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Abstract

This paper examines how immigrants' migration duration and saving decisions in the host country respond to changes in purchasing power parity (ppp) as well as in the wage ratio between the host and source countries. For this purpose, I develop a model of immigrants' joint migration duration and saving decisions and derive comparative static results regarding the impact of ppp and wage ratio on these decisions. An interesting implication of the theoretical model is that immigrants may in fact stay longer in the host country as a result of an increase in ppp, in particular those with a low degree of relative risk aversion. I test the implications of this model using a longitudinal data set that includes immigrants from four different source countries in Germany and employing panel data estimation methods. The empirical results reveal that an increase in ppp decreases the optimal migration duration. Moreover, optimal migration duration is elastic with respect to ppp. An interesting empirical finding is that, holding individual immigrant characteristics constant, immigrants from poorer source countries have a shorter migration duration than immigrants from wealthier source countries. The empirical results also reveal that ppp has a positive effect on saving rate, which is consistent with the implications of the model, and that saving rate is also elastic with respect to ppp.

JEL Classification Codes: F22, J61

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1 Introduction

In 2000, 175 million people, about 3 percent of the world's population were living in a country in which they were not born (United Nations). The migrant stock in developed countries increased from 29 to 89 million people from 1960 to 2000 (World Bank). According to Hatton and Williamson (2002), gross flows of migrants have increased faster than the net flows because return migration has become more common. While 2.8 million people left developing countries for developed countries in the 1960-65 period, this number increased to 13.6 million people in the 1995-2000 period (World Bank). The fivefold increase in the flows from developing to developed countries compared to threefold increase in the stock in developed countries attests to the increasing importance of return migration. The level of return migration from several host countries has been high as well. According to the German Federal Statistics Office, between 1962 and 2005, while about 800 thousand migrants entered Germany on average annually, more than 560 thousand left. Jasso and Rosenzweig (1982) report that of the 1971 cohort of immigrants in the U.S., the fraction that returned by 1979 could be as high as fifty percent.

A number of conjectures have been postulated in order to rationalize return migration decisions. In this paper, the reason that immigrants return to their home countries is the higher purchasing power of savings accumulated in the host country after returning to the home country due to lower prices there.[1] Therefore, in this case, return migration can be interpreted as a part of optimal life-cycle location decisions because at the time of in-migration decision immigrants know that it will be optimal for them to return after they accumulate a certain amount of savings (Borjas, 1994). In the savings accumulation model, immigrants make joint migration duration and saving decisions. Two key characteristics of source countries that influence the migration duration and saving decisions of immigrants are purchasing power parity (for instance, if purchasing power parity is 2, while a unit of savings buys one apple in the host country, it buys two apples in the home country) and relative wages between the host and source countries. This paper examines how purchasing power parity (ppp) and relative wages influence immigrants' migration duration and saving choices.

Using a model of joint consumption and migration duration decisions, I first derive comparative statics results on the impact of ppp as well as relative wages on the optimal migration

[1] This motivation for return migration has been used in a number of papers: Djajic,1988; Dustmann, 1997, 2003; Stark et al., 1997.

duration and saving decisions of immigrants. Then, in the empirical part of the paper, I test the comparative statics results obtained from the model using a rich longitudinal data set on immigrants from various source countries (Turkey, Greece, Italy, and Spain) in Germany. The empirical context is appropriate for testing the hypotheses derived from the savings accumulation model because the empirical literature has provided ample evidence on the savings accumulation motivation for the immigrants originating from these Mediterranean countries. Kırdar (2008), using the same data set, reports that these immigrants' return realizations in fact respond to the purchasing power parity between Germany and the source countries. If these immigrants are in Germany to save, we would expect their saving rates to be high right after arrival. In fact, Kumcu (1989) finds quite high saving rates for Turkish immigrants in Germany. In addition, examining Turkish return migrants from Germany in Turkey, Dustmann and Kirchkamp (2002) observe that very few are wage earners and most live on their savings.

The findings of this paper within a savings accumulation model has applicability to a much wider context as the empirical literature on migration boasts evidence that immigrants in several parts of the world in fact have a savings accumulation motivation. Yang (2006) shows that return migration of Philippine migrants depends on the exchange rate with the host countries. Massey and Espinosa (1997) find that return migration of Mexican immigrants in the U.S. responds to prices in Mexico.

Understanding how ppp and relative wages influence migration duration and saving choices is important due to a number of reasons. While some immigrants originate from poor countries, other immigrants come from countries with relatively similar characteristics to those of the host country. For instance, are intra-European immigrants from high wage and low purchasing power parity countries or immigrants from developing countries with low wage and high purchasing power parity more likely to stay longer? A second reason is related to policy instruments used by source countries: several source countries implemented exchange rate policies to attract more savings from immigrants. To understand the impact of this policy, it is important to understand the impact of ppp on not only the saving but also the migration duration decision of immigrants because both decisions determine the level of accumulated savings at the time of return. Another reason is simply to understand the changes in immigrants' behavior in response to the changes in the macroeconomic environment. How does migration duration change if the economic disparity, and therefore relative wages, or the purchasing power parity between host and source countries changes,

for instance as a result of fast economic growth or an economic crisis in the source country? Purchasing power parity fluctuates over time substantially for many source countries. For instance, that between Germany and Turkey increased by 35 percent in the aftermath of the 1994 financial crisis in Turkey.

The simple model I use is an extension of that used by Stark et al. (1997) in their theoretical paper, which examines the impact of ppp on optimal migration duration also in a framework of joint consumption and migration duration decisions. Using a specific utility function in their analysis, the logarithmic function, Stark et al. find a negative impact of ppp on migration duration. This paper improves on it in a number of dimensions. First, it allows for a more general utility function – where there is a parameter governing the risk aversion level of immigrants –, which yields more general comparative statics results that depend on the risk aversion level of immigrants. Second and more importantly, my paper also includes an empirical section that tests the hypothesis derived from the model. Finally, the scope of this paper is wider in the way that it also examines the impact of ppp on the saving behavior of immigrants as well as the impact of relative wages between the host and source countries on the migration duration and saving decisions. Dustmann (2003), in fact, studies the impact of the wage differential on the optimal migration duration, using the same data set, and finds that optimal migration duration may decrease as the wage differential grows. Dustmann (2003) uses individual level wages to control for the wage differential whereas this paper examines the impact of aggregate expected wage ratio between the host and source countries.

Both micro- and macro-level data are used in the estimation. The micro-level data come from the German Socioeconomic Panel, which includes a random sample of immigrants from certain source countries in Germany in 1984, who are followed up each year. The macro-level data are ppp and wages from 1984 to 2000. The impacts of ppp and relative wages are identified through the cross-country variation in each calendar year. Moreover, the impacts of these two key variables are allowed to vary by immigrants' age, which is an important determinant of other demographic characteristics, like household size, that would affect the importance of ppp and relative wages in immigrants' migration duration and saving choices. In the estimation, panel data methods are used.

An interesting implication of the theoretical model, not recognized by the previous theoretical literature, is that for certain immigrants – those with a high willingness to substitute consumption intertemporally – an increase in ppp can in fact increase the optimal migration

duration. However, numerical solutions of the model illustrate that in most cases a higher ppp implies a shorter optimal migration duration. This paper also conducts the first empirical testing, to my knowledge, of the impact of ppp on optimal migration duration[2], which reveals that the impact of ppp on optimal migration duration is negative and large. A 10 percent increase in ppp lowers the migration duration of a 30-year-old entrant by 20 percent.

Stark et al. (1997) claim that immigrants originating from poorer countries may in fact stay shorter in the host country if the impact of a higher ppp in shortening the optimal migration duration dominates the impact of lower relative wages in lengthening the optimal migration duration. This paper shows empirically that this is possible: immigrants facing Turkish ppp and relative wage values have a shorter predicted migration duration than immigrants facing the ppp and relative wage values of wealthier EU countries in the sample, when all other characteristics of immigrants are the same.

Galor and Stark (1990) show theoretically that immigrants would save more than the natives as they face lower prices after returning to their home countries. In a similar vein, the theoretical part of this paper shows that immigrants who face a higher purchasing power parity after return would save more. The empirical section of the paper confirms this finding. Purchasing power parity has a positive impact on the saving rate, which is also large in magnitude: a 10 percent increase in ppp increases the saving rate of a 20-year-old entrant in his first year of residence in Germany by 18.4 percent.

The next section describes the theoretical model. Section 3 explains the data set and presents some descriptive statistics. Section 4 covers the estimation method and section 5 presents the empirical results. Section 6 concludes.

2 Model

I write a simple model of joint consumption and migration duration decisions. In this model, the return of immigrants to their home countries, despite higher earnings in the home country, are rationalized by the higher purchasing power of savings accumulated in the host country

[2]The impact of relative prices on other return migration outcomes have been analyzed by the recent empirical literature. Yang (2006) examines the effect of exchange rate between the host and source countries on the return rate of Philippine immigrants from various host countries. Similarly, Kırdar (2008) investigates the impact of ppp on return rates of immigrants in Germany. The impact of relative prices on other decisions of immigrants is also analyzed. Yang (2008) measures the impact of exchange rate variations on immigrants' remittance decisions.

after returning to their home country due to lower prices there.

2.1 Basic Structure

In the optimization problem shown below, τ denotes the remaining worklife and t the duration of residence in the host country Immigrants preferences depend on consumption in the host country (c_1) and consumption in the home country after return (c_2) according to a per-period utility function, $u(.)$. The utility maximization problem of immigrants is subject to a number of constraints. The first one is a lifetime budget constraint, where p denotes the purchasing power parity between the host and home countries, y_g the real wage rate in the host country, and y_h the real wage rate in the home country. The second one is a minimum consumption constraint: immigrants' consumption in the host country can not fall below a minimum consumption level, denoted by $c_{\min}$. Finally, duration of residence obviously has to lie between zero and the duration of remaining worklife.

$$\begin{aligned} \max_{t,\ c} \quad & tu(c_1) + (\tau - t)u\,(c_2) \\ s.t. \quad & ptc_1 + (\tau - t)c_2 \leq pty_g + (\tau - t)y_h \\ & y_g \geq c_1 \geq c_{\min}, \quad \tau \geq t \geq 0 \end{aligned}$$

In the above problem, purchasing power parity is taken to be greater than one ($p > 1$) and the real wage rate in the host country is higher than the real wage rate in the home country ($y_g > y_h$). While the former assumption is required to rationalize the return migration decision, the latter condition is the reason why these foreign workers are in the host country. I choose a constant relative-risk aversion utility function,

$$u(c) = \begin{array}{ll} c^\alpha/\alpha & \alpha < 1,\ \alpha \neq 0 \\ \ln(c) & \alpha = 0 \end{array}$$

because this functional form allows me to examine how the optimal migration duration and consumption decisions of immigrants vary by the curvature of the utility function (or by immigrants' risk aversion or their willingness to substitute consumption intertemporally). The relative risk aversion is measured by $1 - \alpha$ and elasticity of intertemporal substitution of consumption is $1/1 - \alpha$.

2.2 Characterization of the Solution

First, I characterize the solution to the above problem assuming that the optimal solution is an interior one.[3] (At the end of this section, numerical solutions that also allow for corner solutions are illustrated.) Since the utility function is monotonic, the budget constraint binds. Therefore, I can replace c_2 in the objective function with $\left(y^H + \frac{p.t.\left[y^G - c_1\right]}{(\tau - t)}\right)$ and write the first order conditions for an interior optimal point as follows:[4]

$$u(c_1) + \frac{p.\left[y^G - c_1\right].\tau}{\tau - t} u'\left(y^H + \frac{p.t.\left[y^G - c_1\right]}{(\tau - t)}\right) = u\left(y^H + \frac{p.t.\left[y^G - c_1\right]}{(\tau - t)}\right) \quad (1)$$

$$u'(c_1) - p.u'\left(y^H + \frac{p.t.\left[y^G - c_1\right]}{(\tau - t)}\right) = 0 \quad (2)$$

The left-hand-side of equation 1 is the benefit of staying for one more period in the host country: the first term is the utility from consumption in the host country for one more period and the second term is the utility from the consumption of added savings, acquired by staying an additional period in the host country, after returning to the home country. The right hand side of equation 1 is the utility from consumption for one period in the home country. Equation 2 is the familiar consumption smoothing condition: the marginal utility of consumption is set equal across periods after accounting for the price differences in different periods.

When the F.O.C.'s given in equations 1 and 2 are solved for this utility function, the following optimal migration duration and consumption decision rules are found:

$$t^* = \frac{\tau(1-\alpha)p^{\alpha/(\alpha-1)}\left(y_h/y_g\right) + \tau\left[\alpha p - \left(y_h/y_g\right)\right]}{\left(1 - p^{\alpha/(\alpha-1)}\right)\left[p - \left(y_h/y_g\right)\right]} \quad (3)$$

$$c^* = \frac{\alpha p^{1/(\alpha-1)}\left(py_g - y_h\right)}{(1-\alpha)(1 - p^{\alpha/(\alpha-1)})} \quad (4)$$

The above consumption decision rule gives the following optimal consumption rate.

$$c^*/y_g = \frac{\alpha p^{1/(\alpha-1)}\left[p - \left(y_h/y_g\right)\right]}{(1-\alpha)(1 - p^{\alpha/(\alpha-1)})} \quad (5)$$

[3] Since the objective function is continuous and the constraint set for (t, c) is closed and bounded, there exists an optimal solution to this problem according the Extreme Value Theorem. Moreover, since the objective function is a strictly concave function (it is a non-negative summation of two strictly concave functions) and the constraint set is convex, the solution is unique.

[4] These F.O.C. are both necessary and sufficient. Since the objective function is a non-negative summation of concave functions, it is concave. Moreover, the constraint set is convex. Therefore, the first order conditions are sufficient.

The optimal migration duration is a function of the decision period, curvature parameter, purchasing power parity, and relative wages. An interesting feature of this function is that it is the ratio of the wages that matter, not their levels. The saving rate, $1-c^*/y_g$, also depends on the wage ratio, not on the levels of wages. In the consumption smoothing problem of the migrant in different locations, the ratio of the wages determines the fraction of the host country wage that must be saved in order to smooth consumption. For instance, if both host and home country wages were to double, the fraction of the host country wage that must be saved in order to smooth consumption does not change even though the amount of it changes. In addition, since this increased in amount but not in proportion saving levels make the same proportional increase in the host country earnings after return (compared to the baseline case), it takes the same amount of time in the host country to accumulate these savings. However, the fact that we are assuming an interior optimal point is critical here; if the minimum consumption constraint were binding, this result would obviously not hold. When the minimum consumption constraint binds, a higher wage rate in the host country also implies a higher saving ability. This could change the saving rate as well.

2.3 Comparative Statics

Here, I investigate how optimal migration duration and consumption choices respond to changes in purchasing power parity and relative wages.

2.3.1 Relative Wages and Optimal Migration Duration and Consumption Choices

Equations 6 and 7 give the marginals of the optimal migration duration and the optimal consumption rate with respect to the wage ratio, respectively. The results are summarized in Proposition 1.

$$\frac{\partial t^*}{\partial \left(y_h/y_g\right)} = \frac{p\tau\left(\alpha-1\right)}{\left[p-\left(y_h/y_g\right)\right]^2} < 0 \tag{6}$$

$$\frac{\partial (c^*/y_g)}{\partial \left(y_h/y_g\right)} = \frac{-\alpha p^{\frac{1}{\alpha-1}}}{\left(1-\alpha\right)\left(p^{\frac{\alpha}{\alpha-1}}-1\right)} > 0 \tag{7}$$

Proposition 1 *As the ratio of home country wage rate to host country wage rate increases, both the optimal migration duration and the saving rate in the host country decreases.*

2.3.2 Purchasing Power Parity and Optimal Migration Duration and Consumption Choices

Using equations 6 and 7, I also examine how the optimal migration duration and consumption choices respond to changes in purchasing power parity. The partial derivative of optimal migration duration with respect to purchasing power parity is given in equation 8.

$$\frac{\partial t^*}{\partial p} = \frac{\tau}{(\alpha-1)\left(y_h - p y_g\right)^2 \; p\left(p^{\frac{\alpha}{\alpha-1}} - 1\right)^2} * \tag{8}$$
$$\left\{-y_g y_h(\alpha-1)^2\left(p^{1/2} - p^{\frac{3\alpha-1}{2(\alpha-1)}}\right)^2 - 2\alpha^2 p^{\frac{2\alpha-1}{\alpha-1}} y_g y_h + p^{\frac{3\alpha-2}{\alpha-1}}\alpha^2 y_g^2 + p^{\frac{\alpha}{\alpha-1}}\alpha^2 y_h^2\right\} \lesseqgtr 0$$

The sign of $\partial t^*/\partial p$ is ambiguous. While the first two terms inside the curly brackets are negative, the last two are positive. In the numerical solutions presented later in this section, it is shown that depending on the values of the parameters, $\partial t^*/\partial p$ can, in fact, be of either sign.

This finding that a higher purchasing power parity implies a longer optimal migration duration in certain cases is a new one. Stark et al. (1997) established a negative relationship between purchasing power parity and optimal migration duration; however, their analysis was based on a specific utility function, the logarithmic function, whereas my analysis allows for a general type of utility function.[5]

It is also important to understand the impact of ppp on host country consumption because since immigrants make joint consumption and optimal migration duration decisions, any impact of ppp on host country consumption will have an impact on the optimal migration duration as well. Equation 9 displays the partial derivative of optimal consumption in the home country with respect to purchasing power parity. The sign of this partial derivative is not immediately obvious from the equation; however, it is shown in the appendix that $\partial c^*/\partial p$ is, in fact, negative.

$$\frac{\partial c^*}{\partial p} = \frac{\alpha\left(y_h - p^{\frac{\alpha}{\alpha-1}} y_h - p\alpha y_g + p^{\frac{\alpha}{\alpha-1}}\alpha y_h\right)}{p^{(\alpha-2)/(\alpha-1)}\left(\alpha-1\right)^2\left(p^{\frac{\alpha}{\alpha-1}} - 1\right)^2} < 0 \tag{9}$$

[5] In fact, it is straightforward to show that the partial derivative of optimal migration duration with respect to ppp, given in equation 8, is negative for a logarithmic utility function as Stark et al (1997) claim. However, this is not the case in general.

Proposition 2 *The impact of purchasing power parity on optimal migration duration can take either sign whereas the impact of purchasing power parity on saving rate in the host country is always positive.*

Galor and Stark (1990) show that the probability of return migration would induce immigrants to save more than the natives; however, they do not examine the relationship between immigrants' saving behavior and purchasing power parity. Here, I show that, ceteris paribus, immigrants' from poorer countries save more in the host country compared to immigrants from relatively wealthier source countries.

Special Case: $y_h = 0$ Next, I investigate how immigrants' optimal migration duration and consumption decisions respond to purchasing power parity when they are not intending to work as wage-earners after returning to their home country. This restriction allows drawing more general conclusions regarding the impact of purchasing power parity on optimal migration duration. However, it is not a restriction made only for tractability; it has empirical relevance in many immigration contexts as many immigrants who migrate to the host country to work and accumulate savings are not willing to work as wage-earners in their home country after return. For instance, Dustmann and Kirchkamp (2000) report, based on a sample of Turkish return migrants from Germany in Turkey, less than five percent worked as wage-earners. Massey and Espinosa (1997) report that return migration of Mexican immigrants do not respond to the home country vs. host country wage ratio much.

Here, I focus on the impact of purchasing power parity on optimal migration duration only as the its impact on consumption decision has an unambiguous effect in the general case. In the case that immigrants do not plan to work as wage-earners in their home country after return, the partial derivative of optimal migration duration decision with respect to purchasing power parity is given in equation 10. Unlike the general case above, the partial derivative of optimal migration duration with respect to purchasing power parity is always negative.

$$\frac{\partial t^*}{\partial p} = \frac{\tau p^{\frac{1}{\alpha-1}} \alpha^2}{(\alpha-1)\left(p^{\frac{\alpha}{\alpha-1}}-1\right)^2} < 0 \tag{10}$$

Proposition 3 *In the case that immigrants do not plan to work as wage-earners after returning to their home country, optimal migration duration decreases in purchasing power parity.*

2.4 Numerical Solutions

In this subsection, I provide numerical solutions to immigrants' joint migration duration and consumption decisions accounting for corner solutions, which are displayed in Table 1. The home country real wage rate is set to 75 percent of host country real wage rate in the first panel, to 50 percent of it in the second panel, and to 25 percent in the third. Each panel displays how optimal consumption and migration duration changes as purchasing power increases for various values of the curvature parameter. Whenever the minimum consumption constraint is binding, the optimal migration duration for an interior solution (minimum consumption constraint not enforced) is also given in parenthesis.

As can be seen from Table 1, the optimal migration duration decreases as purchasing power parity increases in most cases, but not all. In fact, when the curvature parameter and the wage rate in the home country are sufficiently high, optimal migration duration increases with purchasing power parity at certain ranges of ppp. (These are displayed in bold.) For instance, when the wage rate in the home country is seventy-five percent of that in the host country and the curvature parameter is 0.7 or higher, the optimal migration duration increases with ppp at certain ranges of ppp. One could wonder if this arises due to the imposition of the minimum consumption constraint because wherever $\partial t^*/\partial p$ is positive in Table 1, the minimum consumption constraint binds. However, an examination of the optimal migration durations when the minimum consumption constraint is not imposed reveals that the fact that $\partial t^*/\partial p$ is positive at certain ranges of ppp when the curvature parameter is high enough still holds. In fact, it now widens in terms of the range of the wage rate in the home country after return: a positive $\partial t^*/\partial p$ is observed in the second and third panels of Table 1 (where the wage ratio is 0.5 and 0.25, respectively), as well. This confirms that the interior solution characterization of $\partial t^*/\partial p$ in equation 8, in fact, takes either sign.

2.4.1 Interpretation

There are two separate effects of increasing ppp. On one hand, consumption in the home country after return increases; therefore, immigrants want to spend a larger fraction of their worklife in their home country. (This is the income effect.) On the other hand, the returns to staying longer in Germany and accumulating more savings, i.e. the opportunity cost of return, also increases (substitution effect). According to Table 1, while the income effect dominates for most immigrants, the substitution effect dominates for immigrants who are less risk averse (more willing to substitute consumption intertemporally). Immigrants who

are more willing to substitute consumption intertemporally are, by definition, more patient about saving in the host country in order to enjoy its benefits in the form of high consumption after return. Therefore, the increase in the opportunity cost of return due to a higher ppp is larger for them. This makes it possible for them that migration duration increases in ppp.

In addition, there is the indirect effect resulting from the change in consumption behavior. A higher purchasing power parity increases savings in the host country. This strengthens the income effect: immigrants accumulate savings faster and the effect of increased ppp in rising consumption after return becomes stronger. This indirect effect – which decreases optimal migration duration – is also weaker for immigrants who are less risk averse because first these immigrants already save more as a result of their higher willingness to substitute consumption intertemporally, therefore there is less room for an increase in their savings; second, again due to their already high saving rates, the minimum consumption level binds immediately, therefore, it is less likely that their saving behavior will change at all.

Another important fact in Table 1 is that a positive effect of ppp on migration duration is more likely when the home country expected wage rate is higher. As illustrated in the model, as the home country expected wage rate increases, optimal migration duration decreases. Therefore, for a given value of the curvature parameter, immigrants who face higher earnings in their home country return earlier with lower savings. Since they return with lower savings, the income effect resulting from a higher ppp is weaker for them. Moreover, since they face a longer duration of time in their home country after return, the substitution effect is stronger for them. Therefore, conditional on a high enough curvature parameter (low enough risk aversion), a positive impact of ppp on optimal migration duration is more likely when the expected wage rate in the home country is higher. In addition, conditional on the curvature parameter and ppp, the minimum consumption level is more likely to be binding when the expected wage rate in the home country is higher. Therefore, the indirect effect through consumption, which decreases optimal migration duration, is less likely to play a role in this case.

3 Data

The data set used in this study is the German Socioeconomic Panel (GSOEP). This is a longitudinal data set conducted every year since 1984. I use the 1984 to 2000 waves in this study. The nice feature of this data set is that it contains an over-sampled group of immi-

grants from five different source countries: Turkey, ex-Yugoslavia, Greece, Italy and Spain. I do not include the ex-Yugoslavian immigrants in this study due to the split of the original country into numerous new countries during the time frame of this study. Many of these immigrants entered Germany in the 1960's and 1970's under the bilateral agreements signed by these source country governments with the German government (guestworker recruitment scheme). Since the first wave of the data set is a representative sample of the stock of immigrants from these source countries in Germany in 1984, many of these immigrants had already been in Germany for some time in the initial wave of the study.

The sample is restricted to households with a male household head who was 18 or older at arrival. This age restriction is made because these immigrants must have made the initial immigration decision themselves given the interpretation of return migration as part of optimal life-cycle migration decisions in the underlying model that is tested.

The variable used for measuring immigrants' migration duration is their intended migration duration. In every survey year, immigrants are asked about how long more they are planning to stay in Germany in number of years. This information along with the duration of residence at the time of survey is used to generate the intended migration duration at each survey year. When the intended age of return exceeds 65 (age of retirement), intended migration duration is taken as the time remaining until age 65. Given the longitudinal nature of the data set, this feature allows me to follow the changes in the intended migration duration for a person over time. This is the major reason why I use data on intended migration durations rather than realized values of this variable. Besides, migration duration generated based on return migration realizations would be right-censored.

The data on the other decision variable, saving rate, are generated using the information on annual savings and household income. The survey includes a question on monthly savings, which is converted to annual level. This information on saving behavior is available only after 1991. An important feature of the saving data is that they are censored below at zero because only positive amount of savings are examined in the survey: the survey first asks whether immigrants saved any, and if so how much. Therefore, some of the saving values registered as zero could, in fact, be negative.

Age and duration of residence are two important micro-level control variables used in the estimation, which are generated using the information on year of birth and year of immigration to Germany, respectively. A number of other individual-level characteristics are used including marital status of the household at arrival, whether the household head had

any children at arrival (in either country), whether the household head arrived after 1973 - last year of guestworker recruitment –, and high school as well as college graduation status of the household head.

Macro-level data are also used in the estimation. In fact, the two key variables in this study are macro-level variables. Purchasing power parity and wage ratio exhibit variation over country of origin and calendar year. In calculating the expected wage ratio, adjustments are made for the variation in aggregate unemployment rate and replacement rate of the unemployment benefits in the source countries.

3.1 Descriptive Statistics

Figure 1 displays, in the first panel, the distribution of the age at arrival for the 828 people in the sample and the age distribution for the 7,754 person-time observations in the full sample. These immigrants are on average quite young at the time of arrival: the median age at arrival is 26 and 95 percent of the immigrants are under the age of 40 at arrival. On the other hand, when we examine the age distribution in the full sample, we see that the median age of immigrants in all observations is much higher at 50 and that in only 15 percent of the observations are immigrants under the age of 40. The reason to this discrepancy between age at arrival and the age distribution in the full sample is shown in the first panel of Figure 2, which illustrates the distribution of duration of residence in the full sample. The median duration of residence in all observations is 20 years. Only in 5 percent of the observations, a duration of residence that is less than 10 years is reported. There are two reasons to this: first, many immigrants arrived Germany much earlier than 1984, the first year the sample is drawn; second, the sample covers a period of 17 years after 1984.

The second panel of Table 2 presents the distribution of intended migration duration. The median intended duration of residence is 33 years. This high value is not a surprise given the similarly high value for the median duration of residence. The more important fact about the distribution of intended migration duration is the fraction of immigrants who report an intention to return back before the age of retirement. Of the 827 people in the sample, only 121 (14.6 percent) consistently report an intention of staying until retirement. For the rest of the people in the sample, we observe variation in the intended migration duration over time.[6]

[6] A no-return decision corresponds to $t^* = \tau$ in the theoretical model.

Figure 3 shows how intended migration duration varies according to the current duration of residence. As expected, intended migration duration increases in current duration of residence. At arrival, intended migration duration averages at around 10 years. Intended migration duration rises to 30 years at about 15 years of residence, and to 40 years at about 30 years of residence. In addition, the trend is close to being linear. (In this figure, obviously, the group of people with 15 years of residence are different from the group of people at arrival in that they chose to stay in Germany for fifteen years.)

Figure 4 presents the mean saving rate by duration of residence. Saving rate is more volatile over time compared to intended migration duration due to the smaller sample size. One of the most salient features of the saving rate profile is its declining trend. Saving rate is between 10 and 12 percent at 10 to 12 years of residence. However, it drops to a level just above 4 percent between 20 and 25 years of residence, and it roughly stabilizes thereafter. These saving rates are rather low, which seems to contradict the saving accumulation motive underlying the theoretical model.[7] However, we should also realize that most of these immigrants are low-income workers with limited saving ability. More importantly, we only observe the saving rate after 10 years of residence in Germany. However, the literature is full of evidence of very high saving rates for these immigrants after arrival. For instance, Paine (1974), using a study carried out by the State Planning Organization of Turkey in 1971 –when all Turkish guestworkers would be in Germany for less then ten years and most for less than four years– calculates a 36 percent saving rate. Using a similar survey to that of Paine, conducted by the Central Bank of Turkey in 1986, which contains information on immigrants' income and savings according to their duration of residence in Germany, I find a saving rate of 39 percent for Turkish immigrants with less than four years of residence. Similarly, Kumcu (1989) reports quite high saving rates for Turkish immigrants in Germany after arrival. We could reconcile these findings of the literature as to the high saving rates in the early years after arrival with the relatively much lower saving rates after ten years of residence, reported in this paper as well as in Bauer and Sinning (2005), with a declining saving rate profile over time. In fact, even after ten year of residence, there is evidence for a declining trend.

Table 1 presents the mean values for micro-level variables by country of origin as well as

[7] Bauer and Sinning (2005) find that immigrants' saving rate is, in fact, lower than that of natives in Germany; however, they also report that the gap vanishes once socio-economic characteristics are accounted for. They also find that saving rate of immigrants who intend to return to their home country is higher.

for the whole sample. Most immigrants, 82 percent, have schooling attainment that is less than high school. Similarly, the college graduation rate is very low at 5 percent. 18 percent of the immigrants arrived Germany after 1973, the last year of guestworker recruitment. This fraction is higher among Italian immigrants, at 25 percent, and lower among Spanish immigrants, at 2 percent. Marital status at arrival and whether the household head had any children at arrival (in either country) for Turkish immigrants are markedly different from those of EU immigrants. While 70 percent of Turkish immigrants were married at arrival, the percentage of immigrants who were married at arrival range from 26 to 37 percent for the three EU countries. Similarly, the percentage of immigrants who were parents at arrival is much higher for Turkish immigrants at 34 percent.

Figure 5 displays the purchasing power parities of the four source countries with Germany from 1984 to 2000. There is substantial variation in levels across source countries: the average ppp, over the 17 years, for Turkish immigrants is roughly twice as much that for Italian immigrants. There is important variation within EU countries as well: the average ppp over the 17 years for Greek immigrants is one and a third of that of Italian immigrants. The variation in ppp over time in Figure 5 is also significant; in fact, it is remarkable for Turkish immigrants: there were a 35 percent rise in 1994 – the year of an economic crisis – and a 34 percent rise in 1986.

The expected wage rate in the source countries as a fraction of the wage rate in Germany is illustrated in Figure 6 for the four source countries. There is substantial variation across the source countries. While the expected wage ratio for Turkish immigrants averages at 0.25 over the 17 years, it averages at 0.47 for Spanish immigrants, and at 0.7 for Italian immigrants. The variation over time is also remarkable. For Italian immigrants, the wage ratio in 1995 was 36 percent lower than the wage ratio in 1990. For Turkish immigrants, the wage ratio in 1993 was 2.8 times the wage ratio in 1988.

4 Estimation

Optimal migration duration and saving rate can be written in the following reduced forms according to equations 3 and 5 given in the model section.

$$d^* = d(\tau, p, y_h/y_g; \alpha) \tag{11}$$

$$s^* = s(p, y_h/y_g; \alpha) \tag{12}$$

In equation 11, we see that in addition to the two key macroeconomic variables and the curvature parameter – which can not be accounted for in the estimation due to its unobserved nature –, optimal migration duration depends on the remaining worklife, i.e. age at arrival. On the other hand, saving rate does not directly depend on the remaining worklife as can be seen in equation 12. However, in the case that relative wages between the two countries vary by age, the saving rate would also vary by age. Therefore, in the empirical specification, I allow the saving rate to vary by age as well.

According to the theoretical model, the impacts of ppp and wage ratio on optimal migration duration vary by the decision horizon (i.e. age at arrival), as can be seen in equations 8 and 6. On the other hand, the impacts of ppp and wage ratio on the saving rate, given in equations 9 and 7, do not depend on the decision horizon. However, I use a more general specification by allowing the effects of ppp and wage ratio on the saving rate to vary by age as well.[8] Therefore, the empirical specifications for migration duration and saving rate are written in the following form.

$$d_i = \beta_0 + \beta_1 ppp_i + \beta_2 ppp_i age_i + \beta_3 wage_i + \beta_4 wage_i age_i + \beta_5 age_i + u_i \quad (13)$$

$$s_i = \gamma_0 + \gamma_1 ppp_i + \gamma_2 ppp_i age_i + \gamma_3 wage_i + \gamma_4 wage_i age_i + \gamma_5 age_i + v_i \quad (14)$$

The theoretical model's predictions are for the time of arrival to Germany and, accordingly, in the above specifications, the dependent variables (intended migration duration and saving rate) as well as the key control variables (purchasing power parity and wage ratio) are written at the time of arrival to Germany for each person i. Therefore, ideally we would need data on intended migration duration and saving choices at the time of arrival. However, GSOEP include information on intended migration duration and saving choices not at arrival but at various years after arrival. Therefore, a time index and a control variable for duration of residence must be added to equations 13 and 14. Since the effects of ppp, wage ratio as well as age would depend on the duration of residence, I also add interaction terms with duration of residence. The resulting specifications are given below in equations 15 and 16. (When duration of residence, t, is zero, equations 15 and 16 reduce to equations 13 and

[8] The main findings on saving rate are robust to this extra inclusion of age interaction terms.

14, respectively.) These equations are estimated separately.[9]

$$\begin{aligned} d_{it} &= \beta_0 + \beta_1 ppp_{it} + \beta_2 ppp_{it} age_{it} + \beta_3 ppp_{it} t_i + \beta_4 wage_{it} + \beta_5 wage_{it} age_{it} \\ &\quad + \beta_6 wage_{it} t_i + \beta_7 age_{it} + \beta_8 age_{it} t_i + \beta_9 t_i + u_i \end{aligned} \tag{15}$$

$$\begin{aligned} s_{it} &= \gamma_0 + \gamma_1 ppp_{it} + \gamma_2 ppp_{it} age_{it} + \gamma_3 ppp_{it} t_i + \gamma_4 wage_{it} + \gamma_5 wage_{it} age_{it} \\ &\quad + \gamma_6 wage_{it} t_i + \gamma_7 age_{it} + \gamma_8 age_{it} t_i + \gamma_9 t_i + v_i \end{aligned} \tag{16}$$

The repeated observations on intended migration duration allows estimation using fixed-effects OLS estimator. Unobserved heterogeneity could bring about biased estimates in equation 15. For instance, age-at-arrival could be correlated with some unobserved characteristic of immigrants that also has an impact on migration duration, resulting in biased estimates. Using fixed-effects estimation allows elimination of any bias that could be caused by time-invariant unobserved heterogeneity by differencing them out. The specification for this fixed-effects estimation is given in equation 17, where Δx_{it} denotes the difference of x_{it} from the average of x_{it} over time.

Since the savings data are censored below at zero, I use censored regression in the saving rate analysis. A pooled panel data approach is taken here rather than a fixed-effects panel estimation, as it is done for migration duration, because fixed-effects methods using dummy variables for individuals resulted in convergence failures. (The sample size for saving rate is much smaller compared to that for intended migration duration.) As time-invariant individual characteristics can not be eliminated in this case, unlike the specification for optimal migration duration, a number of time-invariant individual characteristics are also included in the regression. These include high school and college graduation status, 1974-1983 cohort status, marital as well as parental status at arrival, and country of origin. The inclusion of these additional control variables also reduces the variance in the estimation. The final specification for saving rate is given in equation 18, where X_{it} denotes the vector of individual characteristics.

$$\begin{aligned} \Delta t_{it} &= \beta_1 \Delta ppp_{it} + \beta_2 \Delta (ppp_{it} age_{it}) + \beta_3 \Delta (ppp_{it} t_i) + \beta_4 \Delta wage_{it} \\ &\quad + \beta_5 \Delta (wage_{it} age_{it}) + \beta_6 \Delta (wage_{it} t_i) + \beta_7 \Delta age_i + \beta_8 \Delta (age_{it} t_i) + \beta_9 \Delta t_i + \Delta u_{it} \end{aligned} \tag{17}$$

$$\begin{aligned} s_{it} &= \gamma_0 + \gamma_1 ppp_{it} + \gamma_2 ppp_{it} age_{it} + \gamma_3 ppp_{it} t_i + \gamma_4 wage_{it} \\ &\quad + \gamma_5 wage_{it} age_{it} + \gamma_6 wage_{it} t_i + \gamma_7 age_{it} + \gamma_8 age_{it} t_i + \gamma_9 t_i + X_{it}\Gamma + v_{it} \end{aligned} \tag{18}$$

[9] In the estimation, the average values of the last three years are used for ppp and wage ratio variables.

Calendar year dummies are also included in both regressions. A change in ppp could arise from events in Germany as well as the home countries. When the change arises from an event in Germany, it is common to all observations. Moreover, this event in Germany could change other variables that also have an impact on the dependent variable. In this case, if these other variables are not accounted for in the regression, ppp would in part stand for these variables, resulting in an omitted variables bias. For instance, suppose that an economic downturn in Germany brings about a rise in prices, which would change the ppp. This economic downturn could also cause an upsurge in the anti-immigrant sentiment in Germany. This rise in anti-immigrant sentiment could change immigrants' migration duration and saving choices. However, not accounting for anti-immigrant sentiment, we would mistakenly attribute any change in immigrants' migration duration and saving choices to the change in ppp. For this purpose, I use calendar-year dummies in both regressions. This allows me to capture the impact of ppp and wage ratio through the variation across source countries within each calendar year. This prevents the above-mentioned problem.

Sampling weights provided in the survey are used in the estimation. In the analysis of intended migration duration using fixed-effects estimation, sampling weights for 1984 are used because the information comes from the variation in a person's intentions over time. On the other hand, longitudinal weights are used in the saving rate regression because in this case data from different survey years are pooled.

I use both micro-level and macro-level variables in the estimation. However, macro-level variables do not exhibit variation within groups, which is country of origin in this study. Therefore, random disturbances would be correlated within groups. Moulton (1990) shows that even small levels of correlation could cause significant downward bias in the estimation of standard errors. I address this problem by clustering the standard errors at the level of country of origin, which ensures that variance-covariance matrix is consistent in the presence of correlation within countries. Bertrand et al. (2004) report that this correction does quite well in the context of difference-in-differences estimators. However, they also report that its performance declines and the downward bias in standard errors becomes important when the number of clusters decreases. In addition, Bell and McAffrey (2002) find that this bias is larger when variables are relatively constant within clusters. However, as shown in Figures 5 and 6, my aggregate variables exhibit significant variation within clusters. Cameron et al. (2008), as do Bertrand et al. (2004), report that when the number of clusters is small, even cluster-robust standard errors may lead to downward-biased standard errors. Due to

the small number of clusters in my sample, I use a T-distribution rather than a standard normal distribution in forming the significance levels, which is suggested by Cameron et al. as a minimum requirement for dealing with the issue of few clusters.

Intended migration duration is a subjective piece of information. Due to the psychological environment, certain immigrants' reported responses could be different from the rational response that could be expected from them. For instance, due to wishful thinking, some immigrants may report a shorter intended migration duration. This could cause a problem if immigrants with a bend for wishful thinking also face higher ppp. Suppose, for example, that Turkish immigrants, who face higher ppp values, are more wishful thinkers. In this case, their shorter reported intended migration duration could be wrongly attributed to the higher ppp they face. However, this would not a problem in this study because the fixed effects estimation method relies on the variation in intended migration duration over time for a given immigrant.

5 Empirical Results

5.1 Migration Duration

The results of fixed-effects regression of intended migration duration are presented in Table 3. Since the key variables of interest are interacted with both age and duration of residence, the impacts of these variables are presented in Table 4 at selected values of age and zero duration of residence. In other words, their effects are presented at various ages at arrival for conformity with the theoretical model.

As can be seen from Table 4, there is evidence that an increase in ppp lowers the optimal migration duration in Germany. For immigrants who are 30-years-old or older at arrival, the statistical significance is at the five percent level, and for immigrants who are between 26 and 29 at arrival, the statistical significance is at the ten percent level. However, for immigrants who are 25-years-old or younger at arrival, there exists no evidence for ppp influencing the optimal migration duration.

The theoretical impact of ppp on optimal migration duration, given in equation 8, was ambiguous. However, as shown in the numerical solutions in Table 1, in most cases – excluding the case when the wage ratio and immigrants' willingness to substitute consumption intertemporally are high – the impact of ppp on optimal migration duration was negative.

The empirical results confirm this.

For immigrants who plan to stay in Germany throughout their lives – corner solutions to the optimal migration duration decision – a change in ppp would not make a difference in the migration duration. Since immigrants who are younger at arrival are more likely to stay in Germany throughout their lives – Dustmann (1996) provides empirical evidence for this –, their optimal migration duration would be less sensitive to changes in ppp. In fact, this is what we see in Table 4: both the magnitude and statistical significance of the coefficient of ppp variable is lower at younger ages.

The magnitude of the effect of ppp on optimal migration duration is large. For instance, according to Table 4, for an immigrant who is 30-years-old at arrival, a 10 percent increase in ppp lowers the optimal migration duration by 0.94 years. Since the predicted migration duration for an immigrant who arrives Germany at age 30 is 4.66 years, when ppp and wage ratio are set at their mean values in the sample, I can claim that a 10 percent increase in ppp lowers the optimal migration duration by roughly 20 percent for this immigrant. This impact is even stronger for immigrants arriving at later ages. A 10 percent rise in ppp decreases the optimal migration duration by 1.16 years for an immigrant who arrives Germany at age 40. This implies a 42 percent fall in the optimal migration duration as the predicted migration for this immigrant is 2.76 years.

The effect of wage ratio on the optimal migration duration decision has a negative sign as predicted by the theoretical model. However, this is statistically insignificant. One reason to the failure of uncovering any evidence for an impact of wage ratio could be that wage ratio, in fact, does not matter much in these immigrants' return intentions because they do not plan to work after returning to their home countries. In fact, Dustmann and Kirchkamp (2002), based on a sample of return migrants from Germany in Turkey, report that only six percent worked as wage-earners after return. Turkish immigrants are by far the largest among the immigrant groups in the sample: 58 percent of the population that the sample stand for are Turkish immigrants. For EU immigrants, work intentions after return could be different as they face higher wages after return. However, for Greek return migrants from Germany, McLean Petras and Kousis (1986) report that labor market opportunities are also very limited. Another reason for the failure of finding any evidence for an impact of wage ratio on migration duration could be that the sample is relatively sparse in younger age ranges for which the wage ratio would be expected to matter the most, as can be seen from Figure 1. The econometric model would be expected to fit less well in the sparse region of

the data.

Finally, I will briefly discuss the other statistically significant variables in Table 3. There is evidence, statistically significant at the five percent level, that intended migration duration increases in duration of residence and that for a given duration of residence intended migration duration decreases in age. Both results are expected: current duration of residence is part of intended duration of residence, and, therefore, intended duration of residence increases in current duration of residence. In addition, for a given duration of residence, older immigrants have a shorter remaining worklife, and, therefore, would be expected to stay shorter.

5.1.1 Who would stay longer: immigrants from poorer or relatively wealthier source countries?

The above findings imply that immigrants from poorer countries may, in fact, stay shorter in the host country if the impact of a higher ppp in decreasing migration duration dominates the impact of a lower wage ratio in increasing migration duration. To examine whether immigrants from relatively poorer or wealthier countries would stay longer in the host country, predicted migration durations are given for selected values of ppp and wage ratio in Table 5. Conditional on ppp, as expected from the estimation results, immigrants from poorer countries (lower wage ratio) stay longer. However, when we allow the poorer countries to have a higher ppp, as it actually is, the gap diminishes substantially; and, in fact, in many reasonable cases, immigrants from poorer countries stay shorter. For instance, a 20-year-old immigrant coming from a source country for which the wage ratio is 0.25 and ppp is 2.25 – wage ratio at ppp is 0.5625 – would stay shorter, 6.84 years, than an immigrant originating from a wealthier source country for which the wage ratio is 0.5 and ppp is 1.5 – wage ratio at ppp is 0.75 –, who would stay for 7.2 years. Similarly, a 20-year-old immigrant originating from a source country for which the wage ratio is 0.25 and ppp is 2.75 – wage ratio at ppp is 0.6875 – would stay shorter, 5.4 years, than an immigrant for whom the corresponding values of wage ratio and ppp are 0.75 and 1.25, respectively, – implying a wage ratio at ppp of 0.9375 –, whose predicted migration duration is 5.95 years. Moreover, as immigrants' age at arrival increases, that immigrants' from poorer countries stay shorter becomes more likely. For instance, for a 40-year-old entrant who originates from a source country for which the wage ratio is 0.25 to stay shorter than an immigrant originating from a source country where the wage ratio is 0.5 and ppp is 1.5, a ppp value of 2 is sufficient unlike the case for a

20-year-old entrant for whom this ppp threshold was 2.25.

Next, I examine the predicted migration durations according to the ppp and wage ratio values for the four source countries in my sample. This is given in Table 6 for immigrants who arrive Germany at ages 20, 30, and 40, separately. The major result is that the predicted migration duration of an immigrant facing Turkish ppp and wage ratio values is shorter than that of immigrants facing ppp and wage ratio values of EU countries for all three age-at-arrival groups. In other words, the shortest intended migration duration occurs when the ppp and wage ratio values are taken for the poorest country in the sample. Another important finding here is that as age-at-arrival increases, the intended migration duration of immigrants facing Turkish values for ppp and wage ratio becomes even shorter relative to that of immigrants facing ppp and wage ratio values of the other three wealthier countries.

This finding that the intended migration duration of immigrants facing Turkish values for ppp and wage ratio is shorter may be surprising at first because the literature is full of evidence on the fact that actual return rates of Turkish immigrants are in fact lower. My predictions are based on varying ppp and wage ratio levels holding everything else constant. However, as can be seen from Table 2 and as the literature reports, Turkish immigrants are markedly different in terms of certain individual characteristics. For instance, Table 2 reports that Turkish immigrants are much more likely to be married at arrival and have children at arrival. Kırdar (2008) shows that these characteristics substantially decreases return migration realizations of immigrants in Germany.

5.2 Savings

Table 7 presents the censored regression estimation results for saving rates.[10] Due to the age and duration of residence interaction terms of the key variables, their impacts on the saving rate are presented separately in Table 8 at selected values of age and zero duration of residence (i.e. at arrival to Germany)[11].

Purchasing power parity has a positive impact on the saving rate, as implied by the theoretical model. (The statistical significance is at the five percent level for all age groups.) Moreover, the magnitude of this impact is large. For instance, a 10 percent increase in ppp

[10] Interpretation of censored regression estimates are similar that of OLS estimates.

[11] These estimates are calculated as linear combinations of the coefficients of ppp and wage ratio variables along with the coefficients of their interactions with age as well as duration of residence, where duration of residence is set at zero and age is set at various values given in the table.

increases the saving rate of a 20-year-old immigrant in his first year of residence in Germany by 4.5 percentage points. Given the fact that the predicted saving rate in the first year of residence for an immigrant who arrives at age 20 – when all other variables are set to mean values including ppp and wage ratio – is 24.4 percent, a 10 percent rise in ppp brings about a 18.4 percent increase in the saving rate. The magnitude of the impact of ppp on saving rate for immigrants arriving at later ages is even larger. For an immigrant who enters Germany at age 30, a 10 percent increase in ppp rises the saving rate by 25 percent in his first year of residence in Germany (4.9 percentage points increase from a predicted saving rate of 22.2 percent), and for an immigrant arriving Germany at age 40, a 10 percent increase in ppp rises the saving rate by 32 percent in his first year of residence (6.45 percentage points increase from a predicted saving rate of 20.1 percent).

The predicted saving rates during the first year of residence at 24.4 percent for an immigrant who arrives at age 20, at 22.2 percent for an immigrant who arrives at age 30, and at 20.1 percent for an immigrant who arrives at age 40 are much higher than the mean saving rate given in Table 2. However, the saving rate given in Table 2 is the average of saving rates at various duration of residence values, whose distribution is shown in Figure 2, whereas the predicted saving rates are at the time of arrival. In fact, Kirdar (2004) finds a downward-sloping saving profile for the same group of immigrants in Germany, which he rationalizes with the return of immigrants with a higher saving propensity. This is consistent with the finding here that predicted saving rates at the time of arrival are much higher. In addition, Kumcu (1989) reports quite high saving rates for Turkish immigrants in Germany in their first few years in Germany. I find that the predicted saving rate when ppp and wage ratio values are set at mean Turkish levels is 23.4 percent for a 20-year-old immigrant in his first year in Germany.

The magnitude of the impact of ppp on the saving rate increases with age. An explanation to this fact would be the higher likelihood of corner solutions for younger immigrants, who are more likely to stay in Germany throughout their lives. Therefore, the proportion of immigrants who do not care about ppp would be higher among younger immigrants.

With regard to the impact of wage ratio on the saving rate, there is no statistically significant evidence. This is similar to the lack of any evidence regarding the impact of wage ratio on migration duration. The potential reasons to this would also be the same: either immigrants do not really care about the wage ratio because they do not plan to work as wage-earners after return or the sparsity of data at younger ages in Germany – when wage

ratio matters more – hides any evidence of the impact of wage ratio.

The estimates given in Table 7 also reveal that the positive impact of ppp strengthens as age increases but weakens as duration of residence increases. There is also evidence, statistically significant at the ten percent level, that saving rate decreases in age. When the effects of other control variables are examined, we see that there is some evidence, statistically significant at the ten percent level, for a positive impact of college graduation on saving rates. This is expected as college graduation presumably stands for a higher permanent income level. In addition, immigrants who had children at the time of their arrival to Germany have lower saving rates. (The statistical significance is at the ten percent level.) Finally, after controlling for the variation in ppp and wage ratio across source countries, Spanish immigrants still have higher saving rates than Turkish immigrants. (This is statistically significant at the five percent level.)

When the individual control variables are not included in the specification, the results regarding the impact of ppp and wage ratio still hold; however, as expected, statistical significance goes down slightly. For instance, ppp becomes statistically significant only for immigrants whose age-at-arrival is 30 or higher.

6 Conclusions

This paper examines the impact of purchasing power parity and relative wages between the host and source countries on immigrants' migration duration and saving decisions by first developing a simple theoretical framework that allows for heterogeneity among immigrants according to their risk aversion level and deriving comparative statics implications of this framework, and then testing these implications empirically using a longitudinal data set on immigrants in Germany from four different source countries.

The theoretical model predicts that a higher purchasing power parity can in fact increase the optimal migration duration under certain conditions. In particular, this is the case for immigrants who would earn relatively high wages in their home country after return and whose willingness to substitute consumption intertemporally is high. However, even though a positive impact is possible, it is unlikely: under most conditions, the impact of purchasing power parity on optimal migration duration is negative. In the special case that immigrants do not work as wage earners after returning to the home country, we can conclude for sure that a higher purchasing power parity decreases the optimal migration duration. With regard

to the impact of the relative wages, the model predicts that as the ratio of home country wage rate to host country wage rate increases, the optimal migration duration decreases.

The empirical analysis reveals that purchasing power parity has a negative impact on optimal migration duration. The magnitude of this impact is also large: a 10 percent increase in ppp lowers the predicted migration duration at the time of arrival by roughly 20 percent for an immigrant who arrives Germany at the age of 30. The magnitude of this impact is even larger for immigrants who arrive at later ages.

The empirical results also imply that immigrants from poorer countries may, in fact, stay shorter in the host country. For instance, the estimates reveal that an immigrant coming from a source country where the expected wage rate is 25 percent of that in Germany and the ppp is 2.25 – wage ratio at ppp is 0.5625 – would stay shorter than immigrant originating from a country for which the wage rate is 50 percent of that in Germany and the ppp is 1.5 – wage ratio at ppp is 0.75 –. To be more specific, an immigrant facing Turkish ppp and relative wages would stay shorter in Germany than an immigrant facing ppp and wage ratio values of the wealthier three EU countries in the sample, regardless of age-at-arrival. Moreover, as immigrants' age-at-arrival increases, the probability that immigrants coming from poorer source countries stay for a shorter period increases.

According to the model of joint return migration and saving decisions, the impact of purchasing power parity on the saving decision is positive. The empirical analysis confirms this. For instance, a 10 percent higher ppp increases the saving rate by 4.5 percentage points in the first year of residence for an immigrant who arrives Germany at age of 20. This corresponds to a 18.4 percent increase from the predicted saving rate of 24.4 percent. The magnitude of this impact is even stronger for immigrants arriving at later ages.

This finding implies that exchange rate premium policies implemented by source country governments would encourage these immigrants to save more. On the other hand, this policy would at the same time shorten their migration duration. Therefore, the amount of accumulated savings that would return to the home countries along with the migrants could in fact fall.

An important issue is obviously the transferability of the empirical findings of this paper to other geographical settings at different times. The empirical results of this paper are for temporary migrants who are in the host country to accumulate savings. This type of migration has been prominent historically, in particular the large guestworker recruitment schemes in Europe after the World War II, in a period of rapid economic expansion. Similar

temporary labor migration policies have been used in the Gulf countries, which drew massive migration from other Middle Eastern and Asian countries in a period of rising oil revenues. Similar temporary-worker programs have also been proposed in the U.S.. Birdsall et al. (2005) outline how such temporary migration could help both the developing and developed countries. Therefore, the type of migration on which the empirical results of this paper are based on is still important and likely to stay that way, in particular in periods of economic expansions in developed countries.

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Table 1: Numerical Solutions to Immigrants' Joint Consumption and Migration Duration Decisions

wage ratio = 0.75										
	ppp=1.5		*ppp=1.75*		*ppp=2*		*ppp=2.5*		*ppp=3*	
	c	t	c	t	c	t	c	t	c	t
alpha = 0.9	0.50	35.35 (32.96)	0.50	**35.52 (33.24)**	0.50	**35.64 (33.67)**	0.50	**35.77 (34.30)**	0.50	**35.85 (34.67)**
alpha = 0.7	0.74	33.77	0.50	**29.47 (29.41)**	0.50	**29.60 (27.73)**	0.50	**29.71 (26.60)**	0.50	**29.73 (26.34)**
alpha = 0.5	1.00	40.00	0.76	31.67	0.63	28.00	0.50	25.35 (24.76)	0.50	25.30 (23.33)
alpha = 0.1	1.00	40.00	0.99	39.35	0.87	32.36	0.73	25.89	0.64	22.81
alpha = -1	1.00	40.00	1.00	40.00	1.00	40.00	0.95	34.55	0.89	27.97
wage ratio = 0.5										
	ppp=1.5		*ppp=1.75*		*ppp=2*		*ppp=2.5*		*ppp=3*	
	c	t	c	t	c	t	c	t	c	t
alpha = 0.9	0.50	36.73 (34.96)	0.50	36.67 **(34.64)**	0.50	36.62 **(34.74)**	0.50	36.54 **(35.01)**	0.50	36.49 **(35.20)**
alpha = 0.5	1.00	40.00	0.95	38.67	0.75	33.33	0.53	28.33	0.50	27.32 (26.00)
alpha = 0.1	1.00	40.00	1.00	40.00	1.00	40.00	0.83	32.32	0.71	27.61
alpha = -1	1.00	40.00	1.00	40.00	1.00	40.00	1.00	40.00	0.99	38.64
wage ratio = 0.25										
	ppp=1.5		*ppp=1.75*		*ppp=2*		*ppp=2.5*		*ppp=3*	
	c	t	c	t	c	t	c	t	c	t
alpha = 0.9	0.50	37.46 (36.16)	0.50	37.34 (35.57)	0.50	37.23 **(35.50)**	0.50	37.07 **(35.57)**	0.50	36.95 **(35.64)**
alpha = 0.5	1.00	40.00	1.00	40.00	0.88	37.14	0.60	31.11	0.50	28.83 (28.18)
alpha = 0.1	1.00	40.00	1.00	40.00	1.00	40.00	0.93	37.32	0.78	31.54
alpha = -1	1.00	40.00	1.00	40.00	1.00	40.00	1.00	40.00	1.00	40.00

Values inside paranthesis are optimal migration durations when the minimum consumption constraint is not enforced.

Table 2: Table of Means for Micro Variables

	Turkish	*Greek*	*Italian*	*Spanish*	*Total*
Intended Duration of Residence	32.1	32.7	35.7	35.9	33.4
Saving Rate (%)	5.1	8.1	5.4	11.5	5.8
Current Duration of Residence	20.8	22.8	23.1	24.6	21.8
Age	48.2	49.4	47.4	49.7	48.2
High School Graduate	0.16	0.26	0.18	0.12	0.18
College Graduate	0.03	0.15	0.02	0.06	0.05
Cohort 1974-1983	0.18	0.13	0.25	0.02	0.18
Married at Entry	0.70	0.37	0.26	0.36	0.53
Child at Entry	0.34	0.08	0.06	0.17	0.23
Number of People	312	156	212	148	828
Number of Obs in Panel	3,137	1,468	1,997	1,152	7,754

Table 3: Fixed-Effects Estimates for Intended Migration Duration

Dependent Variable: Intented Migration Duration		
Independent Variables	***Coeff***	***SE***
Log(PPP)	-2.714	7.576
Log(PPP) * Age	-0.223	0.175
Log(PPP) * Dur. of Res.	0.632	0.292
Wage Ratio	-7.944	10.253
Wage Ratio * Age	-0.113	0.106
Wage Ratio * Dur. of Res.	0.595	0.452
Dur. of Residence	2.231	0.600 **
Age * Dur. of Residence	-0.027	0.006 **
Number of obs	6782	
Number of groups	820	
R-Squared	0.46	

The specifications also include year dummies.
Standard errors are adjusted for clustering at the level of country of origin.
*** significant at 1 percent level, ** at 5 percent level, * at 10 percent level.

Table 4: Impacts of PPP and Wage Ratio on Intended Migration Duration at Arrival

	PPP		*Wage Ratio*	
Age at Arrival	*Coeff*	*SE*	*Coeff*	*SE*
20	-7.17	4.33	-10.22	8.30
25	-8.28	3.60	-10.78	7.83
30	-9.40	2.94 **	-11.35	7.37
35	-10.51	2.44 **	-11.92	6.92
40	-11.63	2.18 **	-12.49	6.48
45	-12.75	2.26 **	-13.06	6.05

A T(3) distribution is used in forming the significance levels.
*** significant at 1 percent level, ** at 5 percent level, * at 10 percent level.

Table 5: Predicted Intended Migration Durations at Arrival according to Purchasing Power Parity and Wage Ratio

	PPP						
	1.25	*1.5*	*1.75*	*2*	*2.25*	*2.5*	*2.75*
Age at arrival = 20							
Wage Ratio = 0.75	5.95	4.64					
Wage Ratio = 0.5	8.50	7.20	6.09	5.13			
Wage Ratio = 0.25	11.06	9.75	8.64	7.69	6.84	6.09	5.40
Age at arrival = 30							
Wage Ratio = 0.75	4.60	2.88					
Wage Ratio = 0.5	7.44	5.72	4.27	3.02			
Wage Ratio = 0.25	10.28	8.56	7.11	5.86	4.75	3.76	2.86
Age at arrival = 40							
Wage Ratio = 0.75	3.25	1.13					
Wage Ratio = 0.5	6.37	4.25	2.46	0.90			
Wage Ratio = 0.25	9.49	7.37	5.58	4.03	2.65	1.43	0.32

Duration of residence is set at zero.
Predictions are based on the estimates in Table 3.

Table 6: Predicted Intended Migration Durations according to Actual Values of PPP and Wage Ratios for the Four Source Countries in the Sample

	Age at Arrival		
	20	*30*	*40*
Turkish Values	6.41	4.18	1.94
Greek Values	8.68	7.29	5.89
Italian Values	6.92	5.76	4.60
Spanish Values	8.58	7.48	6.38

Table 7: Censored Regression Estimates for Saving Rate

Dependent Variable: Saving Rate		
Independent Variables	***Coeff***	***SE***
Log(PPP)	0.2540	0.0179 ***
Log(PPP) * Age	0.0097	0.0033 *
Log(PPP) * Dur. of Res.	-0.0309	0.0050 ***
Wage Ratio	0.3031	0.1749
Wage Ratio * Age	0.0036	0.0039
Wage Ratio * Dur. of Res.	-0.0267	0.0091 *
Dur. of Residence	0.0161	0.0149
Age	-0.0099	0.0039 *
Age * Dur. of Res.	0.0001	0.0001
High School	0.0044	0.0253
College	0.0809	0.0279 *
1974-83 Cohort	-0.0795	0.0510
Married at Arrival	0.0395	0.0194
Children at Arrival	-0.0480	0.0153 *
Greek	0.0686	0.0326
Italian	0.1009	0.0444
Spanish	0.1528	0.0367 **
Number of obs	2418	
Pseudo R-Squared	0.21	

The dependent variable is censored below at zero.
The specifications also include year dummies.
A T(3) distribution is used in forming the significance levels.
Significance: *** at 1 percent level; ** at 5 percent level; * at 10 percent level.

Table 8: Impacts of PPP and Wage Ratio on Saving Rate at Arrival

	Log(PPP)		***Wage Ratio***	
Age at Arrival	*Coeff*	*SE*	*Coeff*	*SE*
20	0.450	0.084 **	0.377	0.199
25	0.499	0.100 **	0.395	0.209
30	0.548	0.117 **	0.413	0.220
35	0.597	0.134 **	0.432	0.233
40	0.645	0.151 **	0.450	0.246
45	0.694	0.168 **	0.468	0.261

A T(3) distribution is used in forming the significance levels.
Significance: *** at 1 percent level; ** at 5 percent level; * at 10 percent level.

Figure 1: Distribution of Age at Arrival and Age in the Full Sample

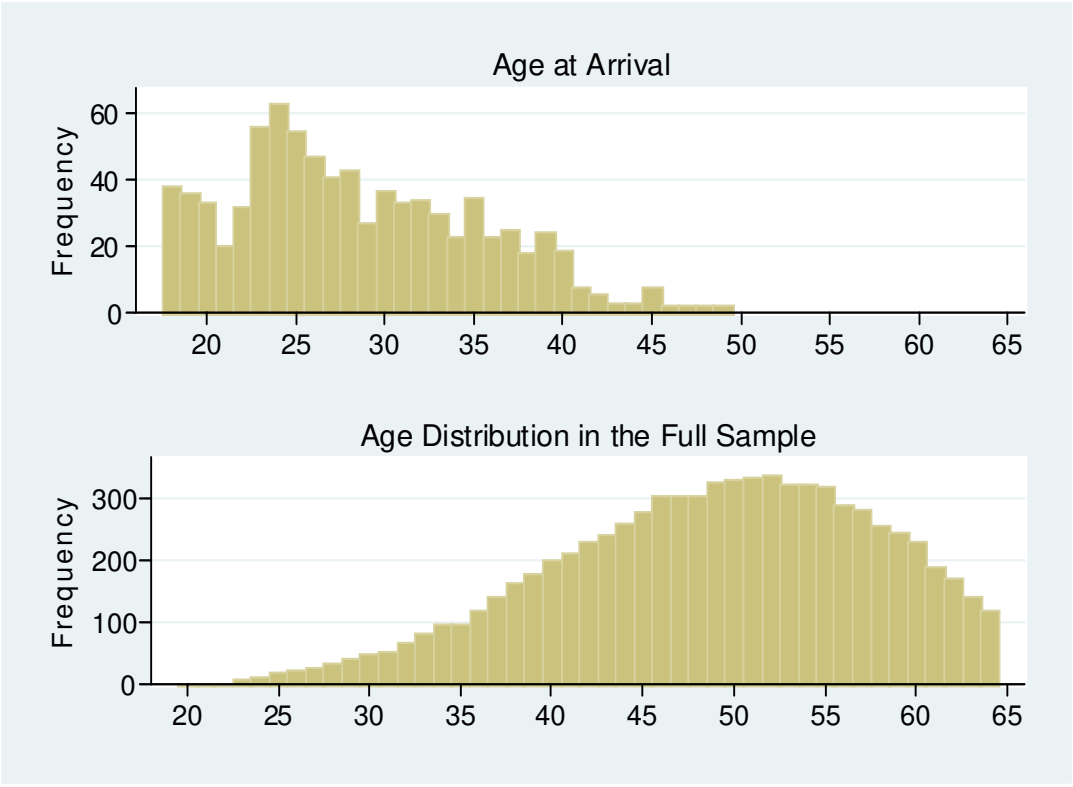


Figure 2: Distribution of Current and Intended Duration of Residences

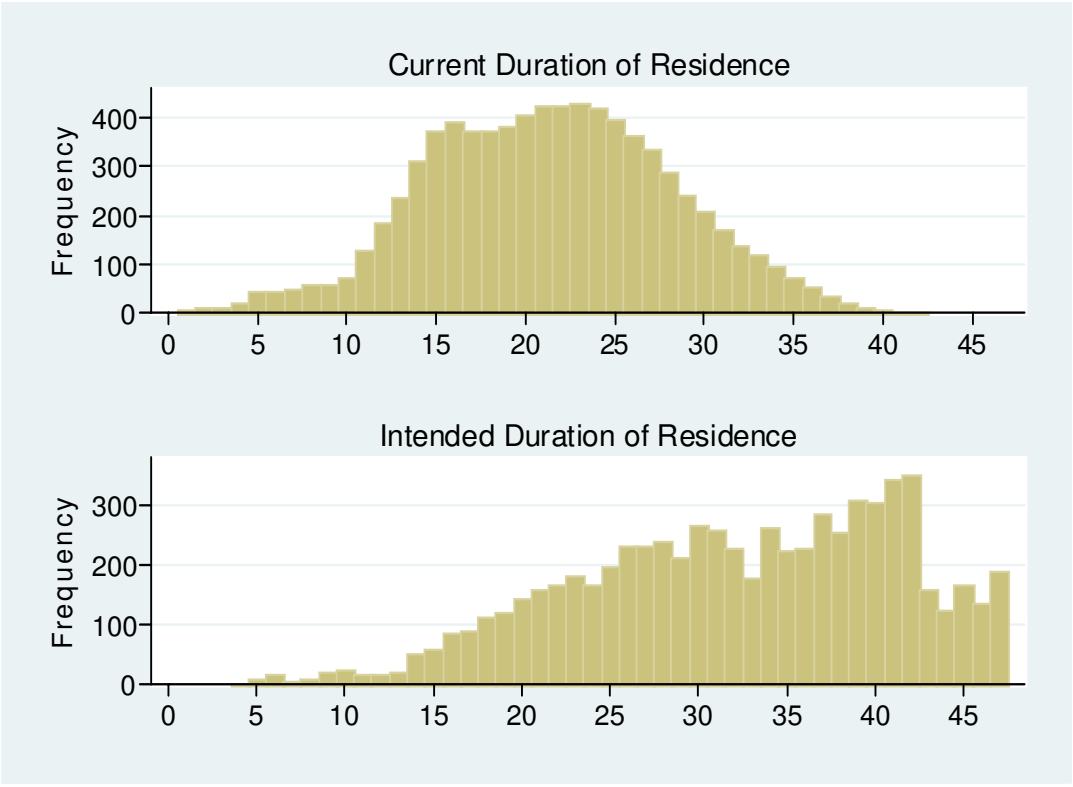


Figure 3: Mean Intended Duration of Residence by Current Duration of Residence

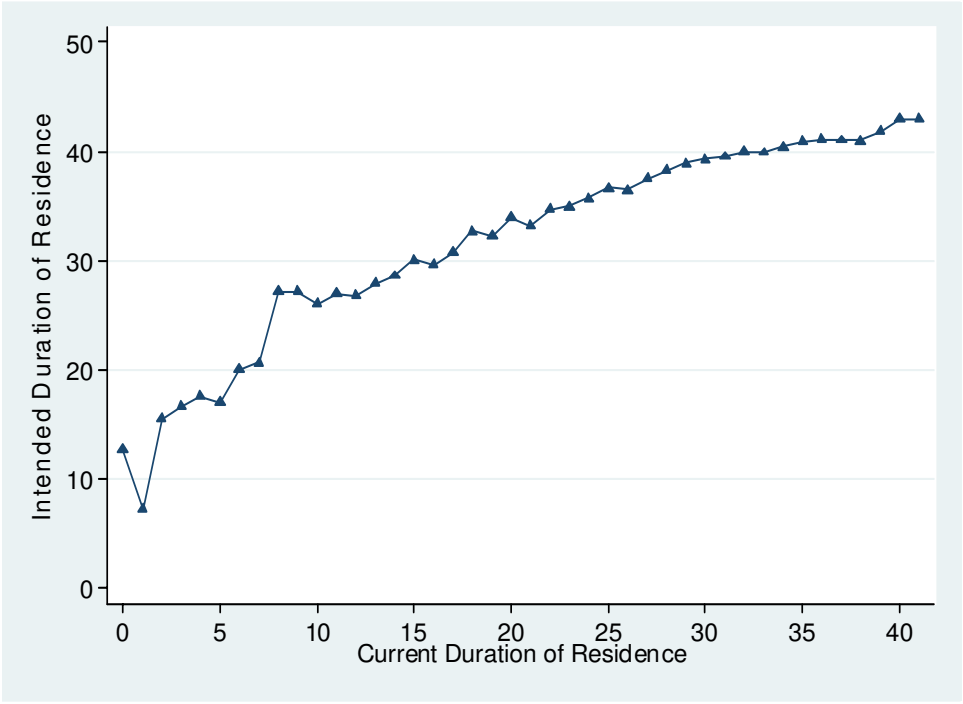


Figure 4: Mean Saving Rate by Duration of Residence

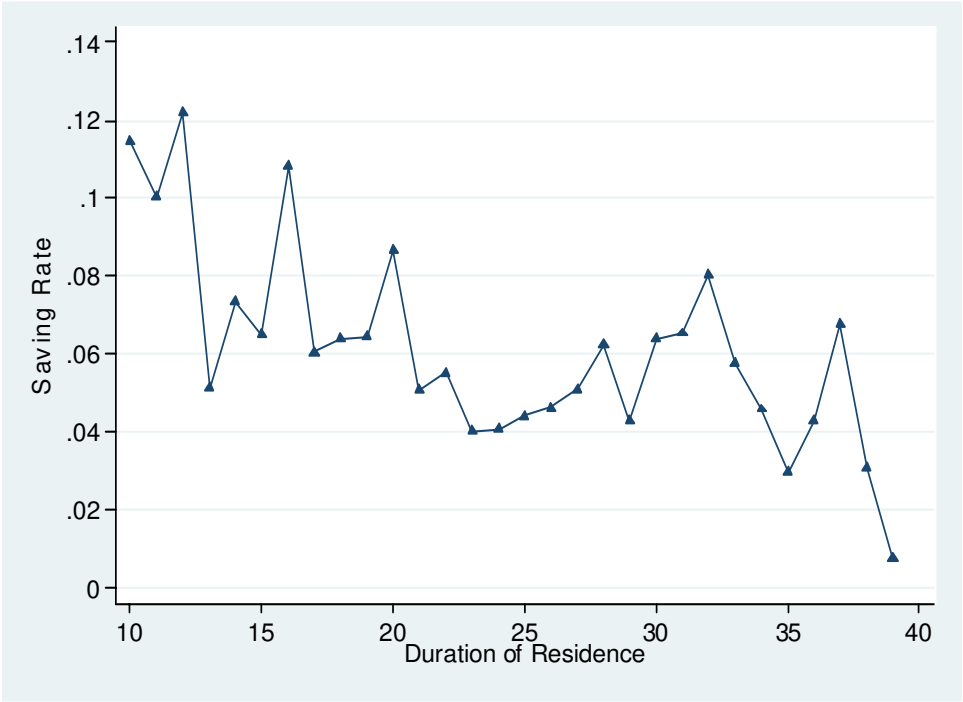


Figure 5: Purchasing Power Parity of Source Countries with Germany

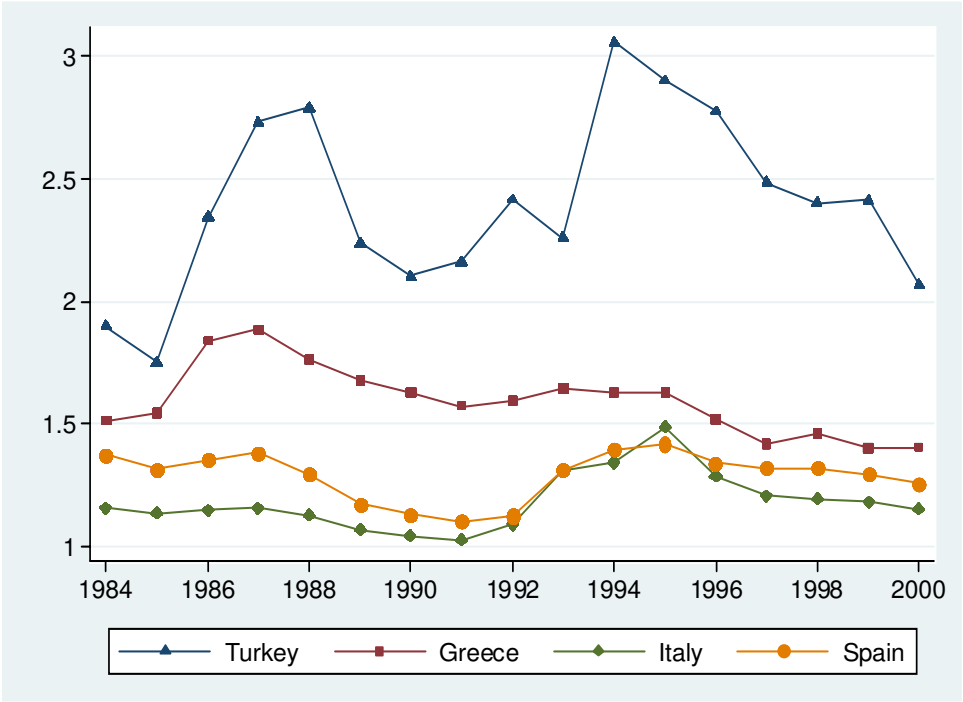
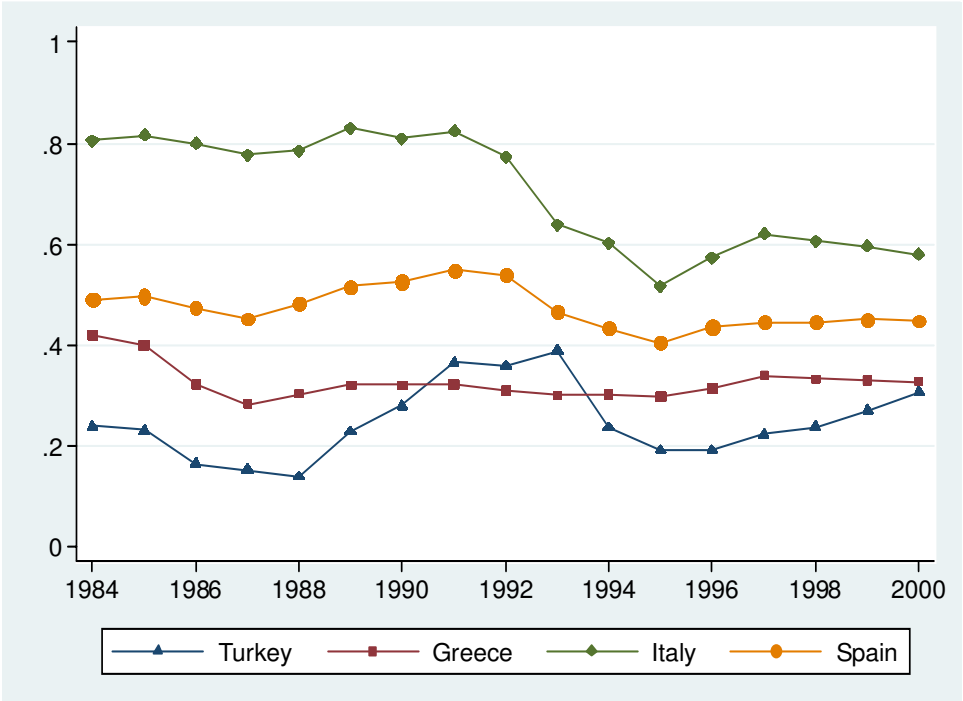


Figure 6: Source Country Expected Wage Rate as a Ratio of German Wage Rate (In Manufacturing)



A Impact of PPP on Consumption

The partial derivative of optimal host country consumption with respect to ppp was given in equation 9 as follows:

$$\frac{\partial c^*}{\partial p} = \frac{\alpha}{p^{(\alpha-2)/(\alpha-1)}(\alpha-1)^2\left(p^{\frac{\alpha}{\alpha-1}}-1\right)^2}\left(y_h - p^{\frac{\alpha}{\alpha-1}}y_h - p\alpha y_g + p^{\frac{\alpha}{\alpha-1}}\alpha y_h\right) \tag{19}$$

Here, I will show that $\partial c^*/\partial p < 0$. This will be done separately for positive alpha, negative alpha, and alpha equal to zero.

a) $\alpha > 0$

Since the term in the denominator is always positive, I need to show that $\left(y_h - p^{\frac{\alpha}{\alpha-1}}y_h - p\alpha y_g + p^{\frac{\alpha}{\alpha-1}}\alpha y_h\right) < 0$. Since $y_g > y_h$ and α and p are positive numbers, the below first inequality follows

$$\begin{aligned} y_h - p^{\frac{\alpha}{\alpha-1}}y_h - p\alpha y_g + p^{\frac{\alpha}{\alpha-1}}\alpha y_h &< y_h - p^{\frac{\alpha}{\alpha-1}}y_h - p\alpha y_h + p^{\frac{\alpha}{\alpha-1}}\alpha y_h \\ &= y_h\left[1-\alpha p + p^{\frac{\alpha}{\alpha-1}}(\alpha-1)\right] \end{aligned} \tag{20}$$

Since y_h is non-negative, I need to show that $1-\alpha p + p^{\frac{\alpha}{\alpha-1}}(\alpha-1)$ is non-positive. For this purpose, I examine the maximum value that this term can take.

$$\frac{\partial}{\partial p}\left(1-\alpha p + p^{\frac{\alpha}{\alpha-1}}(\alpha-1)\right) = \alpha\left(p^{\frac{1}{\alpha-1}}-1\right) \leq 0$$

because $p^{\frac{1}{\alpha-1}} \leq 1$ as $\frac{1}{\alpha-1} < 0$. This implies that $1-\alpha p + p^{\frac{\alpha}{\alpha-1}}(\alpha-1)$ is a decreasing function of p. When p is equal to 1, $1-\alpha p + p^{\frac{\alpha}{\alpha-1}}(\alpha-1) = 1-\alpha+(\alpha-1) = 0$. Since p is greater than 1, $\left[1-\alpha p + p^{\frac{\alpha}{\alpha-1}}(\alpha-1)\right]$ is always non-positive, which implies that $y_h\left[1-\alpha p + p^{\frac{\alpha}{\alpha-1}}(\alpha-1)\right]$ is always non-positive. From inequality 20, it follows that $y_h - p^{\frac{\alpha}{\alpha-1}}y_h - p\alpha y_g + p^{\frac{\alpha}{\alpha-1}}\alpha y_h$ is negative.

b) $\alpha < 0$

The proof is very similar in this case. Since the denominator in equation 19 is positive, I need to show that $\left(y_h - p^{\frac{\alpha}{\alpha-1}}y_h - p\alpha y_g + p^{\frac{\alpha}{\alpha-1}}\alpha y_h\right) > 0$.

Since $y_g > y_h$, $p > 0$, and $\alpha < 0$, I can claim that

$$\begin{aligned} y_h - p^{\frac{\alpha}{\alpha-1}}y_h - p\alpha y_g + p^{\frac{\alpha}{\alpha-1}}\alpha y_h &> y_h - p^{\frac{\alpha}{\alpha-1}}y_h - p\alpha y_h + p^{\frac{\alpha}{\alpha-1}}\alpha y_h \\ &= y_h\left[1-\alpha p + p^{\frac{\alpha}{\alpha-1}}(\alpha-1)\right] \end{aligned} \tag{21}$$

Here, I will show that $\left[1-\alpha p + p^{\frac{\alpha}{\alpha-1}}(\alpha-1)\right]$ is non-negative. For this purpose, I examine the minimum value it attains.

$$\frac{\partial}{\partial p}\left(1-\alpha p + p^{\frac{\alpha}{\alpha-1}}(\alpha-1)\right) = \alpha\left(p^{\frac{1}{\alpha-1}}-1\right) \geq 0$$

because α is negative and $\left(p^{\frac{1}{\alpha-1}}-1\right)$ is a non-positive number ($p^{\frac{1}{\alpha-1}}$ is less than 1 as $\frac{1}{\alpha-1}$ is a negative number). This means that $\left[1-\alpha p+p^{\frac{\alpha}{\alpha-1}}(\alpha-1)\right]$ is an increasing function of p. In fact, when p is equal to 1, $1-\alpha p+p^{\frac{\alpha}{\alpha-1}}(\alpha-1)=1-\alpha+(\alpha-1)=0$. Therefore, since p is greater than 1, $\left[1-\alpha p+p^{\frac{\alpha}{\alpha-1}}(\alpha-1)\right]$ is always non-negative. This implies that $y_h\left[1-\alpha p+p^{\frac{\alpha}{\alpha-1}}(\alpha-1)\right]$ is always non-negative. From this, I can conclude that $\left(y_h-p^{\frac{\alpha}{\alpha-1}}y_h-p\alpha y_g+p^{\frac{\alpha}{\alpha-1}}\alpha y_h\right)>0$ according to inequality 21.

c) $\alpha=0$

$$\begin{aligned}\lim_{\alpha\to 0} & \quad \frac{\alpha}{p^{(\alpha-2)/(\alpha-1)}(\alpha-1)^2\left(p^{\frac{\alpha}{\alpha-1}}-1\right)^2}\left(y_h-p^{\frac{\alpha}{\alpha-1}}y_h-p\alpha y_g+p^{\frac{\alpha}{\alpha-1}}\alpha y_h\right)\\ = & \quad \frac{1}{p^2\ln^2 p}\left(y_h-py_g+y_h\ln p\right)=\frac{1}{p^2\ln^2 p}\left(y_h(1+\ln p)-py_g\right)\end{aligned}$$

Since $1+\ln p\leq p$, and $y_h<y_g$, it follows that $y_h(1+\ln p)-py_g<0$. Therefore, $\partial c^*/\partial p<0$ when alpha is equal to zero.