* to unanticipated changes in the exchange rate and the price levels at time ϕ, we differentiate eq. (20) with respect to e_1, p_1^* and p_1:

$$\frac{d(p_1^* c_1^*)}{de_1}\frac{e_1}{p_1^* c_1^*} = -\frac{R\left(\frac{1-\theta}{\theta}\right)\Pi_1^{1/\theta-1}}{T-\phi+R\Pi_1^{1/\theta-1}} \gtrless 0 \Leftrightarrow \theta \gtrless 1 \tag{21}$$

$$\frac{d(p_1^* c_1^*)}{dp_1^*}\frac{p_1^*}{p_1^* c_1^*} = -\frac{R\left(\frac{1-\theta}{\theta}\right)\Pi_1^{1/\theta-1}}{T-\phi+R\Pi_1^{1/\theta-1}} \gtrless 0 \Leftrightarrow \theta \gtrless 1, \tag{22}$$

$$\frac{d(p_1^* c_1^*)}{dp_1}\frac{p_1}{p_1^* c_1^*} = \frac{R\left(\frac{1-\theta}{\theta}\right)\Pi_1^{1/\theta-1}}{T-\phi+R\Pi_1^{1/\theta-1}} \gtrless 0 \Leftrightarrow \theta \lesseqgtr 1. \tag{23}$$

where Π_1 refers to the PPP relationship following the shock to the corresponding variables. With the empirically relevant value of θ being less than unity, these expressions indicate that p^*c^*, a migrant's nominal rate of consumption spending abroad, decreases (saving rate increases) if the home currency depreciates or the foreign price level rises and increases (saving rate decreases) with an increase in the price level of the source country.

Proposition 1: *Suppose that $\theta < 1$. A migrant's saving rate abroad (i) increases in response to home-currency depreciation and to an increase in the foreign price level;(ii) decreases in response to an increase in the domestic price level.*

When e and p rise in the same proportion, the effect on c_1^* becomes:

$$\frac{d(p_1^* c_1^*)}{de_1}\frac{e_1}{p_1^* c_1^*}+\frac{d(p_1^* c_1^*)}{dp_1}\frac{p_1}{p_1^* c_1^*} = 1-\frac{T-\phi+\frac{R}{\theta}\Pi_1^{1/\theta-1}}{T-\phi+R\Pi_1^{1/\theta-1}}+\frac{R\left(\frac{1}{\theta}\Pi_1^{1/\theta-1}-1\right)}{T-\phi+R\Pi_1^{1/\theta-1}} = 1-\frac{T-\phi+R}{T-\phi+R\Pi_1^{1/\theta-1}} \gtrless 0 \Leftrightarrow \theta \lesseqgtr 1$$

indicating that consumption abroad increases (saving rate decreases) in the empirically relevant case where $\theta < 1$. Moreover, if $dp/p > de/e$, as in the majority of source countries in our sample over the time period under consideration, our analysis suggests that the increase in the consumption rate abroad (decrease in the saving rate) should be even larger for any given nominal rate of currency depreciation. These results are qualitatively similar to those we present in the previous section concerning the response of a migrant who chooses an interior solution. Note, in addition, that movements in the source-country wage have no impact on c^* as a migrant has no intention of participating in the labor market of the source country if he chooses the corner solution.

As may be seen in eqs. (21), (22), and (23), the impact on p^*c^* of any given unanticipated change in e, p or p^* depends on ϕ, the point in time along a migrant's planning horizon at which the unanticipated shock occurs. This is in contrast with our findings in the previous subsection, where the change in c^* is found to be independent of the timing of the unanticipated shock to PPP. In what follows, we refer to ϕ as the number of years since migration (YSM for short). The effect of YSM on the relationship between consumption and PPP is of particular interest if we seek to understand differences in the saving behavior among various cohorts of immigrants. To examine this relationship, we differentiate eqs. (21), (22), and (23) with respect to ϕ, which yields:

$$\frac{d}{d\phi}\left(\frac{d(p_1^*c_1^*)}{de_1}\frac{e_1}{p_1^*c_1^*}\right) = \frac{R\left(\frac{\theta-1}{\theta}\right)\Pi_1^{1/\theta-1}}{\left[T-\phi+R\Pi_1^{1/\theta-1}\right]^2} \gtrless 0 \Leftrightarrow \theta \gtrless 1, \tag{24}$$

$$\frac{d}{d\phi}\left(\frac{d(p_1^*c_1^*)}{dp_1^*}\frac{p_1^*}{p_1^*c_1^*}\right) = \frac{R\left(\frac{\theta-1}{\theta}\right)\Pi_1^{1/\theta-1}}{\left[T-\phi+R\Pi_1^{1/\theta-1}\right]^2} \gtrless 0 \Leftrightarrow \theta \gtrless 1, \tag{25}$$

$$\frac{d}{d\phi}\left(\frac{d(p_1^*c_1^*)}{dp_1}\frac{p_1}{p_1^*c_1^*}\right) = \frac{R\left(\frac{1-\theta}{\theta}\right)\Pi_1^{1/\theta-1}}{\left[T-\phi+R\Pi_1^{1/\theta-1}\right]^2} \gtrless 0 \Leftrightarrow \theta \lessgtr 1. \tag{26}$$

The condition $\theta < 1$ is both necessary and sufficient for (24) and (25) to be negative. In that case, the decrease in the consumption spending abroad (and hence the increase in the saving rate) in response to an unanticipated increase in the exchange rate or the foreign price level is larger, the greater the value of ϕ relative to T, where T is the number of years from the time of migration to retirement. Thus the shorter the period of time between the realization of the PPP shock and the migrant's retirement date, the greater the proportional change in the migrant's consumption rate abroad and the corresponding change in his saving rate. To see the intuition behind this result, let us turn to eq. (24) which relates to the interaction between the effect on p^*c^* of a change in the exchange rate and ϕ. Note that when $\theta < 1$, reflecting a relatively high degree of substitutability between consumption abroad and consumption at home, the increase in nominal spending at home is proportionately greater than the increase in e, for any given c^*, as indicated by eq. (8). This implies that more foreign currency is

needed to cover the optimal rate of consumption over the R years of retirement after return. To support that higher optimal rate of spending, the saving rate abroad has to increase and increase more, the shorter the remaining period of stay abroad before retirement (i.e., the greater is ϕ for a given T). In sum, for the empirically relevant case of $\theta < 1$, the *reduction* in the migrant's foreign consumption rate is larger, the closer is the date of the shock to the retirement (and hence return) date. Accordingly, as a result of an unanticipated increase in the exchange rate, we should expect to see a larger increase in the saving rate of those migrants who have been abroad for a relatively longer period of time, other things being equal, including a worker's age at the time of migration. The same line of reasoning can be invoked to explain eqs. (25) and (26), which state that the response of the migrant's consumption rate (saving rate) abroad to a change in the foreign or the home price level is stronger (weaker) the larger is ϕ relative to T. We summarize the results in

Proposition 2: *Suppose that $\theta < 1$. The response of the migrant's saving rate to changes in the exchange rate or the price levels at home and abroad is stronger as the number of years until retirement and return migration becomes smaller.*

These findings are in sharp contrast with the presumption that an appreciation of foreign currency makes a migrant "wealthier" in the sense of increasing the purchasing power of the savings accumulated in the form of foreign currency, so that he can reduce his saving rate for the remainder of his stay abroad and still meet his expenditures during the retirement phase at home. Reasoning along these lines ignores the fact that an increase in e also creates a larger wedge between the optimal values of c and c^*, which entails an increase in the *foreign-currency value* of the savings needed to support the optimal consumption rate for the R years of retirement after return. Hence the shorter the time period $T-\phi$ over which these additional savings can possibly be accumulated abroad, the larger must be the drop in c^*.

Let us finally consider an environment in which inflation in the source country drives both the exchange rate and the price level higher at the same rate. For the case of $\theta < 1$, we find

that a migrant's saving rate abroad increases, the smaller the difference between ϕ and T.

$$\frac{d}{d\phi}\left[\frac{d(p_1^*c_1^*)}{de_1}\frac{e_1}{p_1^*c_1^*}+\frac{d(p_1^*c_1^*)}{dp_1}\frac{p_1}{p_1^*c_1^*}\right]=\frac{R(\Pi_1^{1/\theta-1}-1)}{\left(T-\phi+R\Pi_1^{1/\theta-1}\right)^2}\gtrless 0\Leftrightarrow\theta\lesseqgtr 1, \tag{27}$$

The intuition behind this result is along the same lines as outlined in the previous paragraph.

4 The Evidence

4.1 Data

The micro-level data in our empirical analysis come from the German Socio-Economic Panel (GSOEP). It is a large and nationally representative panel data of households in Germany; around 30,000 individuals in 11,000 households are surveyed each wave. The data include foreigners and recent immigrants to Germany, as well as Germans. In fact, the initial wave in 1984 started with an oversample of foreigners in Germany from five main source countries (Turkey, ex-Yugoslavia, Greece, Italy, and Spain). Immigrants from these countries still form the bulk of the immigrant sample in GSOEP. We use the 2013 version of GSOEP, which includes annual data from 1984 to 2013. An advantage of the GSOEP is that it is very rich with regards to socio-demographic and economic characteristics of individuals.

Since our dependent variable, monthly savings, is available at the household level, we need to conduct our analysis also at the household level. Hence, we extract all immigrant households in all subsamples of the GSOEP. We define immigrant households as those whose head is an immigrant. In turn, an immigrant household head is defined as an individual who arrived in Germany after age 18. (Since we interpret return migration as part of optimal life-cycle decisions, the individual must have made the decision to migrate himself/herself.) We exclude household heads who arrived in Germany after age 18 but who are Germans who previously lived abroad. (This information for this tiny fraction of individuals is available in the immigration biography of individuals.) Our final sample includes 4,498 households with an immigrant head.

We put the data into person-year format for these immigrant household heads. We follow these from the time they enter the data to the time they drop from the sample or until 2013. We drop person-year observations in which the household head is aged 65 or above (in accordance with the retirement age in Germany). In addition, we drop immigrants from countries where purchasing power parity averages below 1 in the data (all of which are developed countries) because the purpose of the immigration of these individuals to Germany could not be accumulating savings [11]. The remaining sample includes immigrants from 112 countries.

The key piece of information that comes from GSOEP is immigrants' monthly savings. Immigrants are asked about how much they save on average monthly for larger purchases, emergency expenses or to acquire wealth.[12] However, this variable in censored below at zero because households are not asked about dissaving. This question was introduced to the survey in 1992 for the first time. Hence, we have data on monthly savings for the 1991-2012 period. The other variables that come from GSOEP include years since migration, household income, household size, and dummies for the following outcomes: unemployed, married, spouse abroad, child abroad. All prices (monthly savings, household income) are normalized in 2010 Euros.

GSOEP also includes a peculiar question on immigrants' willingness to return to their home countries. If an immigrant indicates an intention to return, he/she is also asked about the intended duration of residence in Germany in years. We also utilize this information in our empirical analysis in distinguishing between immigrants who intent to return and who do not. Moreover, by generating the intended age of return, we distinguish between immigrants who intend to return before retirement and those who intend to return after retirement.

We combine our micro-level dataset with a number of auxiliary datasets. Data on purchasing power parity and exchange rates of source countries with respect to Germany come from the World Development Indicators (WDI) database of the World Bank. Data on the consumer price index in Germany also come from the WDI. We combine these three pieces of

[11] These countries are Norway, Denmark, Japan, Switzerland, New Zealand, Sweden, Australia, Finland, Ireland, Great Britain, Luxembourg, France, and Holland.

[12] The exact wording of the question is as follows: "Do you usually have an amount of money left over at the end of the month that you can save for larger purchases, emergency expenses or to acquire wealth? If yes, how much?"

information to calculate the consumer price index in each source country. The final piece of data from the WDI is GDP per capita (in constant 2010 US dollars) for all source countries in the sample.

Finally, we obtain data on political violence at the country level from the MEPV dataset. This dataset includes information on both interstate conflict and societal conflict. Interstate conflict covers international violence and international warfare, whereas societal conflict covers civil violence, civil warfare, ethnic violence and ethnic warfare. Each item is given a score from 1 (lowest) to 10 (highest). We use the aggregate political violence score, which is the sum of these six items.

4.1.1 Descriptive Statistics

Table 1 provides descriptive statistics on individual-level characteristics in panel (A) and on country-level characteristics in panel (B). Individual-level characteristics are further divided into two panels; panel (A1) gives descriptives for the 3,084 individuals in the sample whereas panel (A2) gives descriptives for the 11,643 person-age observations across the panel. According to panel (A1), the mean age at arrival is 30 and 65 percent of the household heads are male. Panel (A2) shows that 44 percent of the immigrants have positive savings and the mean amount of monthly non-negative savings is about 270 Euros. Given that monthly income is about 2,500 Euros, the saving rate (with the censored saving variable) is above 10 percent. In the panel, the average years since migration is 18 years and the average age is 47. While the fraction of observations in which individuals are married is 79 percent, the majority of the spouses and underage children reside in Germany. In terms of country-level characteristics, panel (B) shows that the average purchasing power parity is 2.37.

Figure A1: PPP of Selected Countries with Germany

Figure A2: Exchange Rate of Selected Countries with Germany

Figure A3: Log Price Level in Selected Source Countries

Figure A4: Log Price Level in Germany

4.2 Empirical Specification and Estimation

In order to test for the implications of the theoretical model regarding the relationship between immigrants' savings with the exchange rate, the price level in the home country and the price level in Germany, we use the following empirical specification,

$$s_{i,t} = \alpha_0 + \alpha_1\ er_{i,t} + \alpha_2\ p^H_{i,t} + \alpha_3\ p^G_t + X'_{it}\ \theta + \gamma_t + \varepsilon_{i,t}, \tag{28}$$

where $s_{i,t}$ is monthly savings of individual i at time t, $er_{i,t}$ is the exchange rate between Germany and individual i's home country at time t, $p^H_{i,t}$ is the price level at time t in the home country of individual i, p^G_t is the price level in Germany at time t, X_{it} stands for the set of control variables for individual i at time t, γ_t stands for time dummies, and ε is the error term. According to our model, we expect our key parameters of interest α_1 and α_3 to be positive and α_2 to be negative. To test the implications of our model regarding how the affects of our key macro-level variables change by years since migration, we modify the above specification as follows,

$$\begin{aligned} s_{i,t} \quad = \quad & \beta_0 + \beta_1 er_{i,t} + \beta_2(er_{i,t} * ysm_{it}) + \beta_3\ p^H_{i,t} + \beta_4(p^H_{i,t} * ysm_{it}) \\ & + \beta_5\ (p^G_t * ysm_{it}) + X'_i\delta + \gamma_t + \eta_{i,t}. \end{aligned} \tag{29}$$

where ysm_{it} is years since migration for individual i at time t and η is the error terms. Here, in accordance with our model, we expect β_1, β_2 and β_5 to be positive and β_3, β_4 to be negative.

The control variables, X, include the key characteristics of the household and household head pertaining their saving behavior: household income and household size (both in logarithmic form), dummies for unemployment, married, child abroad, and spouse abroad status of the household head, as well as duration of residence of the household head in Germany in quadratic form. We would expect savings to increase in household income but decrease in household size, and to decrease in unemployment status of the household head but to increase when the household head has a child or spouse living in the home country (which would stand

for a higher likelihood of return migration and, therefore, imply higher savings in the host country).

A potential specification concern in equation (28) is that our key macro-level variables could partly stand for other macro-level variables that also have a bearing on the saving rate. For instance, if there is a economic crisis in Turkey, not only the exchange rate and prices in Turkey would change but also family members back in Turkey could demand more remittances due to their lower income—which would need to come from migrants' savings. Similarly, an unexpected political conflict in Turkey could not only influence economic conditions and therefore the exchange rate with Germany, but also immigrants' return propensity to Turkey and, therefore, their savings. Hence, the control variables in X also include the GDP per capita in the source countries (in logarithmic form) as well as a political conflict index.

Macro-levels shocks in Germany could also be confounding the effects of our key macro variables in equation (28). Suppose that a negative economic shock changes natives' perception of immigrants in Germany. In that case, immigrants' propensity to return to their home country and, therefore, their saving behavior would change. This negative economic shock would also influence the exchange rate and prices in Germany. To account for these kind of shocks, we include calendar year dummies. These dummies–which are common for immigrants from different countries–capture the effect of macro-level shocks in Germany.

Finally, when we interpret equation (28) as a difference-in-differences framework where we compare countries over time, we are making the common-trend assumption across countries in savings. However, if there are different trends in savings across countries and the degree of trend is correlated with the change in macro-level variables, we would have a specification problem. To account for this possibility, we also add country-specific time trends to equation (28) as a robustness check.

We estimate equations (28) and (29) using four different panel data estimation methods. In the first two, we ignore the censored nature of savings, that is we consider savings which are negative and zero as a part of the continuous savings distribution, and carry out fixed-effects

OLS and first-differenced OLS estimations. In the other two methods, we account for the censored nature of savings by using Tobit type models with fixed-effects and with random-effects. Since unconditional fixed-effects Tobit models are biased, we use the semiparametric estimator for fixed-effects Tobit models developed by Honore (1992).

Do we need a discussion on unit roots on the choice between fixed effects and first differencing? Remember Tobit models are what we prefer.

4.3 Empirical Findings

NEED A MOTIVATING FIGURE 1 LIKE THAT IN YANG AND NEKOEI

4.3.1 Baseline Results

Table 2 presents the estimation results regarding the effect of the exchange rate and prices in the host and source countries on monthly savings. Proposition 1 is tested using the specification in equation (28) in odd-numbered columns, and proposition 2 is tested using the specification in equation (29) in even-numbered columns. As can be seen in all odd-numbered columns, the estimates confirm proposition 1—savings increase in the nominal exchange rate. The estimates are similar across the two OLS methods, wheras the estimates with the Tobit methods are higher—indicating a nonsignificant bias with the OLS estimates due to censoring. The estimates with the Honore Tobit Fixed Effect method, which eliminates time-invariant unobserved heterogeneity, are also larger in absolute terms than those with the Tobit random effects method. According to our preferred method, Hoore Tobit Fixed Effects method, a 10 percent increase in the nominal exchange rate increases montly savings by about 29 Euros, which is equivalent to a more than 10 percent increase given that mean savings is about 260 Euros. A 10-percent increase int he home country prices decreases monthly savings by about 30 Euros. Hence, the findings are completely in accordance with Proposition 1.

The evidence for Proposition 2 is given in the even-numbered columns in Table 2. That the positive effect of the nominal exchange rate and the negative effect of the home country price level are both stronger at higher values of duration of residence holds with all specifications but

the OLS FD method, where the results are statistically insignificant despite the right signs. This evidence is stronger with our prefered Tobit estimates. In order to understand how the effects of the exchange rate and home country prices change over duration of residence, we calcuate the joint effects of the two exchange rate variables and of the two home country price level variables and display these in Table 3. Before discussing Table 3, we should also point out that Table 2 provides evidence that the effect of the host country price level on migrants' savings increases in years since migration with the OLS FD method and the Tobit RE method, whereas the evidence with the Honore Tobit Fixed Effect barely misses the conventional levels with our baseline sample.

As can be seen from Table 3, the statistical evidence for the positive effect of the nomial exchange rate appears after 20 years of residence at the 5 percent level. At 20 years of residence, a 10-percent increase in the nominal exchange rate increases monthly savings by about 43 Euros. The magnitude of this effect is much higher at 30 years of residence, when a 10-percent increase in the nomial exchange rate increases monthly savings about 77 Euros—which is rougly equivalent to a 30-percent increase. The evidence for the negative effect of home country prices on migrants' savings appears at 15 years of residence at the 10 percent statistical significance level; and, the level of statistical significance increases to the 5 percent level at 20 years of residence and to the 1 percent level at 25 years of residence. At 20 years of residence, a 10-percent increase in the home country price level causes a 46-Euros fall in monthly savings of immigrants.

4.3.2 Tests by Return Intentions

Implications one and two are derived under the assumption that immigrants return at retirement. Therefore, we would expect these implications to be more relevant for immigrants who in fact intend to return. In this subsection, we test implications one and two for immigrants with stronger return intentions. This provides a validity check of our empirical results.

As discussed earlier, a strong and peculiar point of our dataset is that it provides annual

information on immigrants' return intentions. Using this information, we generate three subsamples: (i) a sample which includes immigrants who report an intention to return at least one year across the surveys, (ii) a sample that includes immigrants who report an intention to return at least 25 percent of the time across the surveys, (ii) a sample that includes immigrants who report an intention to return at least 50 percent of the time across the surveys. The disadvantage of the first sample is that it is more likely to include immigrants who stay in the sample for a longer time, whereas no such problem exists for the latter two samples. However, the sample size is smaller for the latter two samples. We also add a fourth subsample: the sample of guestworkers (sample B in the GSOEP). Guestworkers constitute the biggest subgroup of our baseline sample; more than 35 percent of the person-age observations come from this subsample. More importantly, guestworkers are significantly different from other immigrants in terms of their return intentions. While slightly less than 30 percent of all observations in our full sample indicate an intention to return, this percentage is about 54 for guestworkers.

Table 4 displays the estimation results of equations (28) and (29) for these four samples. As can be seen in odd-numbered columns, there is evidence for a positive effect of the nominal exchange rate and a negative effect of the home country price level on immigrants' savings across all four samples. However, the coefficent estimates are much higher in absolute terms than that in column (5) of Table 2. For instance, according to column (1), a 10-percent increase in the nominal exchange rate brings about a 63-Euros increase in monthly savings—compared to the 29-Euros increase in Table 2. Moreover, as the return intentions become gradually stronger from column (1) to column (3) to column (5), the absolute magnitudes of the coefficients also increase accordingly. This provides strong validation of our evidence in favor of Proposition 1. With the sample including individuals who indicate a return intention at least half of the time, in column (5), a 10-percent increase in the nominal exchange rate causes a 97-Euros increase in monthly savings. Given the mean monthly non-negative savings for this sample is 347 Euros, this amounts to a 28-percent increase. Finally, column (7) shows

that the coefficient estimates are similar in magnitude for the guestworker sample.

The coefficients of the interaction terms in even-numbered columns in Table 4 indicate that the estimates with these subsamples are also consistent with Proposition 2. However, only those in column (2) are statistically significant at the conventional levels. Despite being not statistically significant presumbably due to the smaller sample sizes, the interaction-term estimates in columns (4), (6), and (8) are similar in magnitude to those in column (2). In addition, the magnitudes of the interaction terms in Table 4 are somewhat bigger than those in column (5) of Table 2, as expected. Hence, the evidence in Table 4 supports the evidence in Table 2 in favor of Proposition 2.

4.3.3 Heterogeneity

individual characteristics: by gender, by education, by age at arrival, year of immigration (this we need in checking composition effect)

country charcteristics: distance,

4.3.4 Labor Market Outcomes

We also estimate equation (28) with earnings and hours workers as dependent variables, respectively, instead of monthly savings. (Cite Nekolei and Australian paper here).

4.3.5 Robustness Checks

- also show with respect to ppp - Appendix
- composition effect - as in Nekoei – THIS IS VERY IMPORTANT – this will be the main issue for the referees

  Our problem is not as acute as that in Nekoei – he uses pooled cross sections whereas we follow individuals over time.

  However, we are not problem free either.mostly due to concerns about selective return migration – control for return intentions explicitly (Yang, 2008)

??? NOT SURE restrict the sample for early comers, their immigration decision is not likely to be related to current values of key macro variables (Nekoei)

This problem should be less acute in panel data than in cross-section data

- Non-random attrition? As long as attrition is not related to the key variable of interest (macro-variables), we are fine. It also has low attrition, which is a crucial aspect for our identification strategy (Knies and Spiess, 2007). Do what Yang (2008). **Check whether attrition is correlated with the key macro-variables.**
- country-specific time trends
- timing of the macro-variables, earlier values, averages...
- Other Controls

  shorter regressions in the appendix

  credit risk in the home country? (correlated with gdp per capita and we might want to leave the referees some points, but investment important?)

  unemployment rate (in addition to or instead of log gdp)

  region and year interactions?
- drop immigrants from the five remaning developed countries - Belgium, Austria, USA, Canada, and Israel
- exclude Turks – are they driving the results?
- Permutation test in Nekolei
- Outlier values of monthly savings
- Hodrick-Prescott?
- include housholds with partner as an immigrant??

5 Concluding Remarks

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Table 1: Descriptive Statistics

	Mean	St. Dev.	Min	Max	Obs.
A) Individual-level Characteristics					
A1) Cross-Section Characteristics					
Year of Immigration	1991.88	13.39	1952	2013	3084
Age at Arrival	30.08	8.79	18	63	3084
Male	0.65	0.48	0	1	3084
A2) Panel-Level Characteristics					
Positive Savings	0.44	0.50	0	1	11,643
Average Monthly Savings (Euros)	269.80	610.67	0	17162.68	11,643
Annual Household Income (Euros)	29847.16	18798.86	0	339530	11,643
Years since migration	17.99	10.27	0	46	11,643
Age	47.13	10.35	19	64	11,643
Year	2001.97	6.84	1991	2012	11,643
Household Size	3.22	1.56	1	13	11,643
Employed	0.64	0.48	0	1	11,643
Married	0.79	0.41	0	1	11,643
Spouse abroad	0.01	0.11	0	1	11,643
Child abroad	0.03	0.17	0	1	11,643
B) Country-level Characteristics					
Purchasing Power Parity	2.37	1.18	0.83	10.58	11,643
Exchange Rate	236.90	1727.41	0.00	28509.52	11,643
Price in Home Country	7480.49	55267.47	0.00	966545.60	11,643
Price in Germany	89.09	9.94	70.19	104.13	11,643
Gross Domestic Product	13467.82	11145.58	186.92	49979.55	11,643
Country Conflict Index	0.75	1.34	0	7	11,643

Table 2: Effect of Exchange Rate and Prices on Monthly Savings – Full Sample

	Dependent Variable: Monthly Savings							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS FE	OLS FE	OLS FD	OLS FD	Honore Tobit FE	Honore Tobit FE	Tobit RE	Tobit RE
Log Exchange Rate	140.4**	12.7	137.1***	65.80	287.6*	-257.5	209.3***	-93.8
	[53.9]	[57.5]	[44.9]	[85.9]	[170.9]	[228.2]	[78.1]	[94.8]
Log Exchange Rate * YSM		8.8**		3.20		34.2***		21.2***
		[3.5]		[3.7]		[12.9]		[3.7]
Log Home C. Price	-127.7**	-23.1	-118.1***	-39.70	-299.3*	194.40	-221.3***	68.90
	[48.9]	[56.1]	[41.8]	[90.2]	[162.1]	[228.1]	[75.1]	[92.8]
Log Home C. Price * YSM		-7.7**		-3.2		-32.7**		-20.8***
		[3.3]		[4.6]		[13.7]		[3.7]
Log Host C. Price * YSM		9.7		133.8**		101.9		18.6***
		[29.1]		[58.8]		[66.1]		[3.6]
Observations	11,643	11,643	8,297	8,297	11,643	11,643	11,643	11,643
No. of households	3,084	3,084	1,385	1,385	3,084	3,084	3,084	3,084

Notes: The controls also include the logarithm of source country's GDP per capita, a control for political conflict in the source country, and year dummies as well as individual-level controls for log household income, log household size, dummies for employed, married, spouse abroad, child abroad, years since migration in 5-year intervals, and state of residence in Germany. Standard errors are clustered at the country of origin level in columns (1) to (4); there are 99 clusters in columsn (1) and (2) and 75 clusters in columns (3) and (4). Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Table 3: Effect of Exchange Rate and Prices on Monthly Savings at Selected Values of Years since Migration – Full Sample

A) Log Exchange Rate				B) Log Home Country Price			
YSM	Coef.	SE	Sign. Lev.	YSM	Coef.	SE	Sign. Lev.
0	-257.54	228.23		0	194.38	228.09	
5	-86.34	188.33		5	30.92	183.65	
10	84.86	164.91		10	-132.54	157.37	
15	256.06	165.14		15	-296.00	158.54	*
20	427.26	188.93	**	20	-459.46	186.65	**
25	598.46	229.05	***	25	-622.92	232.11	***
30	769.66	278.53	***	30	-786.38	286.78	***
35	940.86	333.23	***	35	-949.84	346.33	***
40	1112.07	390.97	***	40	-1113.30	408.64	***
45	1283.27	450.57	***	45	-1276.77	472.60	***

Notes: Coefficients and standard errors gives the joint estimates -- based on Honore Fixed Effect Tobit Estimates given in column (6) of Table 2 -- of the exchange rate variable and its interaction with years since migration in panel (A) and of the home country price variable and its interaction with years since migration in panel (B) at selected values of years since migration given in row headings. Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Table 4: Return Intentions and Effects of Exchange Rate and Prices on Monthly Savings - Honore Tobit Fixed Effects Estimates

Dependent Variable: Monthly Savings								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Return Intention at Least for One Year		Return Intention more than 25 Percent of the Time		Return Intention more than 50 Percent of the Time		Guestworker Sample	
Log Exchange Rate	628.0*	-167.8	840.2**	95.1	968.1*	299.9	838.8**	6.1
	[332.0]	[489.0]	[406.3]	[641.8]	[572.4]	[842.8]	[415.9]	[784.9]
Log Exchange Rate * YSM		43.0*		36.1		34.1		38.3
		[23.8]		[29.4]		[43.8]		[37.0]
Log Home C. Price	-668.9**	44.70	-884.9**	-166.2	-991.7*	-341.4	-821.5**	10.70
	[315.3]	[467.3]	[386.2]	[613.6]	[541.3]	[796.1]	[390.1]	[749.3]
Log Home C. Price * YSM		-40.0*		-36.4		-34.5		-40.1
		[24.2]		[29.9]		[43.8]		[37.4]
Log Host C. Price * YSM		185.5**		176.4*		216.3*		272.1**
		[92.8]		[106.8]		[128.8]		[124.2]
Observations	5,718	5,718	4,542	4,542	3,406	3,406	4,109	4,109
No. of households	1,050	1,050	934	934	799	799	519	519

Notes: The controls also include the logarithm of source country's GDP per capita, a control for political conflict in the source country, and year dummies as well as individual-level controls for log household income, log household size, dummies for employed, married, spouse abroad, child abroad, years since migration in 5-year intervals, and state of residence in Germany. Standard errors are clustered at the country of origin level in columns (1) to (4); there are 99 clusters in columsn (1) and (2) and 75 clusters in columns (3) and (4). Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Appendices

.1 Alternative Specification: All Savings Continuously Remitted to the Source Country in the form of Domestic Currency

(This subsection can possibly constitute an appendix) If all savings out of earnings abroad are immediately converted into domestic currency and remitted back to the source country, then assuming again that the change in PPP is due to a change in e, p^* or p at $t = \phi$, the migrant's optimal consumption rate abroad from time ϕ to T satisfies the following budget constraint.

$$e_0[A_0^* + \phi(w^* - p_0^* c_0^*)] + (T - \phi)e_1(w^* - p_1^* c_1^*) + R[\alpha_T e_1 w^* - \Pi_1^{1/\theta} p_1 c_1^*] = 0, \tag{30}$$

where we assume, as before, that pension income is received from abroad in the form of foreign currency. We then have

$$c_1^* = \frac{e_0[A_0^* + \phi(w^* - p_0^* c_0^*)] + [T - \phi + R\alpha_T]e_1 w^*}{p_1[(T - \phi)\Pi_1 + R\Pi_1^{1/\theta}]}. \tag{31}$$

The impact of a change in any of the components of PPP on c_1^* can be seen by differentiating eq. (31) with respect to each of the variables.

$$\frac{dc_1^*}{de_1}\frac{e_1}{c_1^*} = \frac{(T - \phi + \alpha_T R)}{\frac{e_0}{e_1 w^*}[A_0^* + \phi(w^* - p_0^* c_0^*)] + (T - \phi + R\alpha_T)} - \frac{T - \phi + \frac{R}{\theta}\Pi_1^{1/\theta - 1}}{T - \phi + R\Pi_1^{1/\theta - 1}} < 0, \ \forall \theta < 1, \tag{32}$$

$$\frac{dc_1^*}{dp_1^*}\frac{p_1^*}{c_1^*} = -\frac{T - \phi + \frac{R}{\theta}\Pi_1^{1/\theta - 1}}{T - \phi + R\Pi_1^{1/\theta - 1}} < 0 \tag{33}$$

$$\frac{dc_1^*}{dp_1}\frac{p_1}{c_1^*} = \frac{R\left(\frac{1-\theta}{\theta}\right)\Pi_1^{1/\theta - 1}}{T - \phi + R\Pi_1^{1/\theta - 1}} \gtrless 0 \Leftrightarrow \theta \lesseqgtr 1. \tag{34}$$

Comparing Eq. (21) with (32), we see that the last terms are identical, while the first term in (32) is smaller than unity. The elasticity of consumption with respect to the exchange rate in the setting where all assets are continuously remitted back home and held in the form of domestic currency is therefore algebraically smaller than if assets are accumulated in the form of foreign currency. But why should consumption abroad decline by more when the migrant

holds his savings in the form of domestic rather than foreign currency? Having done so, as a result of an increase in e, he experiences a capital loss on his savings when measured in terms of foreign currency. This calls for a relatively greater reduction in consumption abroad in response to an increase in e in order to generate the savings needed to meet his optimal consumption program after return. Thus the qualitative impact of an increase in the exchange rate on c^* is the same, regardless of whether the migrant remits savings continuously to the source country and holds them in the form of domestic currency, as we assume here, or holds savings in the form of foreign currency over the entire planning horizon, as we assumed earlier. This is important from the perspective of our study as we do not address the problem of what determines whether and what fraction of savings a migrant chooses to hold in the form of domestic currency. Our empirical analysis in the next section simply examines the impact of changes in PPP on the saving rate.

The effect of YSM on (32)-(34) is also identical to (24)-(26). Since the last two expressions, respectively, are the same, only the effect of ϕ on the elasticity with respect to the exchange rate deserves a further comment. As the last terms in (21) and (32) are identical, we need to consider only the effect of ϕ on the first term in (32). This is given by

$$\frac{d}{d\phi}\left\{\frac{T-\phi+\alpha_T R}{T-\phi+R\Pi_1^{1/\theta-1}}\left(\frac{w^*}{c_1^* p_1^*}\right)\right\} = -\frac{[A_0^*+(w^*-p_0^* c_0^*)(T+\alpha_T R)]e_1 w^*}{e_0\left[A_0^*+\phi(w^*-p_0^* c_0^*)+e_1 w^*(T-\phi+\alpha_T R)/e_0\right]^2} < 0. \tag{35}$$

Since (24) is negative (for $\theta < 1$), which is also the same as the effect of YSM on the last term in (32), we can conclude that the overall effect of YSM on (32) is unambiguously negative. These are qualitatively the same results we obtained earlier under the assumption that a migrant's savings are held in the form of foreign currency.

Appendices

A Appendix to Section 2

The optimal return date after a PPP shock becomes

$$\tau = \frac{\phi e_1(p_0^* c_0^* - p_1^* c_1^*) + T(\alpha e_1 w^* - w) - R(\alpha e_1 w^* - p_1 c_1)}{e_1(w^* - p_1^* c_1^*) - (w - p_1 c_1)}$$

and

$$\begin{aligned}
\frac{d\tau}{dp_1^*} &= \frac{1}{\Delta_\tau}\left\{\frac{e_1 c_1^*\left(1 + \frac{dc_1^*}{dp_1^*}\frac{p_1^*}{c_1^*}\right)(\tau - \phi) + (R - \tau)\frac{dc_1}{dp_1^*}}{e_1(w^* - p_1^* c_1^*) - (w - p_1 c_1)}\right\}, \\
\frac{d\tau}{dp_1} &= \frac{1}{\Delta_\tau}\left\{\frac{e_1 p_1^* \frac{dc_1^*}{dp_1}(\tau - \phi) + c_1\left(1 + \frac{dc_1}{dp_1}\frac{p_1}{c_1}\right)(R - \tau)}{e_1(w^* - p_1^* c_1^*) - (w - p_1 c_1)}\right\},
\end{aligned}$$

where

$$\begin{aligned}
\Delta_\tau &= 1 - \frac{(T - R)e_1 w^* \alpha'}{e_1(w^* - p_1^* c_1^*) - (w - p_1 c_1)} \gtrless 0, \\
1 + \frac{dc_1^*}{dp_1^*}\frac{p_1^*}{c_1^*} &= \frac{\theta - 1}{\theta}\frac{\Pi_1^{1/\theta - 1}}{\Pi_1^{1/\theta - 1} - 1} \gtrless 0 \Leftrightarrow \theta \gtrless 1, \\
\frac{dc_1}{dp_1^*} &= \frac{c_1}{p_1^*}\left(\frac{1 - 1/\theta}{\Pi_1^{1/\theta - 1} - 1}\right) \lesseqgtr 0 \Leftrightarrow \theta \lesseqgtr 1, \\
1 + \frac{dc_1}{dp_1}\frac{p_1}{c_1} &= \frac{1/\theta - 1}{\Pi_1^{1/\theta - 1} - 1} \gtrless 0 \Leftrightarrow \theta \lesseqgtr 1.
\end{aligned}$$

The expression for Δ_τ is unambiguously positive if $R/T > \theta$ and of ambiguous sign otherwise.

APPENDIX FIGURES AND TABLES

Table A1: Effect of Exchange Rate and Prices on Monthly Savings at Selected Values of Years since Migration – Samples with High Return Propensity

	Return Intention at Least for One Year			Return Intention more than 25 Percent of the Time			Return Intention more than 50 Percent of the Time			Guestworker Sample		
					A) Log Exchange Rate							
YSM	Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE	
0	-167.77	489.00		95.10	641.76		299.94	842.80		6.08	784.85	
5	47.06	405.49		275.76	531.75		470.34	679.93		197.55	630.38	
10	261.89	343.65		456.42	443.85		640.74	557.03		389.01	497.05	
15	476.71	316.47		637.09	393.17		811.15	504.21		580.47	406.28	
20	691.54	332.53	**	817.75	394.35	**	981.55	542.34	*	771.94	389.06	**
25	906.37	386.50	**	998.41	446.96	**	1151.95	655.75	*	963.40	453.86	**
30	1121.20	465.37	**	1179.07	536.09	**	1322.35	813.55		1154.87	573.51	**
35	1336.03	558.68	**	1359.73	646.79	**	1492.76	994.82		1346.33	721.22	*
40	1550.85	660.35	**	1540.40	769.83	**	1663.16	1188.89		1537.80	883.01	*
45	1765.68	767.05	**	1721.06	900.15	*	1833.56	1390.40		1729.26	1052.41	
					B) Log Home Country Price Level							
YSM	Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE	
0	44.68	467.26		-166.16	613.63		-341.40	796.08		10.68	749.25	
5	-155.29	382.23		-347.93	501.77		-513.81	633.27		-189.64	591.87	
10	-355.25	321.04		-529.70	414.53		-686.22	514.15		-389.96	457.34	
15	-555.22	298.71	*	-711.47	369.79	*	-858.63	472.97	*	-590.27	371.38	
20	-755.18	323.39	**	-893.24	382.75	**	-1031.04	528.30	*	-790.59	369.60	**
25	-955.15	386.17	**	-1075.02	448.43	**	-1203.45	656.15	*	-990.91	452.98	**
30	-1155.11	472.09	**	-1256.79	548.20	**	-1375.86	823.41	*	-1191.23	586.26	**
35	-1355.08	570.79	**	-1438.56	666.94	**	-1548.27	1010.70		-1391.54	743.05	*
40	-1555.04	676.71	**	-1620.33	796.19	**	-1720.68	1208.74		-1591.86	911.30	*
45	-1755.01	786.93	**	-1802.10	931.61	*	-1893.09	1413.02		-1792.18	1085.69	*

Notes: Coefficients and standard errors gives the joint estimates -- based on Honore Fixed Effect Tobit Estimates given in column (6) of Table 2 -- of the exchange rate variable and its interaction with years since migration in panel (A) and of the home country price variable and its interaction with years since migration in panel (B) at selected values of years since migration given in row headings. Note that the specifications for the guestworker sample do not include dummies for state of residence due to convergence problems that occur otherwise.Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Table A2: Effect of Purchasing Power Parity on Monthly Savings – Full Sample

Dependent Variable: Monthly Savings								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS FE	OLS FE	OLS FD	OLS FD	Honore Tobit FE	Honore Tobit FE	Tobit RE	Tobit RE
Log PPP	117.8**	-20.9	126.9***	54.2	305.1*	-87.5	230.9***	-34.5
	[48.2]	[81.5]	[42.5]	[87.2]	[158.9]	[208.5]	[74.4]	[88.9]
Log PPP * YSM		9.7**		4.3		26.3**		19.1***
		[4.5]		[3.8]		[12.7]		[3.5]
Observations	11,643	11,643	8,297	8,297	11,643	11,643	11,643	11,643
No. of households	3,084	3,084	1,385	1,385	3,084	3,084	3,084	3,084

Notes: The controls also include the logarithm of source country's GDP per capita, a control for political conflict in the source country, and year dummies as well as individual-level controls for log household income, log household size, dummies for employed, married, spouse abroad, child abroad, years since migration in 5-year intervals, and state of residence in Germany. Standard errors are clustered at the country of origin level in columns (1) to (4); there are 99 clusters in columsn (1) and (2) and 75 clusters in columns (3) and (4). Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Table A3: Return Intentions and Effect of Purchasing Power Parity on Monthly Savings - Honore Tobit Fixed Effects Estimates

Dependent Variable: Monthly Savings								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Return Intention at Least for One Year		Return Intention more than 25 Percent of the Time		Return Intention more than 50 Percent of the Time		Guestworker Sample	
Log PPP	706.3**	227.3	912.3**	553.1	998.3*	544.8	806.8**	16.5
	[311.3]	[435.2]	[374.8]	[540.5]	[530.8]	[649.8]	[370.7]	[551.3]
Log PPP * YSM		26.3		18.2		23.3		38.9
		[22.9]		[27.5]		[38.6]		[30.3]
Observations	5,718	5,718	4,542	4,542	3,406	3,406	4,109	4,109
No. of households	1,050	1,050	934	934	799	799	519	519

Notes: The controls also include the logarithm of source country's GDP per capita, a control for political conflict in the source country, and year dummies as well as individual-level controls for log household income, log household size, dummies for employed, married, spouse abroad, child abroad, years since migration in 5-year intervals, and state of residence in Germany. Note that the specifications in columns (7) and (8) for the guestworker sample do not include dummies for state of residence due to convergence problems that occur otherwise. Standard errors are clustered at the country of origin level in columns (1) to (4); there are 99 clusters in columsn (1) and (2) and 75 clusters in columns (3) and (4). Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.