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Estimating the Impact of Immigrants on the Host Country Social Security System When Return Migration is an Endogenous Choice

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Abstract

In this paper, I examine the impact of immigrants on the social security system in Germany when return migration is an endogenous choice. For this purpose, I develop a dynamic stochastic model of joint return migration and saving decisions that accounts for uncertainty in future employment and income and estimate this model using a longitudinal dataset on immigrants from five different source countries. I find that immigrants make positive net contributions to both the pension and unemployment insurance systems in Germany regardless of their country of origin and age-at-entry. Moreover, the magnitudes of the net contributions are remarkable for certain groups. Return migration plays a critical role in generating these positive net contributions. In a counterfactual, I examine how much exogenous modeling of the return decision, which has been the practice of the literature so far, changes immigrants' net contributions. Such a restriction causes a serious misestimation of net contributions. I also examine the impact of a counterfactual policy experiment in which financial bonuses are provided conditional on return to certain unemployed immigrants. Such a policy turns out to be ineffective in a number of dimensions.

Keywords: Immigrant Workers, Life Cycle Models and Saving, Social Security and Public Pensions, Unemployment Insurance, Public Policy

JEL Codes: J61, D91, H55, J65, J68

1 INTRODUCTION

Many European countries see immigration as a potential solution to the social security crisis they face due to an aging native population, rising health costs and low fertility rates. Börsch-Supan (2000) reports, based on OECD projections, that the ratio of elderly to working age people will increase from 20.6 percent in 1990 to 39.2 percent in 2030 for European member countries. This rise is even higher for Germany, the country this study addresses, where the old-age dependency ratio is expected to increase from 21.7 percent in 1990 to 49.2 percent in 2030. Immigration slows down the aging of population by bringing in younger workers. Due to their age composition, immigrants are more likely to be contributing to the social security system rather than receiving benefits. From a life-cycle perspective, immigrants do not spend a period of childhood in the host country during which their net fiscal contribution would obviously be negative. Moreover, many immigrants do not spend the later part of their lives – when their net fiscal contribution is also likely to be negative, for instance, due to higher health expenditures – in the host country, either, because many return to their home countries. Even when they choose to stay in the host country for the rest of their lives, they are likely to be drawing pension benefits for a shorter period of time because immigrants coming from less developed countries generally have lower life expectancies. On the other hand, immigrants can become a financial burden on the host country if they come at or stay until older ages because in that case they could draw from public health and pension insurance systems more than they contribute to them. Moreover, high rates of unemployment resulting from poor economic integration would imply negative net contributions to the social insurance system. For instance, the unemployment rate was 22.2 percent for immigrants in Germany at the end of 2004.

The number of studies investigating the fiscal impact of immigration has recently increased. These studies investigate whether the fiscal impact of immigrants in net present value terms is positive and whether immigration can have a substantial impact on the fiscal imbalance in the countries studied. For instance, in one of the most challenging studies, Storesletten (2000) builds a dynamic general equilibrium model to measure the fiscal impact of immigrants in the U.S. However, like the other studies on this topic, he treats return migration as an exogenous factor and approximates the aggregate level of return migration. Exogenous return migration obviously fails to account for the potential selection in the return decision according to immigrants' characteristics. Moreover, aggregation of return behavior fails to capture the heterogeneity in the level and timing of return migration behavior across various demographic groups.

Accounting for return migration properly is very important because the level of return migration of immigrants to their home countries is significant in many host countries.[1] Moreover, the variation in the incidence of return migration over immigrants' duration of residence has important implications for their fiscal impact. For instance, the timing as well as the level of return migration determines the fraction of immigrants who can utilize the early retirement schemes that exist in countries like Germany and, therefore, their average age of retirement. Finally, the type of selection in return migration is also quite important because whether immigrants become a burden or boon on the social security system depends on whether the returners are selective of the most or least economically successful immigrants.

This paper contributes to the literature by exploring for the first time the fiscal impact of immigrants when return migration is an endogenous choice. Another key distinguishing feature of my work is its empirical content. Unlike the previous studies whose findings are based on simulations from calibrated parameters, my results come from a maximum likelihood estimation of a structural model in which I use a rich longitudinal micro level data set. The structural framework of the model allows me to evaluate the impact a number of counterfactuals. In fact, I examine how much exogenous modeling of return migration decision misses the actual value of immigrants' net contributions to the German social security system. In addition, I examine the impact of a counterfactual policy experiment in which the German government provides financial bonuses conditional on return to encourage certain immigrants to return to their home countries. Since I model the immigrants' decisions in a dynamic setting, I am able to explore the effect of this policy not only on immigrants' return decision but also on their duration of residence.

This paper develops and estimates a dynamic model of joint return migration and saving decisions under uncertainty.[2] In the model, immigrants are subject to earnings, employment and preference shocks and they make decisions about whether to stay in Germany for an additional period and how much to save. The level of heterogeneity in my model is richer compared to other studies examining the net fiscal effect of immigrants. I calculate the

[1] According to German Federal Statistical Office, between 1962 and 1983, for every 13 in-migrants there were 10 out-migrants. According to Jasso and Rosenzweig (1982), of the 1971 cohort of immigrants in the U.S., the fraction that returned by 1979 could be as high as fifty percent. Aydemir and Robinson (2006) find an out-migration rate of 35 percent by 20 years of residence for working-age male immigrants in Canada.

[2] Berninghaus and Seifert-Vogt (1992) carry out a theoretical analysis of optimal saving and return migration strategies in a stochastic dynamic model where the cause of return is higher purchasing power parity.

impact of immigrants on the German social security by country of origin and age at arrival to Germany.[3] The model also incorporates unobserved heterogeneity in a number of permanent characteristics of immigrants, like their preferences and labor market ability. In the model, the reasons that immigrants return to their home country include higher purchasing power of accumulated savings in the home country due to lower prices there, immigrants' preference to live in their home country rather than in Germany, and unexpected events. I exploit the variation in the price levels across source countries to identify the effects of purchasing power on immigrants' decisions. The model also incorporates variation in the earnings potential across the source countries.

The model is estimated using a unique longitudinal data set from Germany that contains information on immigrants from five different countries, which include EU member as well as non-member countries. The pieces of information employed from the dataset include immigrants' labor market status and earnings as well as their return migration and saving choices. In the estimation of the model, a simulated maximum likelihood technique is used. The results indicate that the model can account very well for the key features in these four pieces of information according to EU status.

I find that immigrants' net lifetime contributions to the German pension insurance system are positive regardless of their age-at-entry and country of origin. Moreover, the magnitudes of net lifetime contributions are large: They are roughly 2.7 times entry-level annual earnings for Turkish and 3.25 times entry-level annual earnings for ex-Yugoslavian immigrants. Non-EU immigrants and younger age-at-entry cohorts make higher contributions. The primary reasons to the higher net contributions of non-EU immigrants are their shorter life-spans and longer duration of residence in Germany due to the level and timing of their return behavior. Since per-period contributions average positive except for the latest periods, a longer contribution period implies higher lifetime contributions. An interesting fact that highlights the important role of return migration is that although ex-Yugoslavian immigrants have a longer life-expectancy than Turkish immigrants, their net pension insurance contributions are higher mostly due to their lower levels of return migration. Older age-at-entry cohorts have lower net contributions because first they have a lower contribution period not only due to a shorter remaining worklife but also higher return migration rates, second they have

[3] While some studies (Storesletten, 2000; Bönin et al., 2000) calculate net contributions by age at arrival, no study to my knowledge accounts for the variation in net contributions by country of origin. However, many empirical studies (Borjas and Bratsberg, 1996; Lam 1994) note important differences in the return migration behavior across country of origin groups.

lower earnings, and third the probability of unemployment averaged over the life-cycle is higher for them. These facts overwhelm the fact that they also receive lower benefits after retirement.

An important factor that contributes to the positive net pension insurance contributions is that the average age of retirement of immigrants is higher than that of natives for all country of origin groups. For instance, the average age of retirement for Spanish immigrants is about four years higher than that of German natives. The primary reason to this is that immigrants who return to their home countries can not take advantage of the many early retirement schemes available in Germany. A higher average retirement age for all immigrants could take place despite higher retirement rates conditional on age for immigrants in Germany. For instance, even though Turkish immigrants that reside in Germany are more likely to be retired than natives conditional on age, their average age of retirement is roughly two years higher than that of natives when we include those who return to Turkey.

Unemployment insurance contributions are also positive regardless of nationality and country of origin. However, there exists significant variation across nationalities. While they are roughly three quarters of entry-level annual earnings for Greek immigrants, they are only a quarter of entry-level annual earnings for Turkish immigrants whose unemployment rates are higher. An interesting feature of the age-at-entry profiles of net contributions to the unemployment insurance system is that while the profile of Turkish immigrants is upward-sloping, those of all other country of origin groups are downward-sloping. It may be surprising to hear that the net contributions to the unemployment insurance system of these immigrants in Germany are positive given their current high unemployment rates. However, the unemployment rates of immigrants currently residing in Germany were very low for a notable period in the years following their arrival. More importantly, many immigrants returned to their home countries and the unemployment rates of these immigrants, who on average stayed for a shorter time, were much lower.

Since a key contribution of this paper to the literature on the fiscal impact of immigrants is that it includes return migration as an endogenous choice, I also investigate how the results regarding immigrants' net contributions to the two insurance systems would change in the case of exogenous return migration that maintains the aggregate hazard rates by country of origin and duration of residence. (Even this includes a higher level of heterogeneity than the previous studies because they do not account for the timing of return migration.) In fact, the results indicate that this would result in a substantial misestimation for all country of origin groups. While it increases net contributions of Turkish immigrants from 78,375 DM to 93,491 DM, net contributions of all other nationalities fall: from 111,538 to 74,765 DM for ex-Yugoslavian, from 63,023 to 16,613 DM for Greek, from 44,497 to 1,796 DM for Italian, and from 44,697 to 23,647 DM for Spanish immigrants (1998 prices). A critical reason to this misestimation is that exogenous return migration does not account for the selection in return migration in terms of labor market characteristics like unemployment status. For instance, it does not capture the fact that unemployed immigrants are more likely to return, particularly in earlier periods, for EU immigrants; and, therefore, it seriously underestimates net contributions of EU immigrants. In addition, this counterfactual – like the previous studies – allows for limited heterogeneity in return migration behavior. While it maintains the level and timing by country of origin, it does not account for the variation in the level and timing of return migration behavior by other demographic characteristics like age-at-arrival. However, estimation results indicate that there exists substantial variation both in the level and timing of return migration by age-at-entry. As a result, this counterfactual also produces serious rotations in the age-at-entry profiles of net contributions.

I also examine the impact of a counterfactual policy experiment in which financial bonuses are provided to certain unemployed immigrants conditional on return. Given the high unemployment rates of immigrants in Germany, it could be less expensive for the German government to pay these one-time bonuses rather than unemployment benefits for extended periods of time. However, I find that such a policy is not cost-effective when I compare the gain from net contributions of immigrants to the unemployment and pension insurance systems with the cost of bonuses. One important reason to this finding is that unemployed immigrants are more likely to return anyway; therefore, the bonus becomes a gift to many immigrants. Moreover, although this policy brings about extra returners, most of these are immigrants who would return in the following periods anyway. Therefore, the benefit from extra returners is limited to only a few periods.

The next section provides background information and reviews the relevant literature. In section 3, the model and its solution are described. Section 4 describes the data and presents descriptive statistics. Section 5 covers the estimation method and section 6 presents the estimation results. The impact of immigrants on the German social security system and how this changes in the case of exogenous modeling of return decision are discussed in section 7. The results of a policy experiment in which financial bonuses conditional on return are provided to certain immigrants are given in section 8. Section 9 concludes.

2 BACKGROUND AND RELEVANT LITERATURE

This study analyzes the fiscal implications of the behavior of immigrants in Germany from five Mediterranean countries (3 European Union countries: Greece, Italy and Spain; and 2 non-EU countries: Turkey and ex-Yugoslavia) using a stock-sample of these immigrants in 1984 that are followed up. Most of these immigrants are the guestworkers of 1960's and 70's that immigrated to Germany under the bilateral agreements signed by the German government with the source country governments.[4] The level of in-migration to Germany was quite high before 1984. On average, 657 thousand immigrants (including ethnic Germans) entered Germany annually between 1962 and 1983. Of all these immigrants, sixty-one percent were from the five source countries in this study. Out-migration of immigrants in Germany has been at significant levels as well. During the same time period, 503 thousand immigrants left Germany on average annually. Immigrants constitute a relatively significant part of the German work force. The Federal Ministry of the Interior reports that "1.95m foreigners had a job that made them liable to pay social security contributions in the western federal territory, meaning they account for 8.9 percent of all gainfully employed persons."

The reasons to return migrate in this paper include higher purchasing power of accumulated savings in the home country, migrants' preference to live in their home country, and unexpected events. Borjas and Bratsberg (1996) explain return migration as a part of optimal life-cycle location decisions. At the time they immigrate, migrants realize that after they acquire physical or human capital in the host country, it may be optimal for them to return because the returns to that type of capital are higher in the home country. The savings that immigrants accumulate in Germany have higher purchasing power in their home country due to the lower prices there. Dustmann (1995, 1997) uses this fact as a motivation for return migration. On the other hand, since most guestworkers took jobs as unskilled workers, it is quite unlikely that their goal in moving to Germany was to acquire human capital. Even if they acquired some skills, these skills would be specific to the German labor market, which is a more capital-intensive production environment, and would not fit to the needs of the

[4] The initial goal of the guestworker recruitment system was to have these migrants work in Germany for a limited number of years and replace them with new ones once their permit expired. While many of the migrants in fact went back, some stayed. Paine (1974) reports that, in practice, if these guestworkers maintained their employment status in Germany for a few years, they were able to stay. In 1973, after the oil price shocks, recruitment of new immigrant workers came to a halt. However, immigration continued mostly in the form of family reunification.

home country labor market. In fact, based on a survey of Turkish emigrants from Germany in Turkey, Dustmann and Kirchkamp (2002) report that only 6 percent worked as salaried workers after return whereas 51 percent of the returners were self-employed. The other 43 percent were retired. The facts that half of these migrants engaged in entrepreneurial activities after return and that most of the rest lived as rentiers suggest a savings motive for immigrating to Germany. If the goal of guestworkers were to accumulate savings, they would have high saving rates. Based on an empirical investigation of Turkish households in Germany, Kumcu (1989), in fact, finds evidence for very high saving rates. Another reason for return migration, used by Hill (1987) and Djajic and Milbourne (1988), is that migrants have a preference for location. Return migration may also be the result of unexpected events, either in the host or home country (Berninghaus and Siefer-Vogt, 1992; Tunalı, 2000). Even when it is optimal to immigrate ex-ante, it may be optimal to return after the realization of negative shocks in the host country.

There have been a number of studies on the impact of immigrants on the host country social security system. Borjas (1994) calculates the fiscal burden on native taxpayers imposed by immigrants in the U.S. by accounting for welfare expenditures and taxes paid by immigrants. Analyzing the redistribution caused by public transfers, old-age pensions, and tax and social security contributions, Büchel and Frick (2001) find that immigrants in Germany are net payers. They attribute this fact mainly to the age composition of immigrants, which makes them less likely to receive old-age pensions. These studies examine the net contributions in a few years and, therefore, are likely to be influenced with the particular age composition or labor market situation in that few years.

Noting the need for longitudinal calculations for assessing the fiscal impact of immigration, Lee and Miller (2000) calculate the net fiscal impact of immigration over the life-cycle and generations in the U.S using detailed demographic and fiscal environment projections. They find that the NPV of a legal immigrant as $99,000; however, they also claim that changing the level of immigration would still have a small fiscal impact. There are also a number of studies that use the generational accounting framework of Auerbach et al. (1991), which allows not only the calculation of net contributions but also the impact of immigrants on the fiscal imbalance. The findings of Auerbach and Oreopoulos (1999), using this framework, agree with those of Lee and Miller (2000) that immigration would have a small impact on the fiscal imbalance in the U.S.. Storesletten (2000), using a dynamic equilibrium model that accounts for certain demographics and a detailed fiscal structure, also finds a positive net impact; however, unlike Lee and Miller (2000) and Auerbach and Oreopoulos (1999), he claims that it would be possible to sustain the current U.S. fiscal structure by selective immigration. Positive fiscal impact of immigrants is also reported in other countries. Also using generational accounting frameworks, Dolores-Collado et al. (2004) for Spain and Mayr (2005) for Austria reach this conclusion. However, the studies from Scandinavian countries reveal opposite results. Schou (2006) finds that increased immigration would worsen the fiscal balance in Denmark. Storesletten (2003) finds that in Sweden net contributions of existing immigrants are negative; however, he also notes that net contributions of younger immigrants are positive.

Studies regarding the fiscal impact of immigrants in Germany generally point out to a positive net impact, which is in accordance with my findings, as well as potentially important contributions to the fiscal imbalance. For instance, Bönin et al. (2000) find that immigrants, especially those that arrive at younger ages, have a positive fiscal impact in Germany. Moreover, they calculate that the tax burden of natives decreases by thirty percent in the case an annual immigration that is 0.25 percent of the population. Börsch-Supan (1994) finds that immigration at historical levels (300,000 persons per year) makes an important contribution to keeping the public pension system stable. In fact, it reduces the increase that would happen otherwise in the contribution rates to the various social security systems by about 50 percent.

Unlike Storesletten (2000), I ignore the indirect effects on wages and on native productivity. However, most empirical studies conducted on this issue find that there is no evidence for immigrants depressing the labor market conditions for natives. Friedberg and Hunt (1995), in their survey paper, and Lalonde and Topel (1991) point out that the effect of immigration on equilibrium wages is negligible. Moreover, given the rigid institutional features of the German labor market, this becomes even more likely. On the other hand, one might expect the impact on the employment of natives to be more important. However, Pischke and Velling (1997) find no employment displacement effects of immigration on natives in Germany. Therefore, I think that a partial equilibrium approach for this study is appropriate.

3 MODEL

In this section I present the basic structure of the model and its solution in the dynamic setting.

3.1 Basic Structure

The basic structure is the discrete choice dynamic programming approach, as outlined in Eckstein and Wolpin (1989). Immigrants choose among a finite set of mutually exclusive alternatives over a finite horizon. I model the decisions of male household heads.

3.1.1 Choice Set

The elements of the choice set are return migration and saving decisions. Each period, immigrants realize their labor market status and earnings and decide first whether to stay in Germany or go back to their home country. If they choose to stay, they also make a decision about how much to save.

3.1.2 Preferences in Germany

Immigrants have preferences over consumption (c_t) and location of residence. Their marginal utility of consumption (μ) varies by their age and permanent unobserved preference characteristics (type). (There is a finite number of types of immigrants according to their various permanent unobserved characteristics, and immigrants within the same type group share the same unobserved heterogeneity.) Below, $\rho(.)$ stands for immigrants' psychic cost of living in Germany. This is the difference between the psychic utility in Germany and that in the host country. Immigrants' psychic cost varies by their duration of residence in Germany (t), as they adjust to the new surroundings, as well as by their age at entry and unobserved permanent characteristics.

$$u_t(.) = \mu(age_t, type)\frac{c_t^{\lambda}}{\lambda} + \rho(t, age_0, type)\exp(\eta_t^s)$$

Above, λ is the constant relative risk aversion parameter and η_t^s is a random shock to preferences.

Constraints There are three constraints: (i) Given their net earnings (y_t) and asset income (rA_t), immigrants make their consumption and saving decisions. A_t is asset holdings at period t and r is the interest rate. (ii) There is a minimum consumption level, $c_{\min}$, which is an institutional feature in this model because this consumption level is guaranteed by the German government through its social assistance for subsistence income program. I allow this subsistence income, which depends on family size, to vary by age and nationality (z).

(This is explained later in the social assistance subsection.) (iii) Borrowing is not allowed.[5]

$$(i)\ \ c_t + (A_{t+1} - A_t) \leq y_t + rA_t, \qquad (ii)\ \ c_t \geq c_{\min}(age_t, z), \qquad (iii)\ \ A_t \geq 0$$

3.1.3 Labor Market Status in Germany

There are three potential paths to retirement in Germany: old-age retirement schemes after age 60, disability, and pre-retirement. Old-age retirement is, in turn, possible through four different paths for male workers: 1) One can retire after age 65. 2) Retirement is also possible at age 63 conditional on having a long service life, which is 35 years. 3) Conditional on a qualifying period of at least 15 years, workers who have been unemployed for 52 weeks can retire at age 60. 4) Retirement after age 60 is also possible for disabled workers.[6] It is also possible to enter retirement before age 60 through disability and pre-retirement. The German public pension system provides benefits to disabled workers below age 60. Pre-retirement before age 60 is also possible if the worker is receiving unemployment compensation.

I assume that all male household heads who are not retired are willing to work. Moreover, retirement is an absorbing state. Labor market status is modeled using a multinomial logit that depends on the labor market status in the previous period, age, age at entry to Germany, nationality as well as permanent labor market characteristics.

$$l_t = L(l_{t-1}, age_t, age_0, z, type)$$

3.1.4 Income in Germany

Gross Earnings Labor market earnings of an immigrant at period t, $\overline{y_t}$, depends on how much human capital he has acquired, H_t, on the rental price of human capital, p, as well as a random productivity shock, η_t^y. The level of human capital at any period depends on the years of residence, age at entry, nationality and permanent skill characteristics of the immigrant.

$$\overline{y_t} = pH_t \exp(\eta_t^y), \quad \text{where} \quad H_t = H(t, age_0, z, type)$$

[5] Immigrants are there to save.

[6] I assume that this structure is unchanged during the life-cycle of an immigrant and that immigrants expect no change. (In fact, there was an upward adjustment in the retirement age with a reform passed in 1992. However, as Börsch-Supan and Wilke (2004) report, this reform will be completely in effect only in 2017 and would not affect most of the workers in my sample.)

Social Security Contributions Workers in Germany pay three types of social security contributions: pension, unemployment and health insurance. Pension insurance contribution is applied at a rate of 9.35% (τ^p) and unemployment insurance contribution is applied at a rate of 2.15% (τ^u), both up to an earnings maximum of 85,000DM ($y^{\max}$) (1998 prices). The health insurance contribution is applied at a rate of 7% (τ^h) up to an earnings maximum of $0.75y^{\max}$. Earnings below 6,000DM ($y^{\min}$)(1998 prices) are exempt from social security taxes.[7] Thus, total security taxes, $\Gamma(.)$ can be written as follows:

$$\Gamma(\overline{y_t}) = \begin{array}{ccc} 0 & \text{if} & \overline{y_t} \leq y^{\min} \\ (\tau^p + \tau^u + \tau^h)\overline{y_t} & \text{if} & y^{\min} < \overline{y_t} \leq 0.75y^{\max} \\ (\tau^p + \tau^u)\overline{y_t} + \tau^h y^{\max,1} & \text{if} & 0.75y^{\max} < \overline{y_t} \leq y^{\max} \\ (\tau^p + \tau^u)y^{\max,2} + \tau^h y^{\max,1} & \text{if} & y^{\max,2} < \overline{y_t} \end{array}$$

Net Earnings Net earnings, y_t, are gross earnings net of social security contributions and income taxes.

$$y_t = (1 - \tau\left[\overline{y_t} - \Gamma(\overline{y_t})\right])\left[\overline{y_t} - \Gamma(\overline{y_t})\right]$$

Above, $\tau\left[\overline{y_t} - \Gamma(\overline{y_t})\right]$ is the average income tax rate for $\overline{y_t} - \Gamma(\overline{y_t})$, earnings net of social security contributions. $\tau(.)$ is calculated according to following marginal tax rate schedule: Income below subsistence income is tax free. Above that level, the marginal tax rate rises from 22% to 56% up to an earnings level of 120,000DM (in 1998 prices)[8][9]

Unemployment Benefits and Unemployment Assistance Workers who were employed for at least 360 days in the last 3 years qualify to receive unemployment benefits, which are equal to 67% of their last net earnings if they have at least one child. The entitlement duration varies from 180 to 960 days depending on the age and experience of the worker. There is also a second phase of the unemployment insurance system. Workers who are no longer eligible for unemployment benefits can receive unemployment assistance. This is equal to 57% of their last net earnings if they have at least one child and there is no limit to the duration of unemployment assistance after the exhaustion of unemployment benefits.

[7] This period still counts toward the pension-qualifying period for the worker.

[8] These numbers are chosen to average the values for the years 1965 to 2000 (German Ministry of Finance, 2004).

[9] There have been very small changes in the social security contribution and income tax rates. I assume that immigrants expect these rates to stay at these levels when they make forecasts about the future in the forward-looking nature of the model.

Unlike unemployment benefits, unemployment assistance is means tested according to asset income. Both unemployment benefits and assistance are net earnings and, therefore neither social security nor income taxes are applicable.

I make a number of modeling simplifications for tractability. I take unemployment benefits and assistance at any period as the above percentages of expected net earnings at that period rather than the realized last net earnings.[10] In addition, I take the duration of entitlement to unemployment benefits as two years (which is equivalent to one period in the solution of the model). Finally, I assume that after four years of residence all immigrants qualify for unemployment benefits. In other words, residence in the host country without any work experience can not last for more than 4 years.[11] Thus, earnings of an unemployed immigrant can be written as follows:

$$y_t = \left\{ \begin{array}{c} 0 \quad \text{if} \quad \text{not qualified for benefits} \\ \\ 0.67\left(pH_t e^{\sigma_y^2/2} - \Gamma(pH_t e^{\sigma_y^2/2})\right)\left[1 - \tau\left(pH_t e^{\sigma_y^2/2} - \Gamma(pH_t e^{\sigma_y^2/2})\right)\right] \\ \text{if} \quad (l_t = 0 \text{ and } l_{t-1} = 1) \\ \\ 0.57\left(pH_t e^{\sigma_y^2/2} - \Gamma(pH_t e^{\sigma_y^2/2})\right)\left[1 - \tau\left(pH_t e^{\sigma_y^2/2} - \Gamma(pH_t e^{\sigma_y^2/2})\right)\right] - rA_t \\ \text{if} \quad (l_t = 0 \text{ and } l_{t-1} = 0 \text{ and qualified for benefits}) \end{array} \right\}$$

Pension Benefits German pension insurance system is mandatory to all workers except for the self-employed and those with very low incomes. I assume that these two groups, which constitute a small fraction of the immigrant population, choose to enroll in the pension insurance system.

The minimum contribution period to qualify for pension benefits is five years in Germany. Since periods of unemployment are included in the qualifying period in the German pension insurance system and in the model all immigrants are willing to work, everybody with duration of residence longer than the qualifying period is entitled to pension benefits in the model.

[10] There is an additional approximation here in that taxes are calculated based on expected earnings. Expected value of taxes could be different from taxes calculated based on expected earnings due to the kinks in the tax function.

[11] It would be impossible to maintain residence status after 4 years of unemployment for non-EU immigrants. Moreover, many of the guestworkers were already assigned to German employers at the time of entry. Besides, further residence after four years of unemployment would be very unlikely for any economic migrant with zero earnings.

All three different paths to retirement (regular retirement schemes after age 60, disability, and pre-retirement) in fact pay the same level of benefit.[12][13]. Two key determinants of pension benefits in Germany are workers' history of labor market earnings and their contribution period.[14] Workers' history of labor market earnings is averaged to generate their relative contribution position. Their contribution period, which includes periods of unemployment, determines the replacement rate applied to the relative contribution position.

According to Börsch-Supan and Schnabel (1999), the replacement rate – defined as the ratio of net pension benefits to average net earnings while employed – for a worker with a forty-five year earnings history and average lifetime earnings is 72 percent. In addition, pension benefits are proportional to the duration of contribution. Therefore, for a worker with average lifetime earnings, each additional year of earnings history amounts to a 1.6 percent increase in the replacement rate.[15]

For tractability, I generalize this property for the worker with average lifetime earnings to all workers. This assumes that the replacement rate does not depend on the relative income level of workers, i.e., there is no redistribution. Borsch-Supan and Schnabel (1999) report that there is in fact very little redistribution in the German pension insurance system, except for those with very high incomes (those whose incomes are three times as much as the national average). Given the relatively low incomes of immigrants in Germany, there is a very tiny of fraction of them in this income range.

Again for tractability, in calculating pension benefits at period t, I assume that replace-

[12]In order to qualify for disability benefits, a worker must pass an earnings test. If he passes the stricter earnings test, he is qualified for full benefits. If he can only pass the weaker earnings test, he receives two-thirds of his old-age pension. Börsch-Supan and Wilke (2004) report that these rules were interpreted very broadly in the 1970s and the early 1980s, and, as a result, the vast majority of the workers received full benefits.

[13]Börsch-Supan et al. (2002) report that even though pre-retirement income is subject to a negotiation between the worker and the employer, the resulting level generally tracks the public insurance benefits closely.

[14]There are also two other adjustment factors: one for the pension type and one for the average pension level, which determines the income distribution between pensioners and the working population.

[15]I ignore the adjustment factors for late retirement. Late retirement is very uncommon due to the strong incentives for early-retirement in the German retirement system. Moreover, the importance of these adjustment factors is diminished after accounting for the increase in benefits due to the longer years of service life.

The 1992 reform also introduced a penalty to the replacement rate in the case of early retirement. The additional penalty is rather small. The pre-1992 replacement rate (and that in my model) for early retirement decreases only due to a shorter service life.

ment rate is applied to the average of expected net earnings at all periods until period t rather than to the average of realized net earnings. When the replacement rate of $0.016t$ is applied on the average of expected net earnings, the level of pension benefits (y_t) is found.

$$y_t = 0.016 * t * \sum_{j=1}^{t} \frac{\left(pH_t e^{\sigma_y^2/2} - \Gamma(pH_t e^{\sigma_y^2/2})\right)\left[1 - \tau\left(pH_t e^{\sigma_y^2/2} - \Gamma(pH_t e^{\sigma_y^2/2})\right)\right]}{t}$$

Social Assistance for Subsistence Income Immigrants can also receive social assistance if their income is not high enough to provide for their basic needs. Eligibility depends on net earnings and asset holdings. If the sum of monthly net earnings and asset flows of residents falls below the subsistence income level[16], the government makes up for the difference. Subsistence income for a family depends on its size and varies across states. In 1998, the payment for the head of the household averaged around 520 DM across states. The spouse of the household head receives 80% of this amount and there is an additional payment for each child, which varies from 50% to 90% depending on the age of the child. Marriage status and number of children are not included in the model as state variables. However, they are strongly correlated with age and nationality. Therefore, I write the subsistence level income as 520DM times a family multiplier that varies by age and nationality. This multiplier as a function of age and nationality is estimated outside of the model.

$$y_t + rA_t >= 520 * family\_multp(age_t, z)^{17} \quad \text{DM per month}$$

3.1.5 Preferences in the Home Country

Once an immigrant returns to his home country, he exits the sample. As a result, I have no information on his labor market status, earnings or saving decisions after return. Therefore, the utility an immigrant receives from returning to his home country to spend the rest of his life there, $V^L(\widetilde{\mathbf{S}}_t)$, is written as a function of a subset of the state variables at the

[16]According to the German Ministry for Health and Social Services, this subsistence income includes expenses on food, housing, clothing, toiletries, household goods, heating and everyday personal necessities, and -within reasonable limits- expenses for socializing.

[17]I calculate the probability of being married and the mean number of children by age for each nationality. Then, I smooth both the probability of being married and mean number of children profiles using lowess smoothing and use these smoothed values in calculating the family multiplier according to the rules of the social assistance program:

$family\_multp(age_t, z) = [1 + 0.8(prob\_married(age_t, z)) + 0.7(no\_children(age_t, z))]$

I average the fraction received by children as 70 percent.

time of return. These state variables include assets interacted with purchasing power parity ($pppA_t$), age, duration of residence and nationality. This part of immigrants' preferences is deterministic.

$$V^L(\widetilde{\mathbf{S}}_t) = V^L(pppA_t, age_t, t, z)$$

This function is explained in detail in Appendix A along with the other functional specifications.

3.2 The Problem in Recursive Formulation

Given the current realizations of the shocks to their earnings and preferences, immigrants calculate the value of staying in Germany, $V_t^S(S_t)$, and the value of returning to their home country, $V_t^L(\widetilde{\mathbf{S}}_t)$, and make their return decision accordingly. $\mathbf{S}_t$ is the state space at time t. The decision spell starts when an immigrant enters Germany and goes until he dies or returns to his home country. Mortality is deterministic and the age of mortality is taken as 70 for Turkish, 72 for Yugoslavian and 76 for Italian, Greek and Spanish immigrants in accordance with life expectancies for males in these countries (for the birth cohorts in the sample). A detailed explanation of how these life expectancies are calculated is given in Appendix B.

$$V_t(\mathbf{S}_t) = \max\{V_t^S(\mathbf{S}_t), V_t^L(\widetilde{\mathbf{S}}_t)\}$$

If immigrants choose to stay in Germany, they make a saving decision over K alternatives to maximize the present discounted value of their remaining lifetime utility.[18] Below $d_\tau^k = 1$ if alternative k is chosen at period τ and =0 otherwise. δ is the discount factor, which varies by type. The expectation is taken over the distribution of shocks to earnings and preferences.

$$V_t^S(\mathbf{S}_t) = \max_{\Delta A_t^k} E\left[\sum_{\tau=t}^{T}\sum_{k=1}^{K} \delta(type)^{\tau-t} u_\tau^k d_\tau^k | \mathbf{S}_t\right]$$

The above problem can be recast in the following dynamic programming form.

$$V_t^S(\mathbf{S}_t) = \max_{A_{t+1}}\{u(c_t, \boldsymbol{\eta}_t) + \delta E_t V_{t+1}(\mathbf{S}_{t+1})\}$$

The solution to this problem is given by a decision rule that takes the points of the state space to the optimal saving choice. In the last period of the problem, the continuation

[18] The saving choice is discretized into 10 separate values, which are ±(6,000, 12,000, 24,000) and 0, +18,000, +36,000 and +48,000.

value is a bequest function that depends on the level of assets and the permanent preference characteristics: $V_{T+1}(\mathbf{S}_{T+1}) = B(A_{T+1}, type)$. (This function does not introduce any new parameters. As explained in Appendix A, all of its parameters are also parameters in the value of the returning to home country function, $V^L(\widetilde{\mathbf{S}}_t)$.)

The solution of this problem is not analytic and a numerical backward solution algorithm is used. This solution involves the calculation of $E_t V_{t+1}(S_{t+1})$, which requires the calculation of multi-dimensional integrals due to the number of stochastic elements in the model. This is done using Monte-Carlo integration over the joint distribution of shocks to preferences and earnings at all possible points of the state space for all periods. Since the number of the state space points at which the problem needs to be solved depends on the decision horizon, I take the decision period as two years to alleviate the computational burden.

4 DATA

The data set used in this study is the German Socio-Economic Panel (GSOEP). This is a longitudinal data set of households in Germany that contains an oversampled group of immigrants from five Mediterranean countries, of which three are members of the European Union (Greece, Italy and Spain) and two are not (Turkey and Ex-Yugoslavia). I use the 2000 version of the GSOEP, which is conducted annually from 1984 to 2000. The initial sample contains 1326 households.

I analyze the behavior of male immigrants who made the choice to immigrate to Germany. Therefore, I restrict the sample to households with a first-generation immigrant male. A first-generation immigrant is defined as one who entered Germany after the age of 18. 1055 households have a first-generation male household head. In addition, nine households have a first-generation male whose family status is registered as a spouse. Defining these nine males as household heads, I end up with 1064 households with a first-generation male household head. Two of these who entered Germany after the age of fifty are dropped. Consequently, the final sample contains 1062 male first-generation household heads.[19]

The surveys on these household heads contain detailed information on return migration, saving, labor market status and earnings. Return migration is reported as "moved out

[19] In addition, there are 28 other first-generation males who enter the sample later, after 1984, mostly through marriages to the initial members of the sample. However, since this group is selected into the sample through their higher propensity to marry, I exclude this group.

of country" in the sample by information gathered from other family members, relatives, neighbors, and so forth. Of course, it is possible that some of these immigrants were elsewhere in Germany but mistakenly reported as "moved out of the country". The model incorporates these possibilities by allowing for classification error in return migration outcomes. Saving information is available only after 1991. Immigrants are asked about their average monthly saving. However, the data is censored below at zero because respondents are not asked about their dissaving. Therefore, I treat the zero saving values as interval data, i.e. as zero or negative, in the estimation. (The saving choice can take negative values in the model.)[20] Information on immigrants' labor market status is available from their year of entry to Germany whereas income information is available after 1983, including amounts for each type of income. In accordance with the sources of income in the model, I use labor income, unemployment benefits and assistance, pension benefits, subsistence income and asset flows components. All the income data in the paper are reported in 1998 prices. All four pieces of information – return migration, saving, labor market status, and income – are aggregated to two-year intervals in accordance with the solution of the dynamic model.

The initial sample of immigrants is a random sample of immigrants from five source countries in Germany in 1984. Since some immigrants already returned to their home country by 1984, this is not a random sample of the initial cohorts of immigrants, but a stock-sample with follow-up. Therefore, I use the standard techniques in duration analysis to handle left-truncation in generating the hazard functions. The information on return behavior, for instance, within the first ten years in Germany comes from only those immigrants who entered Germany after 1975; within the first 20 years it comes from those who entered after 1965 and so forth. (The first return is observed in 1985.) This implies that when I compute the Kaplan-Meier hazard functions, I assume that there are no cohort effects.[21]

Another issue with regard to the data is that there is no information about accumulated savings, which is a state variable of the model. (However, I have saving information.) To

[20] GSOEP has also information on remittances and how much of the remittances are for consumption and how much for saving purposes. The assumption I make in calculating saving data is that if an immigrant make remittances in the form of savings, he also includes this amount when he answers the question on his average monthly saving. In fact, both the GSOEP data and a study by Koç and Onan (2004), using data from Turkey, show that most of the remittances are for consumption purposes.

[21] In fact, a test of equality of the survivor functions according to year of entry is not rejected. (The test is done under stratification according to country of origin because the country of origin composition of year-of-entry cohorts varies significantly.)

deal with this problem, I use a particular estimation method that solves the problem of missing state variables in dynamic panel data models.

Macro data are also used in the estimation. These are the purchasing power parity of the source countries with Germany, which determine the purchasing power of accumulated wealth in Germany, and the ratios of expected wages in the source countries, which are used as measures of the relative attractiveness of the labor markets in the source countries. In calculating the expected wages, unemployment rates and the replacement rates of unemployment benefits in the source countries are taken into consideration.[22] Since there is no calendar year in the model, averages of time series data are taken.[23] The macro data are displayed in Table 4.1.

4.1 Descriptive Statistics

Figure 4.1.1 illustrates the percent unemployed and retired immigrants over duration of residence by EU status. For both EU groups, the percentage of unemployed immigrants increases significantly by duration of residence. The upward profile is much more prominent for non-EU immigrants, though; at thirty year of residence while the unemployment rate of EU immigrants is around ten percent, it is above twenty percent for non-EU immigrants. The percentage of retired immigrants before the age of sixty – the earliest age of any regular retirement scheme – is higher for non-EU immigrants. Before the age of sixty, more than twenty percent of non-EU immigrants and more than ten percent of EU immigrants are already retired. The percent of retired immigrants increases substantially at age sixty and after age sixty-five in accordance with the rules of the German retirement system.

The smoothed Kaplan-Meier hazard contributions according to EU status[24], presented in Figure 4.1.2, reveals significant differences between the EU groups. In fact, a statistical

[22] Wage data are taken from Freeman and Oostendorp (2000) and data on the replacement rates of unemployment benefits from OECD Benefits and Wages Indicators (2002).

[23] Including calendar time would substantially increase the computational burden. One could argue that not having calendar time, I could miss the impact of a time trend in the macroeconomic conditions in the source countries. In particular, this is the case for Spain, which saw an improvement in labor market conditions after joining the EU. However, these changes would be much less important for older generations and most of the Spanish guestworkers were beyond their prime-age when the positive changes in the Spanish labor market took place.

[24] This is based on a weighted kernel smooth of estimated hazard contributions. A relatively narrow bandwidth is chosen in order not to smooth too much.

test of the equality of the survivor is rejected. EU immigrants are more likely to return. There are important differences in the timing of return as well. EU immigrants are much more likely to return at earlier periods. Their hazard function exhibits a precipitous decline in the first five periods and after that it smoothens at a six percent level, with a slight rise as immigrants reach retirement age. On the other hand, non-EU immigrants' hazard function has a hump shape that peaks at around the 7th to 8th periods (15 years of residence) at a level of five and a half percent per period (two years).

Figure 4.1.3 presents the income and saving profiles over duration of residence by EU status. The income profiles are rather flat for both EU groups, in particular for non-EU immigrants. Per period income levels are slightly higher for EU immigrants; while they roughly lie between sixty and seventy thousand DM for non-EU immigrants, for EU immigrants they average around seventy thousand DM except for the very early and late periods. In other words, annual income levels are around thirty to thirty–five thousand DM. In the few last periods, income levels drop as immigrants retire. Mean non-negative saving profiles[25] by EU status are illustrated in Figure 4.1.3[26]. The most salient feature of the figure is the difference in the shape of the profiles according to EU status. There is a significant decrease in the saving profile of non-EU immigrants over their duration of residence. It goes down from a level well above 10,000DM in the fifth period to a level below 5,000DM after the 15th period. On the other hand, the saving profile of EU immigrants is relatively constant over time at a level just below 10,000DM until the 17th period.

5 ESTIMATION METHOD

The observed outcomes in the data are return migration choice (m_t), saving choice ($A_{t+1} - A_t$), earnings (y_t), and the labor market status of the migrant (l_t). Let $\{O_i\} = \{D_i, X_i\}$ denote the observed outcomes for individual i, where $D_i = \{d_{it}\} = \{\{m_{it}\}, \{A_{it} - A_{it-1}\}\}$ is the history of observed choices and $X_i = \{x_{it}\} = \{\{l_{it}\}, \{y_{it}\}\}$ is the history of observed exogenous covariates. The data are $\mathbf{O}_i^{obs} = \{\{m_{it}\}_{t=1}^{T_i}, \{A_{it} - A_{it-1}\}_{t=t_{i,1991}}^{T_i}, \{l_{it}\}_{t=1}^{T_i}, \{y_{it}\}_{t=t_{i,1983}}^{T_i}\}$ where $t_{i,19xx}$ is the period number for individual i in 19xx and T_i is the last period in the sample for individual i. If the return choice is to leave, the other outcomes are not observed.

One of the endogenous state variables, assets, is not observed. Therefore, I use the

[25] This is mean non-negative saving because saving data are censored below at zero.

[26] Since the saving data is available only after 1991, the earliest saving observation is at the fifth period.

method introduced by Keane and Wolpin (2001) for estimating dynamic panel data models with unobserved endogenous state variables. Typically, calculation of the probabilities that form the likelihood function requires conditioning on past state variables (see, for instance, Keane and Wolpin (1997)). The novel feature of this method is that it removes the need to calculate these conditional probabilities. The basic idea of this estimation method is to minimize the distance between the simulated and reported outcomes. A measure of the distance between the simulated and reported outcomes is constructed by assuming that the observed outcomes are measured with error. Keane and Sauer (2003) show that this estimator has good small sample properties in a more extended setting.

By acknowledging the existence of measurement errors (classification errors in the case of discrete outcomes), I incorporate into the likelihood calculation, for instance, the fact that when a migrant is observed as employed, there is a positive probability that he was in fact unemployed but his employment status was classified incorrectly in the data. In the case of observed earnings and saving, I take a similar approach; however, in this case the measurement errors have continuous distributions.

Using the initial state variables, $\{A_0 = 0$[27]$, l_0 = 1$[28]$\}$ and the sequence of random shocks drawn for each individual and period, I simulate N choice histories, $D^{sim} = \left\{\{m_t, (A_{t+1} - A_t)\}_{t=1}^{T_i}\right\}_{n=1}^{N}$, and histories for exogenous covariates, $X^{sim} = \left\{\{e_t, y_t\}_{t=1}^{T_t}\right\}_{n=1}^{N}$for each individual i. Unbiased classification errors are also constructed using these simulated values. (See Appendix C for the specifications of these classification errors.)

The contribution to the likelihood of individual i is calculated by the below simulator, which is the probability of observing the reported outcomes conditional on the simulated outcomes averaged over the N simulated choice histories. This simulator is conditional on staying in Germany until 1984 because the sample contains only immigrants who stayed in Germany until 1984.

$$\widehat{P}(O_i^{obs}) = \frac{\sum_{n=1}^{N} P((D_i^{obs}, X_i^{obs})|(D_{in}^{sim}, X_{in}^{sim}))I(\{m_{int}\}_{t=1}^{t_{i,1983}} = 0)}{\sum_{n=1}^{N} I(\{m_{int}\}_{t=1}^{t_{i,1983}} = 0)}$$

[27] Since most of these immigrants were unskilled young people from poor regions that chose to work in a foreign country, I assume that their initial wealth is zero.

[28] Since employment transition is a first-order Markov chain and most immigrants were employed in their first period in Germany –being guestworkers, they were already assigned jobs before entry–, this restriction that everybody was employed before entry would have very little impact on the results.

Note that $P((D_i^{obs}, X_i^{obs})|(D_{in}^{sim}, X_{in}^{sim})$ is not conditional on any of the state variables. Therefore, this probability can be calculated even when some of the state variables are not observed.

Unobserved heterogeneity enters the estimation in the following way: Following Heckman and Singer's (1984) non-parametric modeling of unobserved heterogeneity, I assume that there is a finite number (K) of type groups. Each individual i may belong to any of these type groups, 1 to K. It is the probability of being a certain type that differs across individuals. Therefore, when I generate the simulated outcomes for individual i and calculate the above simulator, I do it separately for all types. Then, the likelihood contribution for this individual is calculated as the weighted average of the above simulator over the probabilities of his belonging to each type.

$$\widehat{P}(O_i^{obs}) = \sum_{k=1}^{K} \kappa_{i,k} \left(\frac{\sum_{n=1}^{N/K} P\left[(O_i^{obs})|(O_{ikn}^{sim})\right] I(\{m_{it}\}_{t=1}^{t_{1983}} = 0)}{\sum_{n=1}^{N/K} I(\{m_{it}\}_{t=1}^{t_{1983}} = 0)} \right)$$

where $\kappa_{i,k}$, the probability of individual i being of type k, is specified as a logit with age at entry and country of origin as arguments. $\kappa_k = \kappa(age_0, z)$

The probability of observing the reported spells conditional on the simulated spells can be written as follows: $P((D_i^{obs}, X_i^{obs})|(D_{in}^{sim}, X_{in}^{sim})) = P(M_i^{obs}|M_{in}^{sim}) \prod_{t=1}^{T_i} \Pr(A_{it} - A_{it-1})^{obs}|(A_{int} - A_{int-1})^{sim}] \Pr(y_{it}^{obs}|y_{int}^{sim}) \Pr(l_{it}^{obs}|l_{int}^{sim})$. Measurement error distributions and classification error rates are used to calculate these probabilities. See appendix C for these calculations. The Downhill Simplex Algorithm is used in the optimization.

6 ESTIMATION RESULTS

In this section, maximum likelihood estimation results based on the full solution of the dynamic model are presented.

6.1 Model Fit

I first illustrate and discuss how the model's predictions as to the return migration and saving choices as well as the exogenous transitions fit the observed features of the data according to EU status. Then, I provide more detailed evidence on the model fit by running a logit regression of return migration decision on a number of observed characteristics using both the data produced by the model and the actual data from GSOEP.

Figure 6.1.1 displays the actual and predicted hazard functions according to EU status. The model does a very good job in capturing both the level and timing of return migration for both EU groups despite the marked differences between them. Figure 6.1.2 displays how the predicted saving profile obtained from the model compares to the actual saving profile by EU status. For non-EU immigrants, the model captures the downward sloping saving profile as well as the level of saving very well. The only exceptions are the first and last few periods where the observations are fewer. The model also predicts the flat shape of the saving profile of EU immigrants around 9,000 DM very well. Moreover, it captures the decline toward the last few periods. However, this decline is not as strong as it is in the data.[29]

The model fits for the exogenous outcomes are presented in Figures 6.1.3 to Figures 6.1.5. Figure 6.1.3 illustrates the fit for mean income according to EU status. For both groups, the model predicts the level and shape of the income profiles very well. The fit is worse at the very first and last periods where the data are sparse. The model fit for the unemployment rates is presented in Figure 6.1.4. For both EU groups, the predictions match the data reasonably well except for the early periods for EU immigrants, where the model overestimates the unemployment rates. The fit for the retirement transition is shown in Figure 6.1.5, also by EU status. The model does a very good job in capturing the retirement probabilities by age for both EU and non-EU immigrants. The only exceptions are at ages 52 and 54, where the model overestimates the retirement rates for both EU groups.

Table 6.1.1 compares the coefficient estimates from a logistic regression of return migration decision on a number of covariates using both the actual data and the simulated data, separately for EU and non-EU immigrants. These covariates include duration of residence in Germany, age at entry, country of origin, income, unemployment status and retirement

[29] I can not compare the saving predictions of my model in the first 5 periods as there is no saving information in the data for these periods. The model predicts that both EU and non-EU immigrants save on average more than a third of their income in the first four years after arrival. This high saving rate is consistent with the findings of the literature on immigrants' saving behavior in Germany. Paine (1974), based on a report 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–, reports a saving rate of 36 percent. Based on a study conducted by the Central Bank of Turkey in 1986, which gathered saving and income information according to immigrants' duration of residence, I find that the saving rate of Turkish immigrants with less than four years of residence was 39 percent.

status. A control for accumulated savings, which is a state variable in the model, is not included because actual data are not available.

Overall, the model does a good job also in capturing the relationship between return migration and these covariates. The simulated data do a very good job in accounting for the relationship between income and return decision as well as the differences across country of origin groups for both EU and non-EU immigrants. Despite a slight underestimation of the coefficients of retirement status, the simulated data capture the opposite signs according to EU status. That the probability of return migration increases with age at entry for both EU groups is also accounted for. While the coefficient estimates from the simulated and actual data are very similar for non-EU immigrants, for EU immigrants the estimate from the simulated data overestimates the true value by sixteen percent. The facts that unemployment increases return probability and that this effect weakens as immigrants' duration of residence increases for EU immigrants are also captured well by the simulated data. The discrepancy between the simulated and actual data coefficients is less than ten percent for both unemployment coefficients. On the other hand, the model does not perform as well for non-EU immigrants in this respect. The coefficients for unemployment and its interaction with duration of residence are underestimated by 21 and 15.5 percent, respectively. That hazard rates decrease at a decreasing rate by duration of residence for EU immigrants is also accounted for by the model. The coefficient of duration of residence is somewhat underestimated, though. Also underestimated are both coefficients for duration of residence terms for non-EU immigrants. However, neither is more than twenty percent off the corresponding values from the regression of actual data. Overall, the simulated data predict the signs of the coefficients of all covariates for both EU groups correctly. Moreover, none of the coefficients differs from the actual values by more than twenty one percent and the majority are within ten percent of the values from the actual data. Therefore, I can claim that the model does a good job not only in capturing the level and timing of return migration, as illustrated in Figure 6.1.1, but also in capturing the relationship between return migration and a number of demographic and labor market characteristics.

I believe that the above evidence for the model fit provides a good case for the credibility of the model.

6.2 Parameter Estimates and Interpretation of Types

The estimated parameters and their standard errors are presented in Appendix D. I am not interested in the estimated value of any parameter per se; however, here I will note one interesting finding regarding the coefficient of CRRA utility function.

The estimated coefficient of the CRRA utility function is 0.63; i.e., the coefficient of relative risk aversion is 0.37, which is low compared to what the literature has generally uncovered so far. My estimate implies a high level of willingness to substitute consumption intertemporally and a low level of relative prudence. Normally a high level of prudence is required so that young people do not borrow despite a rising lifetime income profile. However, with borrowing constraints – which is included in my model – a high level of prudence may not be needed anymore. In fact, Keane and Wolpin (2001), also find a low coefficient of relative risk aversion in their model, which also accounts for borrowing constraints.[30] Moreover, one would expect immigrants, who undertake a relatively risky investment by migrating, to be selected out of people that are less risk averse. In addition, as the estimation results indicate, these immigrants are willing to save a lot and endure relatively low levels of consumption after their arrival to Germany to take advantage of the higher purchasing power of their accumulated savings after returning to their home country. This behavior is more likely to come from people with a high level of willingness to substitute consumption intertemporally.

In a migration model, it becomes very important to understand the differences across immigrant types because the characteristics of the immigrant pool change as the distribution of types change over time due to the differences in the level and timing of their return behavior. I assumed that immigrants differ in terms of their unobserved permanent characteristics with respect to their psychic costs of living in Germany, discount factor, marginal utility of consumption, labor market ability and the way the value of returning to their home country varies with respect to their accumulated savings. Due to the variation in these characteristics, different types display quite different return migration and saving behavior. Figure 6.2.1 displays the hazard functions for all immigrants by type. While type 3 immigrants are stayers, types 1, 2, and 4 can be classified as returners. However, there exist significant differences in the level and timing of return across these returner types as well. Type 4s have the highest the hazard rates and their hazard function is rather flat over duration of residence. While both type 1s and type 2s have upward sloping hazard functions, the hazard

[30] Gooree et. al. report (2003) a number of experimental studies that estimate a risk aversion parameter that is around 0.5.

function of type 2s rises much earlier. Another important distinguishing feature across types, that will be illuminating for the following discussion, is unemployment rates. Type 1s and type 2s have much lower unemployment rates than type 3s and 4s. The unemployment rates of type 4s are also markedly higher than those of type 3s.

Table 6.2.2 lists the proportion of each type by nationality over duration of residence. At the time of their arrival to Germany, there exist a higher fraction of type 1s and type 4s among EU immigrants whereas the fraction of type 2s and type 3s are higher for non-EU immigrants. However, there also exists significant variation across nationalities within EU groups: For instance, while 41.7 percent of Turkish immigrants are type 2, only 9.7 percent of ex-Yugoslavians are. The percentage of type 1s are 41.1 for Greek immigrants whereas this percentage is only 14.2 for Italians. As can be seen from the table, the fraction of type 4s in the immigrant pool decreases quickly due to their high hazard rates. For instance, while 48.2 percent of Greek immigrants are type 4 at arrival, this ratio decreases to 14 percent after ten years of residence, and to 3 percent after twenty years of residence. Similarly, the fraction of type 3s have a monotonic trend, which is increasing. On the other hand, the fraction of type 1s and 2s in the sample at first increase and then decrease. For instance, the fraction of type 1 immigrants among Italian immigrants at arrival, which are 14.2 percent, rises to 34.2 percent after 20 years of residence, but then fall to 20.8 percent after 40 years of residence. The variation within unobserved types according to observed characteristics is also significant. For instance, among type 4s while 51.4 percent of ex-Yugoslavian immigrants survive in Germany for six years, only 21.5 percent of Italians do. For type 4s, many of who return at early ages, expected wages in the home country matter more. On the other hand, the order of survivor rates for the same two nationalities is just the opposite for type 2s: While 31.6 percent of ex-Yugoslavian immigrants survive in Germany for 20 years, 50.7 percent of Italians do. For type 2 immigrants, whose value of returning to their home country is strongly associated with their accumulated savings, the purchasing power parity between their home countries and Germany plays an important role.

7 THE IMPACT OF IMMIGRANTS ON THE GERMAN SOCIAL SECURITY SYSTEM

In this section, I examine the net lifetime contributions of immigrants to the pension insurance and unemployment insurance systems and how return migration influences them.[31] Both pension and unemployment insurance taxes are levied equally on employees and employers. (Details about workers' contributions are already provided in the model section.) Unemployed workers do not pay pension and unemployment insurance contributions. Immigrants can receive their pension benefits even after they return to their home countries. Those who return before the minimum qualification period for pension benefits (sixty months), it is assumed, take back their contributions when they return.[32]

7.1 Pension Insurance

The value of net pension insurance contributions of immigrants (including employers' share) at arrival is calculated using the following formula:

$$PIC = \sum_{s=0}^{t_{ret}-1} c\overline{y_s}\delta^s - \sum_{s=t_{ret}}^{t_{last}} y^p\delta^s - \sum_{s=t_{last}+1}^{t_{last}+5} 0.6y^p\delta^s$$

Above, c is the total contribution rate of employers and employees, $\overline{y}$ is gross earnings, y^p is net pension income, t_{ret} is period of retirement, t_{last} is the last period in the model, and δ $(= 1/(1+r))$ is the discount factor. The first term on the right hand side stands for the contributions and the second term for the receipts of benefits. The last term stands for survivor benefits. In Germany, survivors receive sixty percent of the benefits of their spouses. In accordance with the life expectancies of immigrants from the five source countries in the sample, I take the life expectancy of females as five years longer than that of males. (The calculation of life expectancies is explained in Appendix B.)

Figure 7.1 displays the present value (at arrival) of the net lifetime contributions of immigrants to the pension and unemployment insurance systems by country of origin and age at entry. Pension insurance contributions are positive regardless of age-at-entry and

[31] The only element of the social security system that is missing here is health insurance. Since participation in this insurance system entitles not only the immigrant himself but also his family to benefits, calculation of the time profile of benefits would require modeling the dynamics of the family structure.

[32] Those who do not take their contributions back could also count this period toward their retirement in their home country, in which case the German government pays its share of benefits.

country of origin and quantitatively significant for some groups. For instance, the value of net lifetime contributions of a Turkish immigrant that enters at the age of 18 is 84,427 DM, and that for an ex-Yugoslavian immigrant that enters at the same age is 125,368 DM (1998 prices). Table 7.1 lists the aggregated values of net contributions at the country of origin level. According to this, net contributions to the pension insurance system is 71,542 DM for Turkish, 94,880 DM for ex-Yugoslavian, 40,431 DM for Greek, 30,175 DM for Italian, and 28,652 DM for Spanish immigrants. Compared to entry level earnings, net contributions of Turkish and ex-Yugoslavian immigrants are 2.7 and 3.25 times higher, respectively. While net contributions of Italian and Spanish immigrants are roughly equal to entry level earnings, it is 1.4 times higher for Greek immigrants.

A very important factor that contributes to the positive net pension insurance contributions of immigrants is that their average age of retirement is higher than that of natives. The average age of retirement has been rather low in Germany due to the various early retirement possibilities explained earlier. According to Börsch-Supan and Wilke (2004), the average age of retirement has been below sixty since 1978. It was even below fifty-nine between 1980 and 1985. On the other hand, according to my simulations, the average age of retirement is 61.5 for Turkish, 63.2 for ex-Yugoslavian, 62.8 for Greek, 63.2 for Spanish, and 63.6 for Spanish immigrants. The reason to the higher average retirement age of immigrants is that most of the immigrants who return to their home countries can not utilize any of the early retirement schemes and, therefore, can only retire at regular retirement age of sixty-five.

It is also important to note that this later average age of retirement can exist despite earlier retirement of immigrants who stay in Germany. For instance, according to my model, 29 percent of fifty-eight-year-old and 51 percent of sixty-year-old Turkish immigrants are receiving pension benefits. On the other hand, Börsch-Supan and Schnabel (1999) report, based on the 1993-95 waves of the GSOEP, that these percentages are around 20 and 45 percent for fifty-eight and sixty-year-olds, respectively. In other words, even though the Turkish immigrants who stay in Germany have higher retirement rates conditional on age, when we include the Turkish immigrants who return to their home country, their average age of retirement is in fact higher.

Net contributions of non-EU immigrants are much higher because first non-EU immigrants have shorter life-spans; therefore, they collect less benefits. Second, the level of return migration is higher among EU immigrants and, in particular, their return rates are high at earlier periods. Therefore, both the level and timing of return migration of EU immigrants contribute to a shorter duration of residence in Germany. A shorter contribution period implies that when the net contribution of each additional year of residence is positive, lifetime contributions will be lower and, in fact, net contributions from staying one more year average positive except for the latest periods for certain groups. (The contribution of each additional year is lower at later periods mainly because immigrants are more likely to be unemployed and, therefore, making no contributions.) These facts dominate the effects of a slightly lower retirement age and earnings as well as higher rates of unemployment, and their contributions are higher than those of EU immigrants.

Net lifetime pension insurance contributions of younger age-at-entry groups are higher for all nationalities, as can be seen in Figure 7.1. Holding income constant, older age-at-entry groups will claim lower benefits due to their higher average retirement age. However, this fact is overwhelmed by a number of other factors that work in the opposite direction: First, older age-at-entry cohorts have a shorter contribution period due to not only a shorter remaining worklife but also higher return migration levels. Second, since the earnings of older age-at-entry cohorts are lower, their contribution levels are also lower. (Younger age-at-entry have both higher earnings at arrival and a longer worklife during which their earnings increase.) Finally, since the fraction of worklife spent as unemployed is higher for older age-at-entry groups for all nationalities but Turks, their net contributions are lower.

A comparison of the net contributions of Turkish and ex-Yugoslavian immigrants reveals the strong influence of return behavior on net contributions. Although ex-Yugoslavian immigrants have longer life expectancy than Turkish immigrants, their net contributions are higher except for the oldest age-at-entry cohorts. A key reason to this fact is that ex-Yugoslavian immigrants are less likely to return compared to Turkish immigrants. Since per-period net contributions average positive, in particular during earlier periods, a longer duration of residence implies higher net lifetime contributions. That ex-Yugoslavian immigrants' net contributions are not higher than those of Turkish immigrants' for older age-at-entry cohorts is, in turn, mostly a result of the timing of immigrants' return behavior. For both Turkish and ex-Yugoslavian immigrants, older age-at-entry cohorts are more likely to return. However, ex-Yugoslavians' hazard rates peak immediately after arrival whereas Turkish immigrants' hazard profile peaks much later. For older age-at-entry cohorts of Turkish immigrants, there is simply not sufficient worklife remaining until hazard rates peak. Therefore, the difference between the cumulative hazard rates of younger and older age-at-entry cohorts during their worklife is wider for ex-Yugoslavian immigrants, resulting in a steeper age-at-entry profile.

7.2 Unemployment Insurance

The net contributions of immigrants to the unemployment insurance system by age-at-entry and country of origin are illustrated in the second column of Figure 7.1. As it was for pension insurance, net contributions are positive regardless of age-at-entry and country of origin. However, there exists wide variation across these demographic groups. For instance, the net contribution of Greek immigrants that enter Germany at the age of 18 is 28,073 DM, which is almost equal to their annual earnings at arrival. On the other hand, for Turkish immigrants that enter at the same age, net contributions average only 2,327 DM (1998 prices). The age-at-entry profiles of net contributions are downward sloping for all nationalities but Turks. These profiles are aggregated over age-at-entry and listed by country of origin in Table 7.1. The net contributions are 6,833 DM for Turkish, 16,658 DM for ex-Yugoslavian, 22,592 DM for Greek, 14,322 DM for Italian, and 16,045 DM for Spanish immigrants. In other words, they are roughly equal to a quarter of entry level earnings for Turkish immigrants, half of entry level earnings for ex-Yugoslavian, Italian, and Spanish immigrants, and three quarters of entry level earnings for Greek immigrants.

Perhaps the most salient feature of the net contributions to the unemployment insurance system is the upward sloping profile by age-at-entry for Turkish immigrants unlike all the others. There are two competing effects that bring about this fact: On one hand, older age-at-entry cohorts have higher unemployment rates after arrival. On the other hand, unemployment rates increase remarkably over duration of residence. As a result, when younger age-at-entry cohorts reach the later part of their worklife, their unemployment rates at these ages are higher than those of older age-at-entry cohorts at the same ages. For Turkish immigrants – for whom the increasing trend in unemployment rates over duration of residence is particularly strong – this second effect dominates, and younger age-at-entry cohorts are more likely to be unemployed on average throughout their worklife. On the other hand, for the other four country of origin groups, the first effect dominates, and older age-at-entry cohorts are on average more likely to be unemployed throughout their worklife. Moreover, the difference between the level of return migration of older and younger age-at-entry cohorts is wider for Turkish immigrants (as well as ex-Yugoslavians). Younger cohorts of Turkish immigrants are much more likely to stay until later ages where unemployment rates peak. Besides, the timing of return of younger cohorts of Turkish immigrants is also different from the others'. Their return rates peak later; consequently, they are more likely to stay until periods of higher unemployment rates.

The last row of Table 7.1 lists the total of net lifetime contributions to the pension and unemployment insurance systems, which are 78,374 DM for Turkish, 111,538 DM for ex-Yugoslavian, 63,023 DM for Greek, 44,497 DM for Italian, and 44,697 DM for Spanish immigrants. In other words, the total net contributions to these two insurance systems are roughly one and a half times that of entry level earnings for Italian and Spanish immigrants, more than twice the entry level earnings for Greek immigrants, three times the entry level earnings for Turkish immigrants, and almost four times the entry level earnings for ex-Yugoslavian immigrants.

A very important final fact that needs to be emphasized here is the role that the selectivity of return migration with respect to labor market outcomes plays. Type 4 immigrants whose one key characteristic is low labor ability have much higher return rates than other returner types in earlier periods. All nationalities but Turks have a high fraction of these type of immigrants. In the absence of return migration, the net contributions of these immigrants could be tremendously negative, especially to the unemployment insurance system. In fact, a counterfactual that rules out return migration reveals that net contributions to the unemployment insurance system would be negative for all immigrant groups but Turks. (Ruling out return migration does not make such a big difference for the returner types with better than average labor market outcomes, types 1 and 2, because they tend to return at later periods.) Furthermore, the total of the contributions to the pension and unemployment insurance systems would be negative for all three EU nationalities. I do not want to dwell on the exact numbers that this counterfactual produces because no return migration would mean that some of the following calendar-year immigrant cohorts would not be in Germany. However, this counterfactual gives us a good sense of the role that the selectivity of return migration plays. Significant levels of return migration of immigrants who realizes poor labor market outcomes keep the net government gain at a much higher level than it would have been otherwise. Circulation of immigrants not only provides a more flexible labor market but also keeps the net contributions of immigrants to the state coffers at a higher level.

7.3 Counterfactual: Exogenous Return Migration

The studies done so far that investigate the impact of immigration on the host country fiscal system (e.g. Storesletten, 2000; Lee and Miller, 2000) treat return migration as exogenous. In order to analyze the impact of such a restriction, I eliminate the return migration decision in the model and instead take an exogenous hazard function. In this exogenous modeling, hazard rates still vary by duration of residence as well as nationality according to the estimated values in my model. The results of this counterfactual are presented in Table 7.2.

Such a restriction causes a serious misestimation of the total net contributions of immigrants to the two insurance programs. While it causes an overestimation for Turkish immigrants, whose net contributions increase from 78,374 DM to 93,490 DM (19 percent increase), it underestimates the net contributions of all other immigrant nationalities. Net contributions of ex-Yugoslavian immigrants fall by 33 percent, from 111,538 DM to 74,765 DM. The decrease for EU immigrants is especially remarkable: from 63,023 DM to 16,612 DM for Greek immigrants (74 percent decrease), from 44,497 DM to 1,796 DM for Italian immigrants (96 percent decrease), and from 44,697 DM to 23,647 DM for Spanish immigrants (47 percent decrease).

The problem with this restriction is that even though it preserves the level and timing of return migration at the level of country of origin, it completely ignores the differences in the level and timing of return migration behavior with respect to demographic characteristics of immigrants like age-at-entry as well as with respect to unobserved types. This implies that it also ignores the selection in return migration in terms of labor market characteristics like unemployment status because labor market ability varies substantially across the unobserved types.

Labor market characteristics are particularly important here as they have organic ties to the contributions to the both insurance systems and withdrawals from the unemployment insurance system. However, exogenous modeling does not capture, for instance, the fact that immigrants with worse labor market outcomes are more likely to return in earlier periods for EU immigrants, and, therefore, seriously underestimates their net contributions.

In terms of demographic factors like age at entry, there are important differences in the level, timing, and selection of return migration behavior as well. For instance, the facts that immigrants who arrive at younger ages display lower levels of return migration rates and a steeper downward-sloping hazard function and that they are different with respect to certain permanent characteristics like labor market ability have important implications for their net contributions. However, these are missed by aggregate modeling return migration that does not vary by personal characteristics. Therefore, the age-at-entry profiles of net contributions, see for instance Storesletten (2000), that does not account for endogenous return migration may also cause rotations on the true profile. This, I show below that, in fact, takes place in the context of immigrants in Germany.

Next, I examine the impact of this counterfactual on the net contributions to the pension and unemployment insurance systems, separately. In each section, I first analyze the aggregate impact by country of origin and then focus on the changes in the age-at-entry profiles of net contributions.

Pension Insurance The impact of exogenous return migration on net contributions to the pension insurance system varies substantially across the unobserved types. Exogenous return migration increases the average duration of residence of type 4s, who have higher propensity to be unemployed, because they are more likely to return in earlier periods. Moreover, it decreases the level of return migration among them. However, these changes do not make much of a difference in their net contributions because their per-period net contributions average close to zero due to their high unemployment rates. On the contrary, exogenous return migration shortens the average duration of residence of type 1 and 2 immigrants, who have better than average labor market outcomes, because these immigrants are less likely to return in earlier periods but more likely to return later. Since per-period net contributions are positive for these immigrants, their net lifetime contributions fall due to the shorter duration of residence that comes with exogenous return migration. At the same time, there is a countervailing effect for these immigrants. The level of return migration of these immigrants is higher than average; therefore, exogenous return migration brings about a fall in this level. Since per-period contributions are positive, this increases net contributions. While the timing effect dominates for EU immigrants, the level effect dominates for non-EU immigrants because the timing of exogenous return migration behavior is very similar to the actual return behavior of these returner types for non-EU immigrants, in particular for Turkish immigrants. Therefore, while the net contributions of immigrant types with positive labor market outcomes (types 1 and 2) fall for EU immigrants, they increase for non-EU immigrants. For the stayer types (type 3), per period net contributions are also positive. Exogenous return migration, naturally, brings about an increase in the return migration levels for these immigrants and, consequently, their net lifetime contributions fall for all nationalities. This fall is especially pronounced for EU immigrants as they become more likely to return as a result of exogenous return migration.

The above analysis of the change in net contributions by unobserved types indicates a fall for all types of EU immigrants. In fact, net contributions decrease for all three EU nationalities: From 40,431DM to 27,111DM for Greek, from 30,175DM to 17,563DM for Italian, and from 28,652DM to 22,429DM for Spanish immigrants. On the other hand, for non-EU immigrants exogenous return migration has conflicting effects on different immigrant types. While the increase for returner types with positive labor market outcomes dominate for Turkish immigrants, the fall for stayer types dominate for ex-Yugoslavian immigrants (who have a larger share of stayer types). Net contributions of Turkish immigrants rise from 71,542DM to 79,100DM whereas they fall from 94,880DM to 79,374DM for ex-Yugoslavians.

Another factor contributing to the increase in net contributions of Turkish immigrants is that exogenous return migration increases the average age of retirement more for Turkish immigrants than the others. While the increase for Turkish immigrants is 0.72 years, it is only 0.18 years for Greek and 0.04 years for Spanish immigrants. The average age of retirement decreases for ex-Yugoslavian and Italian immigrants by 0.07 and 0.55 years, respectively.

Exogenous modeling of return migration behavior also causes rotations on the age-at-entry profiles of net contributions as can be seen in Figure 7.2. Despite the fact that the direction of level changes conflict for Turkish and ex-Yugoslavian immigrants, age-at-entry profiles receive similar rotations: The change for older age-at-entry cohorts is more positive for both nationalities. A number of factors contribute to this fact: First, with exogenous return migration – which does not vary by age-at-entry – younger age-at-entry cohorts become more likely to return and older age-at-entry cohorts become more likely to stay. Since per-period net contributions tend to be positive, this changes the net contributions of older age-at-entry cohorts in a more positive way. Second, older age-at-entry cohorts have a lower fraction of stayer types whose net pension contributions decrease substantially and a higher fraction of returner types with positive labor market outcomes whose net contributions increase with exogenous return migration.

Contrary to that for non-EU immigrants, the change in net contributions is more negative for older age-at-entry cohorts of EU immigrants. While the change among the 18-year-old entrants is minus eight percent for Greek and minus twenty-five percent for Italian immigrants, and, in fact positive for Spanish immigrants; among the 40-year-old entrants the changes are minus forty-seven, minus sixty-two, and minus forty percent, respectively. Similar to that for non-EU countries, since the aggregate level of return migration falls for older age-at-entry cohorts with exogenous return migration, we could expect a more positive change for them. However, the differences in the aggregate return behavior across age-at-entry cohorts are not as pronounced for EU countries as they are for non-EU countries.

In addition, there is a timing explanation that works in the other direction. Younger age-at-entry cohorts of EU immigrants are much more likely to return at earlier periods and less likely to return at later periods. Therefore, exogenous return migration flattens their hazard function and increases their average duration of residence. On the contrary, for older age-at-entry cohorts; it makes the hazard function steeper and, therefore, decreases their average duration of residence. Since per-period net contributions are more likely to be positive, in particular in earlier periods, the change for older age-at-entry cohorts is more negative. Moreover, unlike non-EU immigrants, there is a higher fraction of stayer types among older age-at-entry cohorts of EU immigrants for whom net contributions fall with exogenous modeling of return decision.

Unemployment Insurance As it was for pension insurance, the impact of exogenous return migration on net contributions to the unemployment insurance system varies considerably across unobserved types. The most dramatic change is for type 4s, who have the highest unemployment rates and exhibit high levels of and early return migration. Since exogenous return migration lowers the level of return migration and increases the average duration of stay of these immigrants, their unemployment rates rise remarkably. Consequently, their net contributions fall dramatically for all nationalities. For type 1s, the returner type with the longest average duration of stay, exogenous return migration brings about a substantial drop in duration of residence. Since this type of immigrants have positive per-period net contributions due to their low unemployment rates, their net lifetime contributions fall for all nationalities. The impact on type 2s, the other returner type whose average duration of residence is between those of types 1 and 4, has different directions on EU and non-EU immigrants. Exogenous return migration decreases the average duration of residence of this type much more for EU immigrants because EU immigrants have very high return rates at early periods whereas hazard rates of non-EU immigrants peak much later. In addition, exogenous return migration decreases the level of return migration for type 2s. Since they have positive per-period net contributions due to their low unemployment rates (like type 1s), this increases their lifetime net contributions. While this latter effect dominates for non-EU immigrants, the former effect dominates for EU immigrants. Finally, the impact on type 3s, stayers whose unemployment rates lie between those of type 4 and those of types 1 and 2, varies by nationality. Since Turkish immigrants have higher unemployment rates, the shorter average duration of residence brought about by exogenous return migration increases their net contributions. On the other hand, it has just the opposite effect on Spanish immigrants, who have the lowest unemployment rates. The impact on Spanish immigrants is especially reinforced by the more drastic shortening of duration of residence due to the higher and much earlier return migration. The impacts on other nationalities lie in between and are small.

For all three EU nationalities, the above analysis indicates a downward change in net contributions regardless of type. In fact, net unemployment contributions of Greek and Italian immigrants turn negative. The exact levels fall from 22,592 DM to -10,698 DM for Greek, from14,322 DM to -15,767 DM for Italian, and from 16,045 DM to 1,218 DM for Spanish immigrants. For ex-Yugoslavian immigrants, the fall for types 1 and 4 dominate the rise for type 2, and their net contributions fall from 16,658 DM to -4,609 DM. On the other hand, for Turkish immigrants, who have the largest share of type 2s, the rise for type 2s dominate the fall for types 1 and 4, and their net contributions increase from 6,833 DM to 14,391 DM.

Figure 7.3 illustrates the impact of exogenous return migration on the age-at-entry profiles of net contributions for the five nationalities. We see a clockwise rotation in the profiles of both non-EU countries. For Turkish immigrants, net contributions of younger age-at-entry cohorts increase. The primary reason to this is that with exogenous return migration younger age-at-entry cohorts become more likely to return, especially in later periods due to the hump-shaped profile of hazard function; as a result, they do not stay until periods where their unemployment rates peak. The clockwise rotation of ex-Yugoslavian immigrants is driven from the fact that net contributions of older age-at-entry cohorts decrease. This rotation is the most dramatic for any nationality. This is primarily caused by the fact that older age-at-entry cohorts have a higher fraction of type 4s, for whom net contributions decrease remarkably with exogenous return. Moreover, the change in the percentage of type 4s over age-at-entry is the largest for ex-Yugoslavian immigrants: While 13 percent of 18-year-old entrants are type 4, 51 percent of 44-year-old entrants are.

For EU immigrants, there are conflicting effects on the shape of the profile. On one hand, since younger age-at-entry cohorts have a higher fraction of type 4s (contrary to that for ex-Yugoslavians), their net contributions fall. On the other hand, older age-at-entry cohorts have a higher fraction of type 1s whose net contributions also decrease. The former effect seems to dominate for Greek and Italian immigrants and the gap between the baseline and counterfactual profiles shrink over age-at-entry. On the other hand, for Spanish immigrants, it is closer to a parallel downward shift.

8 POLICY EXPERIMENT: FINANCIAL BONUSES TO ENCOURAGE RETURN

This section analyzes the impact of a counterfactual policy experiment in which financial bonuses conditional on return are provided to certain immigrants to encourage their return to their home countries. Unemployment rates of immigrants in Germany are very high. These unemployed workers draw significant amount of benefits for extended periods of time. Moreover, they do not pay pension insurance taxes but their unemployment period counts toward the contribution period used in calculating pension benefits. In addition, there is strong persistence in the unemployment state, especially for older working-age immigrants. Therefore, rather than incurring these negative net contributions for extended periods of time, the German government could provide one-time financial bonuses to unemployed immigrants conditional on return. This would potentially be a less-expensive way to deal with the unemployment of immigrants for the German government.

For this purpose, I examine the impact of financial bonus given to only unemployed immigrants with spell lengths longer than two years.[33] Table 8.1 presents the changes in the combined net contributions to the pension and unemployment insurance systems brought about by various amounts of bonuses according to the period the bonus is implemented.[34] As can be seen from the table, the change is negative at almost all periods for all nationalities regardless of the amount of bonus. Higher amounts of bonuses only increase the magnitude of the negative effects. Therefore, we can conclude that financial bonuses conditional on return would decrease the combined net contributions to the two insurance systems.

The majority of the unemployed belong to either type 3 (stayers) or 4 immigrants. The impact of the bonus on the stayer types is simply none. The amount of bonus has to be too high to make any difference in their return behavior, which would not be a cost-effective measure. Even such high amounts are only effective in later periods. The other type of unemployed immigrants, type 4s, has the highest return rates. Therefore, providing financial bonuses, in fact, works as a return gift to many of these immigrants who would

[33] I experimented with more restrictive policies like targeting the unemployed with longer spells of unemployment. The qualitative results do not change.

[34] It is assumed that immigrants do not expect the implementation of such a policy.

return anyway. Figure 8.1 illustrates the impact of a 200,000 DM bonus given to unemployed immigrants with a spell length of at least two years at the fifth period (10 years of residence) and the tenth period (20 years of residence), separately. The policy in fact increases the return rates at the period the bonus is given. However, as can also be seen from the figure, the return rates immediately following the bonus period decrease. In other words, most of these extra-returners are those who would return in the following periods anyway. Even though reducing the average duration of residence of unemployed immigrants would still be beneficial for the state coffers, its impact will be limited as it is a change in the timing only. Moreover, the former effect dominates any such beneficial effect as can be seen from Table 8.1 and the net effect of the bonus policy is negative.

The impact of the policy is particularly negative at earlier periods for EU immigrants whereas for Turkish immigrants, the negative impact is stronger in later periods. Since the policy is restricted to unemployed immigrants only, the fraction of immigrants that are qualified for the bonus increases with duration of residence. This is especially strong for Turkish immigrants because their unemployment rates rise faster. On the other hand, the propensity to return is lower at later periods. Therefore, conditional on being unemployed the probability of bonus take-up is higher at earlier periods. This fact plays a stronger role for EU immigrants because their return propensities at earlier periods are so much higher. Another factor that makes the policy more effective at earlier periods is the lower level of accumulated savings. This is also more pronounced for EU immigrants because conditional on period, they have lower accumulated savings than non-EU immigrants.

Examining the impact of this policy on the combined net contributions to the two insurance systems, however, reveals us only part of the big picture. Unemployed immigrants do not pay income taxes either. Their lower income also implies that they will be more likely to receive other forms of welfare. However, the modest changes in the return rates in Figure 8.1 in the periods the policy is implemented despite a very high level of bonus as well as the fact that most of these extra-returners are those who would return anyway in the immediately following periods imply that this is not likely to be an effective policy in terms of other measures, either.

9 CONCLUSIONS

In this paper, I investigate the impact of immigrants on the social security system using an estimable dynamic stochastic model of joint return migration and saving choices of immigrants in Germany. I use a rich longitudinal dataset that includes immigrants from five different source countries in the estimation of the behavioral model and the results indicate that the model can account for the main features of the data very well.

Net lifetime contributions of immigrants from the five source countries in this study to both the pension and unemployment insurance systems are positive regardless of age-at–entry. Moreover, the magnitudes of the net contributions are substantial. The ratio of net lifetime contributions to entry-level annual earnings is three for Turkish, almost four for ex-Yugoslavian, more than two for Greek, and roughly one and a half for Italian and Spanish immigrants. In terms of age-at-entry, those who arrive Germany at younger ages make higher net contributions. One key factor that contributes to the positive net contributions to the pension insurance system is the later average age of retirement of immigrants which arises as a result of the fact that many in-migrants who return to their home country can not take advantage of the various early retirement schemes in Germany.

The level, timing, and selection of return migration of immigrants exert a strong influence on their net contributions. Higher return rates of EU compared to non-EU immigrants and of older age-at-entry cohorts compared to younger ones result in a shorter contribution period. Moreover, the steeper downward-sloping profile of their hazard functions lowers the contribution period of EU and younger age-at-entry immigrants even more. Since per-period contributions tend to be positive, a shorter contribution period implies lower lifetime benefits. The results of a counterfactual that treats return migration exogenously while preserving the level and timing of return rates by country of origin reveal that such an exogenous modeling – which has been the practice of the literature so far – causes a serious misestimation of net contributions. For instance, net contributions of Italian immigrants decrease from 44,497 DM to all the way down to 1,796 DM. One key reason to this misestimation is that exogenous return migration does not account for the selection in return migration. For instance, not accounting for the fact that unemployed immigrants are much more likely to return in earlier periods, in particular for EU immigrants, causes a serious underestimation of their net contributions. Moreover, there is limited heterogeneity in the return migration behavior in this counterfactual – which has also been another trait of the literature so far –. Even though this counterfactual captures the level and timing of return migration by country of origin, it does not do so in terms of certain other demographic characteristics like age-at-entry. However, there exists significant variation in the level and timing of return migration as well as in terms of permanent unobserved characteristics across age-at-entry groups. This also brings about serious rotations in the age-at-entry profiles of net contributions commonly analyzed in studies of the fiscal impact of immigrants.

In order to influence the number, demographic composition and labor market status of immigrants, some host countries adopted policies to motivate immigrants to return to their home country. [35] The results of a counterfactual policy experiment reveal that such policies are not likely to be effective. First, such a policy would not be a cost-effective measure for the German government primarily because unemployed immigrants are more likely to return anyway; second, even though this policy brings about some additional returners, these extra-returners are those who would return in the following periods anyway.

Accounting for return migration as an endogenous choice in studying the fiscal impact of immigration would be important in many other countries as well. The empirical literature from various countries reports that emigrants are selected in terms of characteristics like education and earnings ability.[36] Moreover, the institutional structure of the social security system, like the minimum period of contributions required to qualify for pension benefits, influences the timing of emigration.[37] In addition, some of the existing studies in the literature draw conclusions regarding selective immigration policies according to age-at-entry profiles of net contributions.[38] This study shows that not accounting for the heterogeneity in return migration behavior across age-at-entry groups causes important rotations in the age-at-entry profiles of net contributions in Germany. Similar variation in return migration behavior by age-at-entry exists in other countries as well.[39] Therefore, the conclusions of the literature

[35] For instance, in 1983 Germany implemented a policy that provided financial aid to immigrants conditional on returning, especially oriented towards certain nationalities and the unemployed. Similar policies were implemented by England and France, too.

[36] Reagan and Olsen (2000) find that individuals with higher earning power are more likely to remain in the U.S. On the other hand, they also note that welfare participation decreases return propensity. Lam (1994) reports selection with respect to educational attainment in outmigration from Canada. Cohen and Haberfield (2001) find negative selection in terms of earnings in return migration of Israeli Jews from the U.S.

[37] Duleep (1994) reports that there is a rise in the emigration rate right after ten years of residence in the U.S., which is the minimum qualification period for pension benefits.

[38] For instance, Storesletten (2000) claims that admitting 40-44 year-old immigrants would be the best policy in the U.S.

[39] For instance, Reagan and Olsen (2000) report that emigration increases with age-at-entry in the U.S..

that models return migration exogenously in an aggregate manner regarding the net contributions of immigrants to the state coffers and what age groups selective immigration should target could be significantly off the mark.

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TABLE 4.1: Data on PPP and Expected Wages in the Source Countries[40][41]

	Turkey	*ex-Yugoslavia*	*Greece*	*Italy*	*Spain*
PPP with Germany	2.2	2.5	1.6	1.3	1.4
Expected Wage / Expected Wage Turkey	1.0	0.8	1.1	1.6	1.3

TABLE 6.1.1: Logit Regression of Return Migration Using Actual and Model Data

NON-EU IMMIGRANTS	Actual Data			Simulated Data		
	Coef.	Std. Err.		Coef.	Std. Err.	
Period	***0.3525***	0.2991		***0.2837***	0.0080	**
Period Sq.	***-0.0179***	0.0152		***-0.0147***	0.0004	**
Age At Entry	***0.0861***	0.0243	**	***0.0932***	0.0007	**
Ex-Yugoslavian	***-0.9405***	0.3423	**	***-0.9011***	0.0082	**
Income	***-0.0086***	0.0077		***-0.0084***	0.0002	**
Unemployed	***5.7483***	4.1552		***4.5315***	0.1784	**
Unemployed * log(Period)	***-2.7502***	1.8348		***-2.3239***	0.0765	**
Retired	***-0.6246***	0.5795		***-0.5204***	0.0165	**
Number of Observations	2,689			3,872,026		
Wald Statistic	38.90			44196.16		
Number of Covariates	8			8		
Significance	0.000			0.000		

EU IMMIGRANTS	Actual Data			Simulated Data		
	Coef.	Std. Err.		Coef.	Std. Err.	
Period	***-0.3882***	0.1375	**	***-0.3156***	0.0062	**
Period Sq.	***0.0156***	0.0065	*	***0.0146***	0.0003	**
Age At Entry	***0.0498***	0.0231	*	***0.0580***	0.0009	**
Italian	***-0.4260***	0.3023		***-0.3948***	0.0112	**
Spanish	***0.3232***	0.2919		***0.3165***	0.0145	**
Income	***-0.0031***	0.0033		***-0.0033***	0.0002	**
Unemployed	***5.5989***	2.0638	**	***5.0732***	0.2315	**
Unemployed * log(Period)	***-2.1875***	0.8751	*	***-2.0084***	0.0944	**
Retired	***0.7992***	0.4918		***0.7080***	0.0194	**
Number of Observations	2,253			2,957,877		
Wald Statistic	52.18			21110.05		
Number of Covariates	9			9		
Significance	0.000			0.000		

** significance at 1 percent level, * significance at 5 percent level.

[40] Since most of the Italian immigrants are from the southern part of the country, I take the differences in prices between the South and the North into consideration in generating the numbers for Italy. I take the ppp 10% higher, wages 10% lower than the national averages. (Source: Istituto Di Studi E Analisi Economica, 2004)

[41] Expected wage ratio is at purchasing power parity.

TABLE 6.2.1: Type Proportions over Duration of Residence

period	*0*	*5*	*10*	*15*	*20*	*25*
			TURKISH			
Type 1	0.091	0.092	0.103	0.072	0.018	0.001
Type 2	0.417	0.391	0.196	0.060	0.008	0.000
Type 3	0.468	0.513	0.700	0.868	0.974	1.000
Type 4	0.023	0.004	0.001	0.000	0.000	0.000
			ex-YUGOSLAVIAN			
Type 1	0.035	0.042	0.043	0.030	0.010	0.000
Type 2	0.097	0.098	0.046	0.019	0.005	0.000
Type 3	0.599	0.751	0.880	0.947	0.985	1.000
Type 4	0.269	0.109	0.031	0.004	0.000	0.000
			GREEK			
Type 1	0.411	0.676	0.757	0.713	0.522	0.029
Type 2	0.019	0.030	0.018	0.008	0.004	0.000
Type 3	0.088	0.154	0.196	0.273	0.473	0.971
Type 4	0.482	0.140	0.030	0.006	0.001	0.000
			ITALIAN			
Type 1	0.142	0.309	0.342	0.297	0.208	0.005
Type 2	0.056	0.120	0.085	0.028	0.012	0.000
Type 3	0.189	0.444	0.556	0.671	0.780	0.995
Type 4	0.613	0.127	0.018	0.003	0.000	0.000
			SPANISH			
Type 1	0.181	0.523	0.749	0.807	0.688	0.091
Type 2	0.028	0.077	0.054	0.027	0.013	0.000
Type 3	0.020	0.061	0.101	0.147	0.296	0.909
Type 4	0.771	0.339	0.096	0.020	0.003	0.000

TABLE 7.1: Net Contributions by Country of Origin

	Turkish	ex-Yugo.	Greek	Italian	Spanish
Pension Insurance	71,542	94,880	40,431	30,175	28,652
Unemployment Ins.	6,833	16,658	22,592	14,322	16,045
TOTAL	78,375	111,538	63,023	44,497	44,697

TABLE 7.2: Net Contributions If Return Migration Were Exogenous

	Turkish	ex-Yugo.	Greek	Italian	Spanish
Pension Insurance	79,100	79,374	27,311	17,563	22,429
Unemployment Ins.	14,391	-4,609	-10,698	-15,767	1,218
TOTAL	93,491	74,765	16,613	1,796	23,647

TABLE 8.1: Change in Total Pension and Unemployment Insurance Net Contributions per Immigrant with Various Bonuses Given at Various Years of Residences (DM, 1998 prices)

	Turkish	Yugoslav	Greek	Italian	Spanish	Turkish	Yugoslav	Greek	Italian	Spanish
Bonus Amount	***Period=2***					***Period=4***				
20,000	-3	-27	-14	-51	-20	-3	12	-7	-43	-20
30,000	-5	-26	-19	-73	-30	-6	10	-25	-68	-41
40,000	-7	-16	-38	-91	-45	-10	3	-54	-94	-67
50,000	-10	-12	-60	-115	-58	-16	-14	-76	-130	-77
	Period=6					***Period=8***				
20,000	-2	0	-22	-23	-13	0	-27	-31	-15	-32
30,000	-7	-2	-30	-37	-20	-5	-42	-45	5	-49
40,000	-10	-5	-49	-48	-36	-10	-45	-52	6	-39
50,000	-13	-16	-65	-56	-56	-14	-62	-62	-8	-44
	Period=10					***Period=12***				
20,000	-1	-10	-11	-8	-15	-1	-8	-18	-8	-7
30,000	-4	-31	-22	-3	-23	-4	-19	-27	-12	-12
40,000	-8	-35	-40	-1	-38	-4	-26	-36	-16	-19
50,000	-14	-60	-47	-7	-39	-8	-38	-47	-18	-24
	Period=14					***Period=16***				
20,000	-1	-7	9	-2	-5	-13	-3	3	-4	11
30,000	-7	-19	0	-4	-7	-21	-7	-1	-6	8
40,000	-14	-39	-8	-8	-16	-29	-10	-5	-8	4
50,000	-17	-56	-16	-11	-25	-37	-15	-7	-10	0
	Period=18					***Period=20***				
20,000	-24	-7	0	0	0	-24	-16	-1	1	-1
30,000	-39	-15	1	0	1	-39	-39	-1	1	-2
40,000	-49	-23	1	0	1	-45	-59	-2	0	-3
50,000	-58	-27	1	0	3	-55	-62	-3	0	-4

Note: One period is two years of residence.

FIGURE 4.1.1: Percent Unemployed and Retired by EU Status

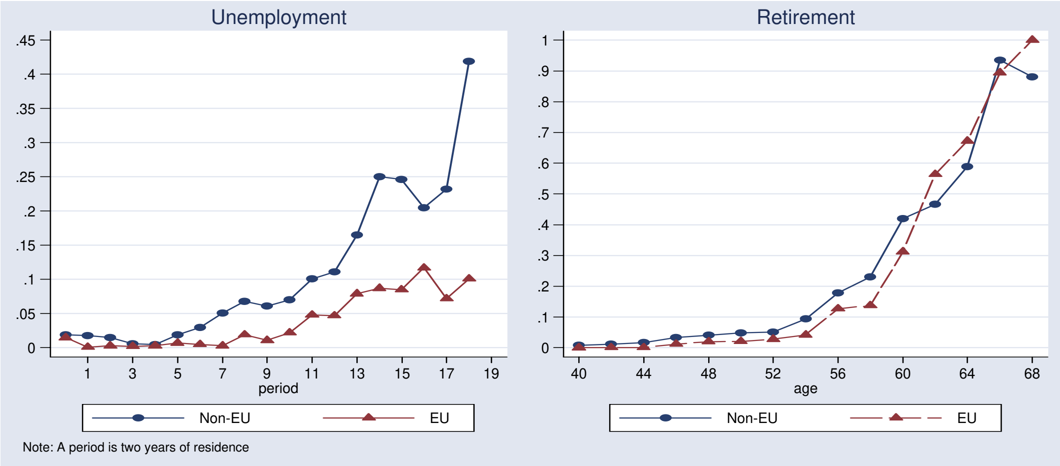


FIGURE 4.1.2: Smoothed Hazard Function by EU Status

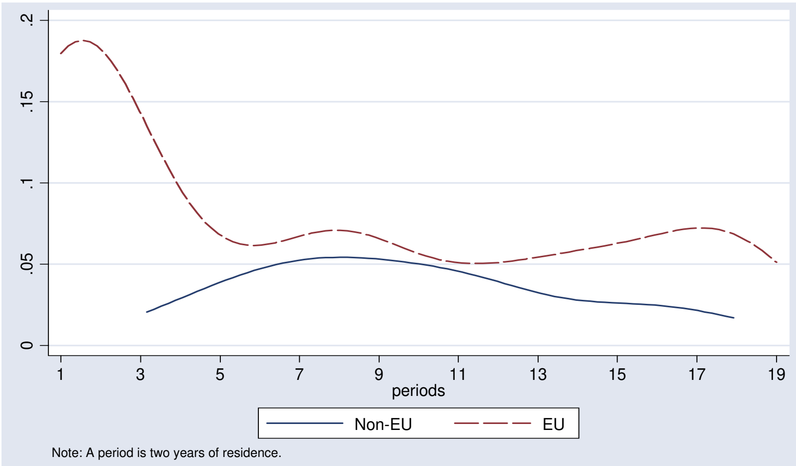


FIGURE 4.1.3: Mean Income and Saving Profiles by EU Status (in 1,000DM, 1998 prices)

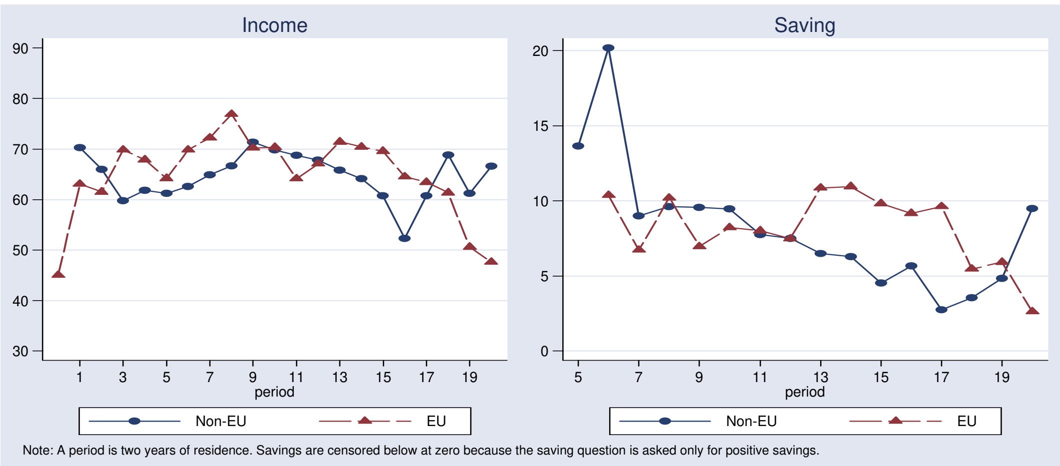


FIGURE 6.1.1: Fit of Hazard Function by EU Status

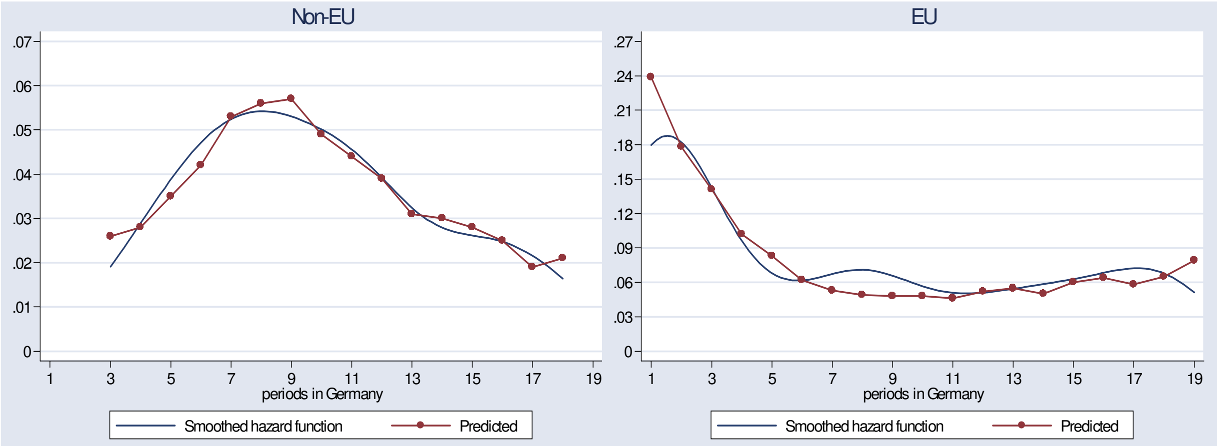


FIGURE 6.1.2: Fit of Saving Profiles by EU Status (in 1,000DM, 1998 prices)

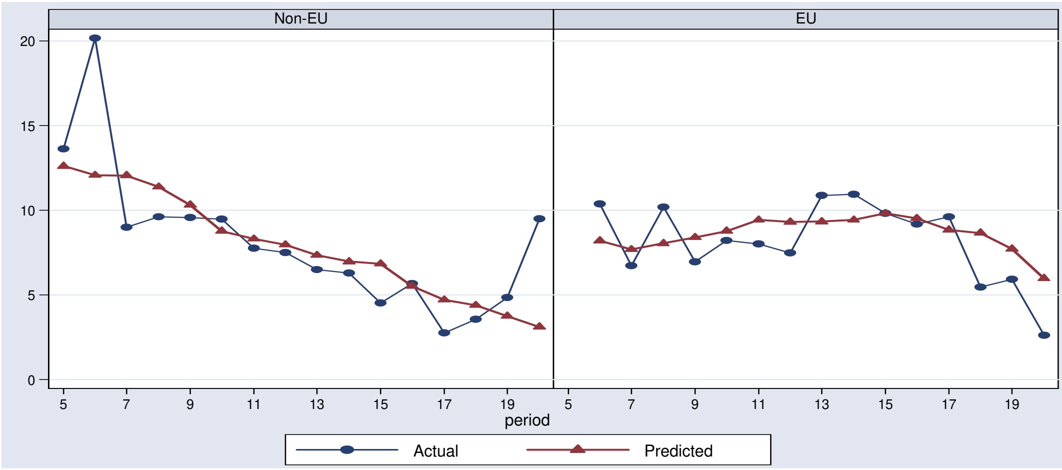


FIGURE 6.1.3: Fit of Income Profiles by EU Status (in 1,000DM, 1998 prices)

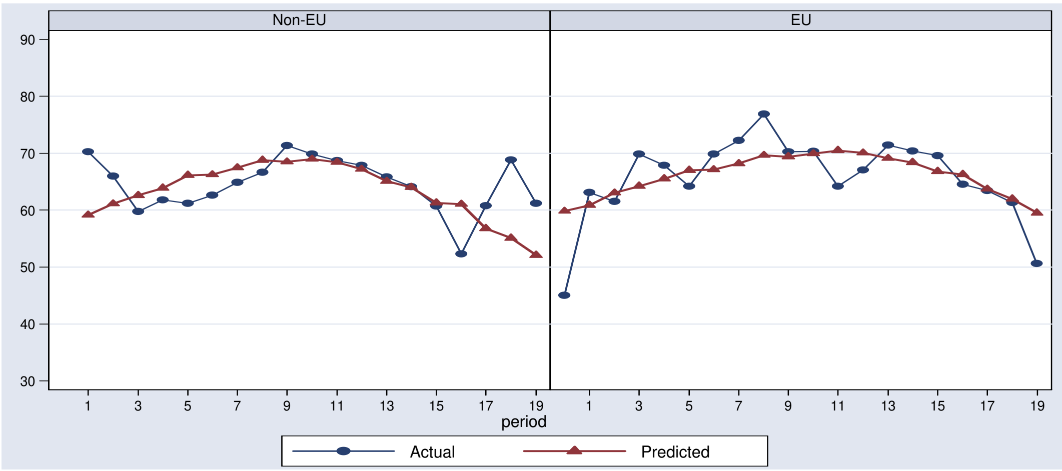


FIGURE 6.1.4: Fit of Unemployment Profiles by EU Status

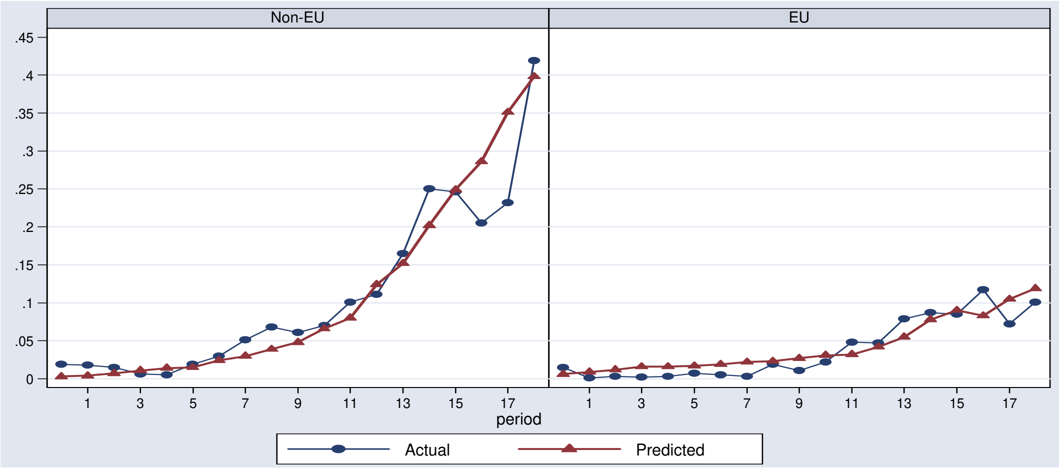


FIGURE 6.1.5: Fit of Retirement Profiles by EU Status

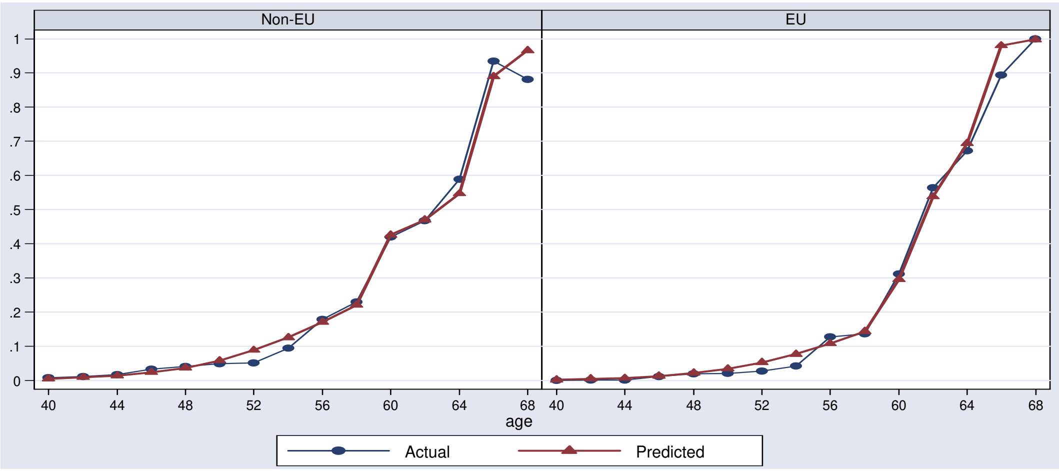


FIGURE 6.2.1: Hazard Functions by Unobserved Types: All Immigrants

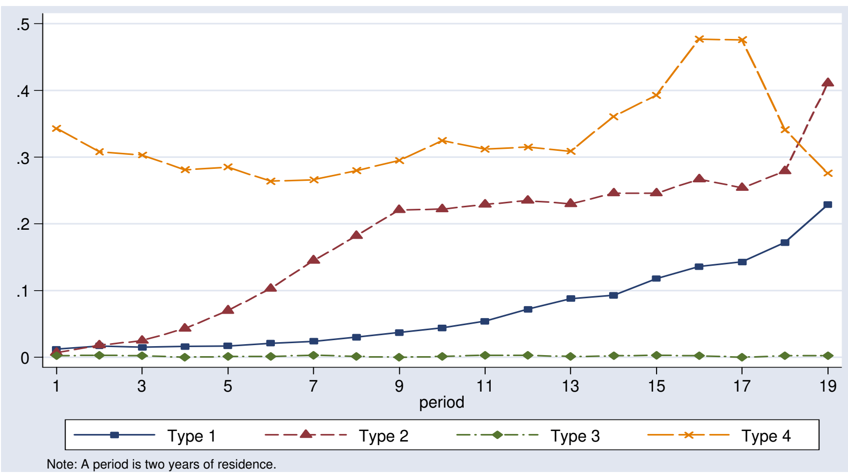


FIGURE 7.1: Net Lifetime Contributions to Pension and Unemployment Insurance Systems by Age at Entry and Country of Origin (in 1000DM, 1998 prices)

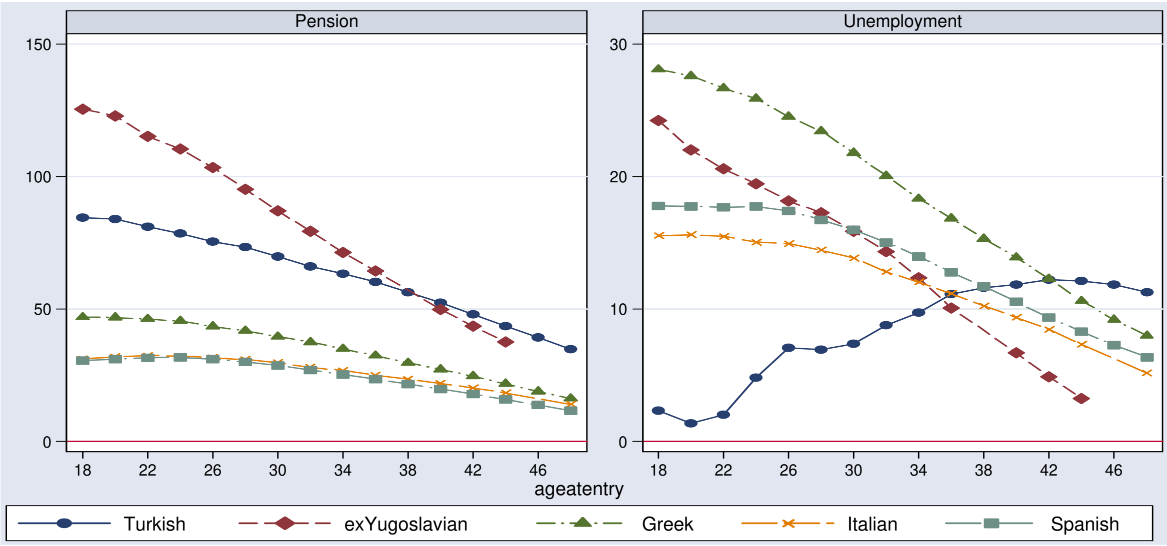


FIGURE 7.2: Comparison of Net Pension Insurance Contributions When Return Migration is Exogenous (in 1000DM, 1998 prices)

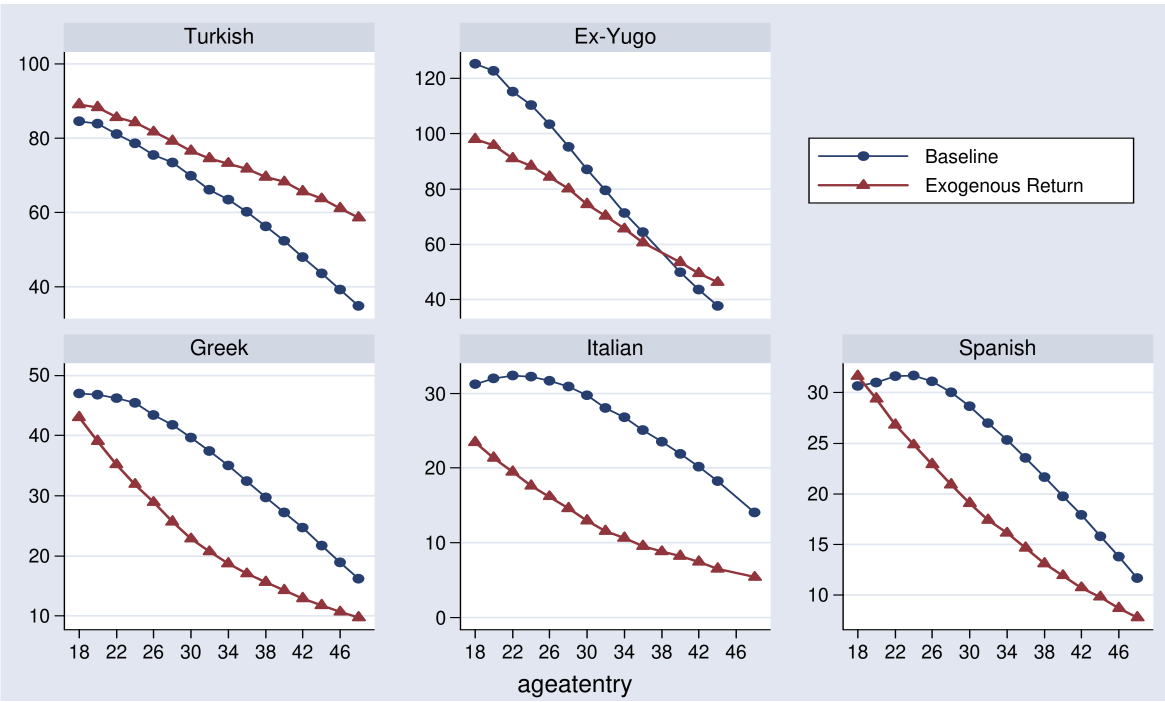


FIGURE 7.3: Comparison of Net Unemployment Insurance Contributions When Return Migration is Exogenous (in 1000DM, 1998 prices)

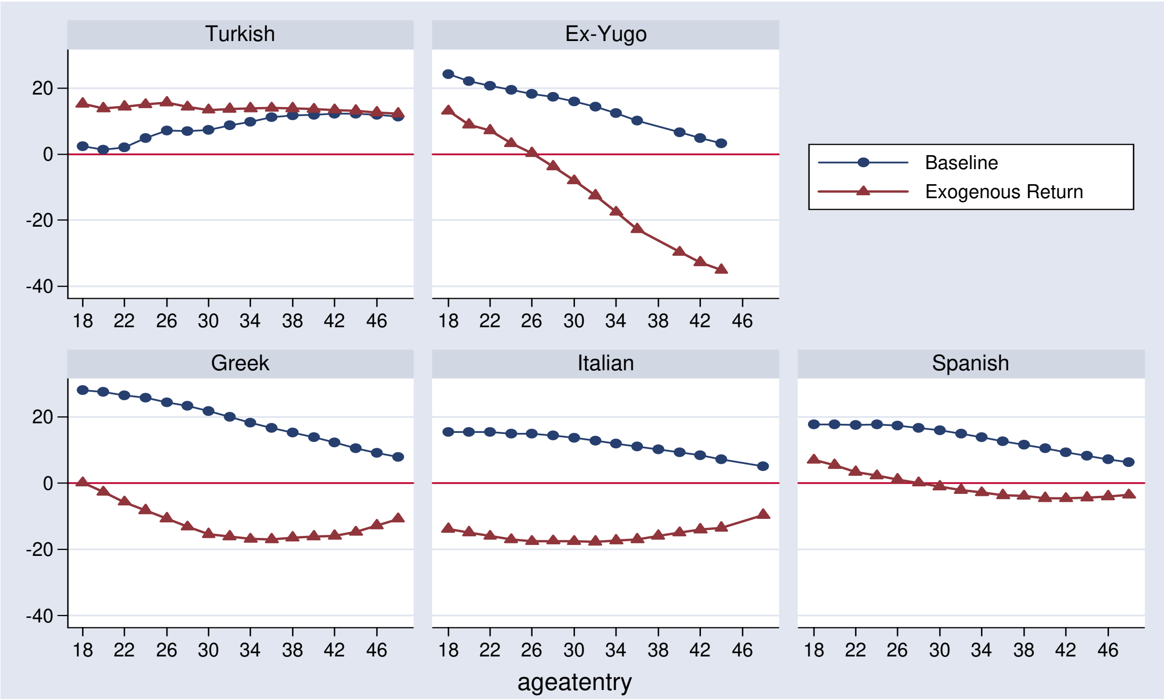
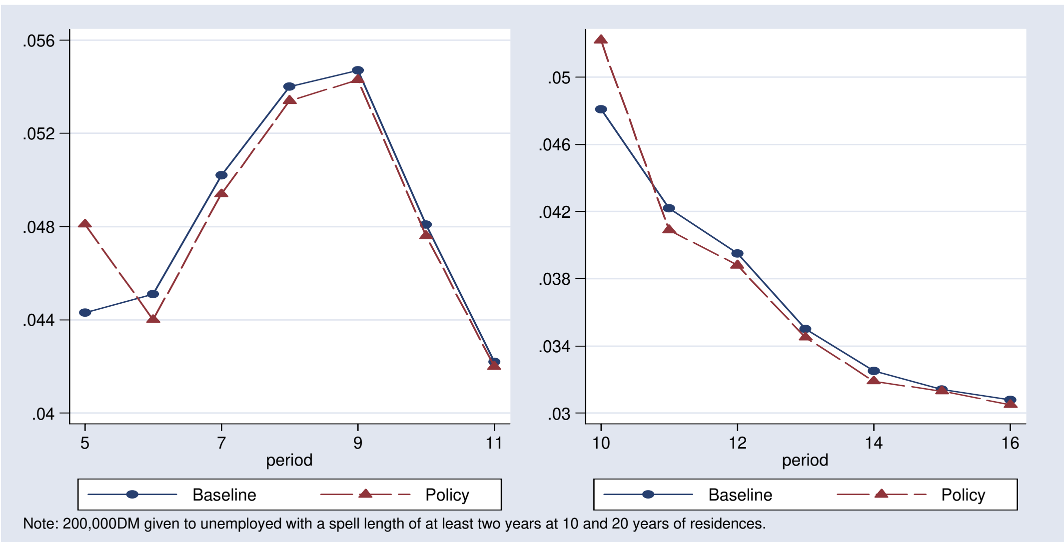


FIGURE 8.1: Impact of a Bonus on Return Migration Hazard Rates (All Immigrants)



A EMPIRICAL SPECIFICATIONS

A.1 Marginal Utility of Consumption in Germany

$$\mu_t = \sum_{k=1}^{4} \mu_k I(type = k) \exp \left[\begin{array}{c} \mu_5 I(age_t \leq 24) + \mu_6 I(age_t \leq 30) + \\ \mu_7 I(age_t \leq 50) + \mu_8 I(age_t \geq 60) + \mu_9 I(age_t \geq 70) \end{array} \right]$$

A.2 Psychic Costs in Germany

$$\rho_t = \sum_{k=1}^{4} (1 + \rho_0 age_0) \rho_k I(type = k) + \rho_{4+k} I(type = k) t$$

A.3 Labor Market Status

I use a multinomial logit model for labor market status.

$$\begin{aligned} P(l &= j) = \left[\begin{array}{c} \exp((\gamma_{17(j-1)+1} + \gamma_{17(j-1)+2} age_0 + \gamma_{17(j-1)+3} I(l_{t-1} = 0) + \gamma_{17(j-1)+4} age_t + \\ \gamma_{17(j-1)+5} age_t^2 + \sum_{z=2}^{5} \gamma_{17(j-1)+4+z} I(country = z) + \sum_{k=2}^{4} \gamma_{17(j-1)+8+k} I(type = k) \\ + \sum_{t=0}^{3} \gamma_{17(j-1)+13+t} I(age = 60 + 2t) + \gamma_{17(j-1)+17} I(age = 62) I(z \geq 3) \end{array} \right] / \\ & \left[1 + \sum_{h=1}^{2} \left[\begin{array}{c} \exp((\gamma_{17(h-1)+1} + \gamma_{17(h-1)+2} age_0 + \gamma_{17(h-1)+3} I(l_{t-1} = 0) \\ + \gamma_{17(h-1)+4} age_t + \gamma_{17(h-1)+5} age_t^2 \\ + \sum_{z=2}^{5} \gamma_{17(h-1)+4+z} I(country = z) + \sum_{k=2}^{4} \gamma_{17(h-1)+8+k} I(type = k) + \\ \sum_{t=0}^{3} \gamma_{17(h-1)+13+t} I(age = 60 + 2t) + \gamma_{17(h-1)+17} I(age = 62) I(z \geq 3) \end{array} \right] \right] \quad j = 1, 2 \\ P(l &= 0) = 1 - P(l = 1) - P(l = 2) \end{aligned}$$

A.4 Human Capital

$$H_t = \upsilon_1 t + \upsilon_2 t^2 + \upsilon_3 age_0 + \sum_{z=2}^{5} \upsilon_{2+z} I(country = z) + \sum_{k=2}^{4} \upsilon_{6+z} I(type = k)$$

A.5 Type Probability Functions

$$\begin{aligned} \kappa_k &= \left[\exp((\gamma_{7(k-2)+1} + \gamma_{7(k-2)+2} age_0 + \gamma_{7(k-2)+3} age_0 I(z \geq 3) + \sum_{z=2}^{5} + \gamma_{7(k-2)+2+z} I(country = z) \right] / \\ & \left[1 + \sum_{h=2}^{4} \left[\begin{array}{c} \exp((\gamma_{7(h-2)+1} + \gamma_{7(h-2)+2} age_0 + \gamma_{7(h-2)+3} age_0 I(z \geq 3) + \\ \sum_{z=2}^{5} + \gamma_{7(h-2)+2+z} I(country = z) \end{array} \right] \right] \quad k = 2, 3, 4 \\ \kappa_1 &= 1 - \sum_{h=2}^{4} \kappa_h \end{aligned}$$

A.6 Distribution of Shocks

$\eta_t = (\eta_t^s, \eta_t^y)$, the vector of contemporaneous shocks to preferences and earnings, has the following joint distribution.

$$\begin{pmatrix} \boldsymbol{\eta}_t^s \\ \eta_t^y \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_s^2 & . \\ \sigma_{sy} & \sigma_y^2 \end{pmatrix} \right)$$

A.7 Preferences for Living in the Home Country

The value of living in the home country has four components: A baseline country dummy, the value of accumulated savings in Germany –where savings are interacted with purchasing power parity between the source country and Germany–, the value of potential earnings in the home country after return -which shifts according to the ratio of expected wages in source countries–, and the value of German pension benefits –which is adjusted according to the ratios of purchasing power parities–. Below is given the parameterization, which is explained in detail at the end of this subsection.

$$V^L(\widetilde{S}_t) = \sum_{country=z} I(z) \left(\frac{1-\delta\,(type)^{p_{age_t}}}{1-\delta\,(type)} \right) \pi_{0,z} +$$

$$\sum_{country=z} I(z) \left[I(type=1) + \sum_{k=2}^{4} \exp(\pi_{1,k-1}) I(type=k) \right] [\exp(\pi_{1,7}) + \exp(\pi_{1,8}) p_{age_t})]$$

$$\left(1 - \exp\left(\left[I(type=1) + \sum_{k=2}^{4} \exp(\pi_{1,k+2}) I(type=k) \right] (\pi_{1,9} + \pi_{1,10} p_{age_t}) ppp^z A_t \right) \right)$$

$$+ \sum_{country=z} I(z) \max \left\{ \left(\frac{\hat{w}^z}{\hat{w}^{Turk}} \right)^{\exp(\pi_{2,1})} \pi_{2,2} + \left(\frac{\hat{w}^z}{\hat{w}^{Turk}} \right)^{\exp(\pi_{2,3})} \pi_{2,4} age_t, 0 \right\}$$

$$+ \sum_{country=z} I(z) \left(\frac{ppp^z}{ppp^{Turk}} \right)^{\exp(\pi_{3,1})} \Delta_{age} \exp(\pi_{3,2}) \left[1 - \exp(\pi_{3,3} t) \right]$$

Above ppp^z is the purchasing power parity ratio between Germany and the source country and $\hat{w}^z$ is the expected wages in country z. Also, $p_{age_t} = (last\_age^z - age_t)/2$ is the number of remaining lifetime periods. (Note that longevity varies by nationality.)

$$\Delta_{age} = I(age_t \geq 64) \left(\frac{1-\delta^{p_{age_t}}}{1-\delta} \right) + I(age < 64) \delta^{(64-age_t)/2} \left(\frac{1-\delta^{p_{age_t=64}}}{1-\delta} \right)$$

is the discount factor for pension benefits, which an immigrant can start receiving only after age 64.

Note that the variation in the above value function according to nationality is limited to three sources: $\pi_{0,z}$ –the baseline country dummy–, ppp^z –the purchasing power in the source country compared to Germany–, and $\hat{w}^z/\hat{w}^{Turk}$ – the ratio of expected wages in source countries when the baseline country is taken as Turkey.

The following is an explanation of the individual terms in the above equation.

1st line (Country Dummy): This is the discounted sum of per period country dummies, $\pi_{0,z}$, which measure the general attractiveness of source countries compared to Germany. It would depend on source country characteristics like per capita income level, whether the country has a socialist regime, income inequality, political stability and so forth. This dummy also includes the transportation cost of return, which would vary by country of origin according to its distance from Germany. In addition, it accounts for the institutional difference between the EU and non-EU countries in that non-EU immigrants can not engage in repeat migration to Germany after they make a permanent return to their home countries.

2nd line (Value of Accumulated Savings): The interaction of accumulated savings with ppp enters the value function in an inverse exponential form. Both parameters of the inverse exponential function vary with the age of the migrant because the marginal utility of his accumulated savings would depend on his age. Moreover, both parameters are allowed to vary across the unobserved types.

3rd line (Value of Potential Earnings at Home): The present discounted value of immigrants' utility from their earnings in their home country after return would depend on their age at return as well as the country they return. Both the constant term and the slope of the age variable varies by $\left(\frac{\hat{w}^z}{\hat{w}^{Turk}}\right)$, which is the ratio of the expected wage level in country z to that in Turkey.

4th line (Value of German Pension Benefits): Δ_{age} discounts the value of the benefits to the period an immigrant is making the return decision. $\left(\frac{ppp^z}{ppp^{Turk}}\right)$ accounts for the different purchasing power of German pension benefits in different source countries. (Turkey is taken as the baseline country.) Pension benefits depend on immigrants' duration of residence in an inverse exponential functional form. (Periods of unemployment are counted toward the contribution period. Since immigrants are always in the labor market in the model, duration of time in the labor market is equal to duration of residence.)

A.8 Bequest Function

The bequest function does not introduce any new parameters. Its parameters are those of the second term of the value of returning home function (the value of accumulated savings) excluding those for the interaction of accumulated savings with .remaining lifetime period.

$$\begin{aligned} B(.) \quad = \quad & \left[I(type=1) + \sum_{k=2}^{4} \exp(\pi_{1,k-1}) I(type=k) \right] \exp(\pi_{1,7}) \\ & \left(1 - \exp\left(\left[I(type=1) + \sum_{k=2}^{4} \exp(\pi_{1,k+2}) I(type=k) \right] \pi_{1,9} ppp^z A_t \right) \right) \end{aligned}$$

B LIFE EXPECTANCY BY COUNTRY OF ORIGIN

This section outlines the method used in calculating life expectancy, which is carried out separately for each gender. (Life expectancy of females is needed in the calculation of survivor benefits.) Immigrants' life expectancies are approximated by the life expectancies of people of similar birth cohorts in their home countries. One could argue that immigrants could have a longer life expectancy due to the better health provision in Germany. On the other hand, many of these immigrants were employed in difficult blue collar manufacturing jobs that natives would not be willing to take. In fact, the high disability benefits use of immigrants attests to this fact.

Life expectancy, which is taken as deterministic, varies only by country of origin. (Modeling survival probabilities according to birth cohorts would substantially increase the computational burden as this would require solving the problem separately for each birth cohort in addition to country of origin, age at entry and unobserved type groups.) For a given birth cohort, total life expectancy increases by age. Moreover, due to the improvement in health conditions over time, life expectancy profiles over age would be at a higher level for later birth cohorts. Because of these reasons, I employ an averaging strategy over the birth cohorts in the sample and over age.

In order to account for increasing life expectancies by age, I take the life expectancies at age 45 for all birth cohorts. I calculate the life expectancies for the oldest and the youngest birth cohorts at this age. As the oldest birth cohort, I take those born in 1925 and as the youngest birth cohort, those born in 1955. (Therefore, I use the 1970 data for life expectancies for the 1925 cohort and the 2000 data for the 1955 cohort provided in the European Health Statistics of the World Health Organization.) Since the life expectancy profiles of almost all birth cohorts in the sample lie between these numbers, I take the average value for these two cohorts. The resulting value for life expectancy for all three EU nationalities is rounded as 76 years.

An alternative strategy would be to take the life expectancy for the median cohort as well as median age, i.e. take the life expectancy for the 1940 cohort at age 45. According to this, life expectancies for the EU nationalities would be rounded to a life expectancy of 76 years as well. For ex-Yugoslavian nationalities, in fact, I use this second method to calculate the life expectancy (due to unavailability of information in 1970).[1] These life expectancies for ex-Yugoslavian republics are averaged as 72 years.

For Turkey, I use the statistics provided by Turkish Statistical Institute. Given the available data, the closest information to the above ones is life expectancy at age 5 in 1990, which is 68. Therefore, I found it appropriate to take the life-expectancy at age 45 as 70 (assuming a negligible change between 1985 and 1990).

C DETAILS OF THE ESTIMATION METHOD

The classification error parameters and parameters that characterize the distribution of measurement errors are estimated along with the other parameters of the model.

C.1 Classification Errors

C.1.1 Unbiased Classification Error in the Labor Market Outcomes

Classification errors are unbiased when the probability of a particular outcome is the same in the simulations and in the data.

Let l^*_{it} denote the observed labor market outcome in the data and l_{it} denote the true value from the simulations. Following Keane and Wolpin's (2001) methodology, I write the classification errors in the following linear form.

$$\theta^l_{1,1} = P(l^*_{it} = 1 | l_{it} = 1) = \widetilde{E} + (1 - \widetilde{E})\widehat{P}(l_{it} = 1) \quad (1)$$

$$\theta^l_{1,\neq 1} = P(l^*_{it} = 1 | l_{it} \neq 1) = (1 - \widetilde{E})\widehat{P}(l_{it} = 1)) \quad (2)$$

where

$$\widehat{P}[l_{it} = 1] = \frac{1}{N} \sum_{n=1}^{N} \Pr(l_{int} = 1)$$

[1] Information for Serbia is not available at this year; however, life expectancy for Serbia is very similar to that in Croatia in the available years.

and $\widetilde{E}$ is a parameter measuring the extent of classification error, which is transformed in the following way in estimation.

$$\widetilde{E} = 1/[1 + \exp(E)]$$

E is estimated along with the other parameters of the model. Unbiasedness of the classification errors requires that when equations (1 and 2) are substituted into the equation below, $P(l^*_{it} = i) = P(l_{it} = i)$ holds.

$$P(l^*_{it} = i) = P(l^*_{it} = i|l_{it} = i)P(l_{it} = i) + P(l^*_{it} = i|l_{it} \neq i)P(l_{it} \neq i)$$

C.1.2 Biased Classification Error in Return Migration

The classification error in return migration outcomes has two important properties. First, a classification error is possible only when the reported choice is to leave because the fact that a migrant was interviewed does not leave any doubt that he was in fact in Germany. This implies that a classification error can exist only in the last period in the sample. Second, the fact that there may be a classification error only if the observed choice is to leave implies that the classification error is biased. Thus, $P(m^*_t = 1) \neq P(m_t = 1)$.

The following expressions, in which G is the parameter indicating the degree of misreporting, are used.

$$\begin{aligned} \theta^m_{1,0} &= P(m^*_t = 1|m_t = 0) = \left(\frac{e^F}{1 + e^F}\right) \\ \theta^m_{0,1} &= P(m^*_t = 0|m_t = 1) = 0 \end{aligned}$$

C.2 Measurement Errors

The measurement error distributions of earnings and saving are independent and serially uncorrelated. They are specified in the following way.

C.2.1 Measurement Error in Earnings

$$y^{obs}_t = y^{sim}_t \exp(\varepsilon^y_t) \qquad where \;\; \varepsilon^y_t \tilde{} N(0, \sigma^2_{y,m})$$

C.2.2 Measurement Error in Savings

$$(A_{t+1} - A_t)^{obs} = (A_{t+1} - A_t)^{sim} + \varepsilon^s_t \qquad where \;\; \varepsilon^s_t \tilde{} N(0, \sigma^2_{s,m})$$

C.3 Calculation of the Probabilities of Reported Spells Conditional on the Simulated Spells

C.3.1 Calculation of $P(M^{obs}_i|M^{sim}_{in})$

The calculation of the probability of observing the registered migration spell conditional on the true migration spell can be categorized into four groups:

Case 1: The simulated spell ends earlier with an exit.

Data	0	0	0	0	X
Simulated	0	0	0	1	

This has zero probability because since a return took place, this person could not have been in the sample. $P(M_i^{obs}|M_{in}^{sim}) = 0$.

Case 2: The data and simulated spell both end with an exit at the same period.

Data	0	0	0	0	1
Simulated	0	0	0	0	1

There are T_1 periods of correct reporting of staying in Germany as well as correct reporting of the exit. The probability of correct of reporting of an exit, $\theta_{1,1}^m$, is equal to 1. Thus, $P(M_i^{obs}|M_{in}^{sim}) = (1-\theta_{1,0}^m)^{T_1}$.

Case 3: The data spell ends earlier with an exit.

Data	0	0	0	0	1	.	.	.
Simulated	0	0	0	0	0	0	0	0

There are T_1 periods of correct reporting of staying in Germany and $T-T_1$ periods of mismatch (classification error). Therefore, $P(M_i^{obs}|M_{in}^{sim}) = (1-\theta_{1,0}^m)^{T_1}(\theta_{1,0}^m)^{T-T_1}$. OR

Data	0	0	0	0	1	.	.	.
Simulated	0	0	0	0	0	0	0	1

There are T_1 periods of correct reporting of staying in Germany and $T-T_1-1$ periods of mismatch (classification error). Therefore, $P(M_i^{obs}|M_{in}^{sim}) = (1-\theta_{1,0}^m)^{T_1}(\theta_{1,0}^m)^{T-T_1-1}$.

Case 4: The data spell ends earlier without an exit.

Data	0	0	0	0	0	.	.
Simulated	0	0	0	0	0	0	X

There are T_1 periods of correct reporting of staying in Germany and $T-T_1$ periods of missing information. Thus, $P(M_i^{obs}|M_{in}^{sim}) = (1-\theta_{1,0}^m)^{T_1}$.

C.3.2 Calculation of $P(l_i^{obs}|l_{in}^{sim})$

Unlike the above case, a classification error in the reported labor market status can exist at any period. Therefore, the probability of observing the reported labor market status spell conditional on the simulated spell can be written as follows.

$$
\begin{aligned}
\Pr(l_{it}^{obs} &= 1|l_{int}^{sim} = 1) = \theta_{1,1}^l \\
\Pr(l_{it}^{obs} &= 1|l_{int}^{sim} \neq 1) = \theta_{1,0}^l \\
\Pr(l_{it}^{obs} &\neq 1|l_{int}^{sim} = 1) = 1-\theta_{1,1}^l \\
\Pr(l_{it}^{obs} &\neq 1|l_{int}^{sim} \neq 1) = 1-\theta_{1,0}^l
\end{aligned}
$$

C.3.3 Calculation of $P((A_{t+1}-A_t)_i^{obs}|(A_{t+1}-A_t)_{in}^{sim})$

The saving data in the GSOEP are censored at zero because the saving question is asked only for positive saving. (Since I aggregate the data into two year periods, there are censoring values other than zero as well.)

For censored observations, the probability that $A_{t+1} - A_t$ equals the censoring value is written:

$$P((A_{t+1} - A_t)_i^{obs} | (A_{t+1} - A_t)_{in}^{sim}) = \Phi\left(\frac{(A_{t+1} - A_t)_i^{obs} - (A_{t+1} - A_t)_{in}^{sim}}{\sigma_{s,m}}\right)$$

Above Φ is the standard normal cumulative distribution function. For uncensored observations,

$$P((A_{t+1} - A_t)_i^{obs} | (A_{t+1} - A_t)_{in}^{sim}) = \frac{1}{\sigma_{s,m}}\phi\left(\frac{(A_{t+1} - A_t)_i^{obs} - (A_{t+1} - A_t)_{in}^{sim}}{\sigma_{s,m}}\right)$$

where ϕ is the standard normal density.

C.3.4 Calculation of $P(y_i^{obs}|y_{in}^{sim})$

$$P(y_i^{obs}|y_{in}^{sim}) = \prod_{t=1}^{T_i} \frac{1}{\sigma_{y,m}}\phi\left(\frac{y_{it}^{obs} - y_{int}^{sim}}{\sigma_{y,m}}\right)$$

D PARAMETER ESTIMATES

Marginal Utility Parameters

μ_1	μ_2	μ_3	μ_4	μ_5	μ_6	μ_7	μ_8	μ_9
8.217	4.539	6.003	4.189	−0.361	−0.146	−1.929[b]	−2.324[b]	−1.929[b]
(0.116)	(0.472)	(0.929)	(0.264)	(0.047)	(0.016)	(0.277)	(0.433)	(0.364)

Psychic Cost Parameters

ρ_0	ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	ρ_7	ρ_8
0.8998[b]	0.4605[f]	0.4503[f]	0.3878[f]	0.6599[f]	0.1071	5.0637	6.5039	0.2198
(0.0987)	(0.0107)	(0.0476)	(0.2423)	(0.0269)	(1.351)	(0.5291)	(0.0021)	(2.236)

Value Home Parameters

π_{01}	π_{02}	π_{03}	π_{04}	π_{05}	π_{11}	π_{12}	π_{13}^c	π_{14}^d	$\pi_{1,5}$	$\pi_{1,6}$
−2.184[h]	−2.889[h]	−1.091[h]	−0.584[h]	−0.674[h]	−0.732	−0.271	−0.128	2.969	−0.614	−0.685
(0.330)	(0.627)	(0.455)	(0.335)	(0.311)	(0.154)	(0.046)	(0.032)	(0.061)	(0.179)	(0.058)

$\pi_{1,7}$	$\pi_{1,8}$	$\pi_{1,9}$	$\pi_{1,10}$	$\pi_{2,1}$	$\pi_{2,2}$	$\pi_{2,3}$	$\pi_{2,4}$	$\pi_{3,1}$	$\pi_{3,2}$	$\pi_{3,3}$
12.29	9.161	−0.418[d]	0.590[e]	−0.171	−1.824	−1.235[f]	−0.325[h]	−2.254	9.769	−5.200[b]
(0.031)	(0.135)	(0.012)	(0.065)	(0.314)	(3.831)	(0.333)	(0.052)	(0.266)	(0.013)	(0.498)

Type Probability Function

κ_1	κ_2	κ_3	κ_4	κ_5	κ_6	κ_7	κ_8	κ_9	κ_{10}	κ_{11}
1.197	0.282[a]	−0.209[a]	0.520	−4.336	−2.189	−3.136	2.349	−0.735[a]	0.824[a]	1.189
(0.753)	(0.462)	(0.688)	(0.666)	(1.037)	(1.074)	(1.042)	(0.627)	(0.394)	(0.488)	(0.540)

κ_{12}	κ_{13}	κ_{14}	κ_{15}	κ_{16}	κ_{17}	κ_{18}	κ_{19}	κ_{20}	κ_{21}
−3.986	−2.136	−4.646	−1.630	0.228[a]	−0.480[a]	3.392	2.040	3.270	3.320
(0.733)	(0.821)	(0.843)	(1.193)	(1.014)	(1.168)	(1.103)	(1.602)	(1.415)	(1.409)

Labor Market Status

γ_1	γ_2	γ_3	γ_4	γ_5	γ_6	γ_7	γ_8	γ_9	γ_{10}	γ_{11}
15.141	0.0435	−5.493	-2.391^a	0.115^b	0.779	0.608	0.747	1.407	−1.025	−4.439
(0.071)	(0.0014)	(0.037)	(0.014)	(0.0017)	(0.099)	(0.041)	(0.110)	(0.248)	(0.181)	(0.048)

γ_{12}	γ_{13}	γ_{14}	γ_{15}	γ_{16}	γ_{17}	γ_{18}	γ_{19}	γ_{20}	γ_{21}	γ_{22}
−6.691	0.629	0.493	−0.388	−1.120	−0.120	−7.444	−0.0474	−2.469	0.461	-0.378^b
(0.233)	(0.128)	(0.182)	(0.315)	(1.047)	(0.143)	(0.122)	(0.0027)	(0.114)	(0.0025)	(0.0062)

γ_{23}	γ_{24}	γ_{25}	γ_{26}	γ_{27}	γ_{28}	γ_{29}	γ_{30}	γ_{31}	γ_{32}	γ_{33}	γ_{34}
−0.286	−1.063	−0.736	−0.712	−3.133	−5.612	−6.082	1.991	−1.089	0.187	2.573	2.389
(0.108)	(0.130)	(0.154)	(0.304)	(0.349)	(0.089)	(0.357)	(0.170)	(0.219)	(0.092)	(0.375)	(0.249)

Human Capital

υ_1^b	υ_2^c	υ_3^b	υ_4	υ_5	υ_6	υ_7	υ_8	υ_9	υ_{10}
0.182^a	-0.090^c	-0.333^b	0.716^a	0.626^a	-0.228^a	0.992^a	−0.195	-0.155^a	0.254^a
(0.0092)	(0.069)	(0.036)	(0.084)	(0.105)	(0.073)	(0.119)	(0.021)	(0.042)	(0.139)

Classification and Measurement Errors, Transitory Shocks

E	F	$\sigma_{y,m}$	$\sigma_{s,m}$	σ_y^2	σ_s^2	σ_{sy}
−1.715	−6.607	0.308	1.210^f	1.384	0.0096	0.0013
(0.359)	(0.097)	(0.0016)	(0.011)	(0.055)	(0.0011)	(0.0019)

Discount Factors, Interest Rate, Utility Function Parameter, Price of Human Capital

δ_1	δ_2	δ_3	δ_4	r	λ	p
0.9751	0.9891	0.9807	0.9764	1.5685^b	0.6304	11.408^i
(0.0017)	(0.0047)	(0.0011)	(0.0056)	(0.0540)	(0.00082)	(0.011)

NOTES: a - Parameter multiplied by 10.

b - Parameter multiplied by 100.

c - Parameter multiplied by 10,000.

d - Parameter multiplied by 1,000,000.

e - Parameter multiplied by 100,000,000.

f - Parameter divided by 10,000.

g - Parameter divided by 100,000.

h - Parameter divided by 1,000.

i - Parameter in the model is defined as an exponential transformation of this.