

A Dynamic Model of Return Migration

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Abstract

This paper analyzes the decision process underlying return migration using a dynamic model. In each period, migrants decide whether to stay in host country or to return to home country, simultaneously with consumption and investment choices. The decisions are taken comparing the discounted flow of utility between staying for an additional year and returning to the home country permanently, and depend on the capital invested in each country as well as on a series of stochastic shocks. We aim to explain how migrants decide whether to stay or to go back to their home country together with their savings and consumption decisions. The dynamic model framework allows migrants to revise their decisions in each period, given shocks in preferences for the home country and shocks in the relative income between the host country and the home country. We use a panel data set from Germany which allows us to follow migrants from different countries for a period of 20 years. It also reveals their return intentions in each time period and whether they return or not. We estimate our model with return intentions, and afterwards we want to perform policy simulations.

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1 Introduction

The theoretical and empirical literature on migration has paid little attention to the fact that many migrants return to their home countries after having spent a number of years in the host country. This is surprising, since many migrations today are in fact temporary. For instance, labor migrations from Southern to central Europe in the 1950's – 1970's were predominantly temporary. Böhning (1984, p.147) estimates that "more than two thirds of the foreign workers admitted to the Federal Republic [of Germany], and more than four fifth in the case of Switzerland, have returned". Glytsos (1988) reports that of the 1 million Greeks migrating to West Germany between 1960 and 1984, 85% gradually returned home. Dustmann (1997) provides evidence for a substantial out migration over that period for other European countries. Return migration is also considerable for the United States. Jasso and Rosenzweig (1982) report that between 1908 and 1957 about 15.7 million persons immigrated to the United States and about 4.8 million aliens emigrated. They found that between 20% and 50% of legal immigrants (depending on the nationality) re-emigrated from the United States in the 1970's. Warren & Peck (1980) estimate that about one third of legal immigrants to the United States re-emigrated in the 1960's.

To understand the motives of return migrations, as well as the factors which explain variation in migration durations, is important for designing optimal migration policies. The large labour migrations to Europe in the 1950's-1970's were thought to be temporary by the receiving countries and, in fact, many of these migrants did eventually return. Only recently, migrations of highly skilled IT specialists have been discussed in Germany, and the core issue of the policy debate is whether residence permits should be temporary. When trying to attract specialised workers for local labour markets, countries may want to offer packages which attract the best individuals. Furthermore, there seems to be an understanding that it is desirable that these workers adopt easily to the social and economic structure of the host country. From the side of the migrant, the incentive for any migration, as well as the incentives to assimilate are heavily interrelated with the expected duration in the

host region.

Little is known about the way migrants form their re-migration decisions. While emigrations are easily explained by simple static models, where the driving force are wage differentials between regions, re-migrations occur despite persistently more favourable conditions in the host countries. Models which explain re-migrations must therefore introduce non-monetary aspects which explain return migration, or deviate from absolute measures of monetary wealth, consider decisions taken within family units, or take a more dynamic perspective, where intertemporal substitution is a driving force for return decisions.

The explanations found in the literature for why a return migration may be optimal, despite persistently more favourable conditions in the host country, build on such considerations. Stark & Taylor (1991) uses the theory of relative deprivation and arguments of risk spreading to explain why migrants may return to a less rich economy or region. Djajic and Milbourne (1988) explain return migration by assuming that migrants have a stronger preference for consumption at home than abroad. Dustmann (1999) shows that return migration may be optimal if the host country currency has a higher purchasing power in the home country, and if there are higher returns in the home economy on human capital, acquired in the host country.

None of these models allow for revisions of return plans during the migrants' migration history. They usually assume that the migrant has full information about the host country, and that no unforeseen shocks occur. Although these models give us some insight into the factors which are responsible for re-migration decisions, they seem to leave out two very important elements: First, habituation processes, which may lead the migrant to revise former migration plans in the course of his/her migration history. Second, shocks, or new information, which may lead the migrant to continuously revise previous migration plans. To appropriately address these issues is only feasible in a dynamic setting, where migration plans and their revisions are modelled explicitly.

In this paper, we develop a dynamic model of return migration. Migrants make a decision each period whether to stay in the host country or to return

to the country of origin. The decisions taken are based on a comparison of the discounted flow of utility in the two locations and depend on the capital invested in each country, as well as on a series of stochastic shocks. On the one hand there is a country specific shock that reflects the economic conditions in the country of origin with respect to the host country. On the other hand, there are shocks specific to the individual, which allow for different stochastic influences across individuals. Migrants are allowed to re-optimize their choices at every period after they have migrated. This feature is realistic: migrants revise their plans during the migration history. There are many reasons that might motivate them to do so, such as changes in his preferences for staying in host country due to habituation or unexpected changes in income.

Understanding the process of migrants' re-migration decisions is not only important for its own sake, though. The mere fact that some immigrants plan to return, while others do not, induces heterogeneity in their behaviour, which explains differences in their labour market behaviour, skill accumulation, consumption etc. This heterogeneity is a consequence of the different economic situations they face after a return to their home countries, and which they take into account when making current economic decisions. These differences in plans may help to explain, for instance, differences in assimilation patterns between immigrant populations with different origin, as found in a number of empirical studies¹.

There is some research on the effect of return plans on migrants' behavior. Djajic (1989) emphasizes that in a guest worker system, changes in wages and prices in the home country affect the migrant's consumption and labor supply in the host country. Galor & Stark (1990), Galor & Stark (1991) show that a return probability different from zero affects migrants' behavior and performance in the host country, if wages in the home country differ from those in the host country. These models assume that return decisions are exogenous, and not optimally chosen by the immigrant. Dustmann (1999) builds a model where human capital accumulation in the host country, and return migrations, are both chosen simultaneously. Dustmann (2000) ex-

¹See, for instance, Borjas (1985), Chiswick and Miller (1993).

plores the consequences for the empirical analysis of migrants' wage growth. If re-migration is chosen optimally, then empirical models which do not condition on the migration duration are misspecified, and may lead to biased parameter estimates.

Again, the process of forming return plans is modelled very simplistic. In our framework, where migrants may constantly revise their return plans, it is possible to detect inefficiencies in the decision making process, which may occur because current behaviour which is based on re-migration plans subsequently revised. From the perspective of the migrant and the host country, it is desirable to avoid these inefficiencies.

2 Data and Some Evidence on Migration

Many migrations nowadays are temporary. We can observe the inflows and outflows of migrants in Germany in last three decades in figure 1. A large number of migrants entered into Germany, and also a large number returned home. Interestingly, the fluctuation patterns are different depending on the migrants country of origin. Country specific economic conditions seem to matter in both migration decisions: to emigrate from the home country and to return to it.

We use data from the first 20 waves of the German Socio-Economic Panel (GSOEP) for the years 1984 until 2003. This data set contains a boost sample of immigrants (including some 1500 households in the first wave) from the former labour migration countries Spain, Italy, Greece, Yugoslavia, and Turkey. Migrants from these countries were actively recruited during the late 1950's - early 1970's. Migrations were intended to be temporary both by the immigrant, as well as by the German authorities. However, no temporary residence permits were imposed, and migrants could stay permanently, if they wanted.

Our data has detailed information on individual characteristics, family background, and economic activities of migrants over the 20 years period. We provide some descriptive information about our data in table 1. Furthermore,

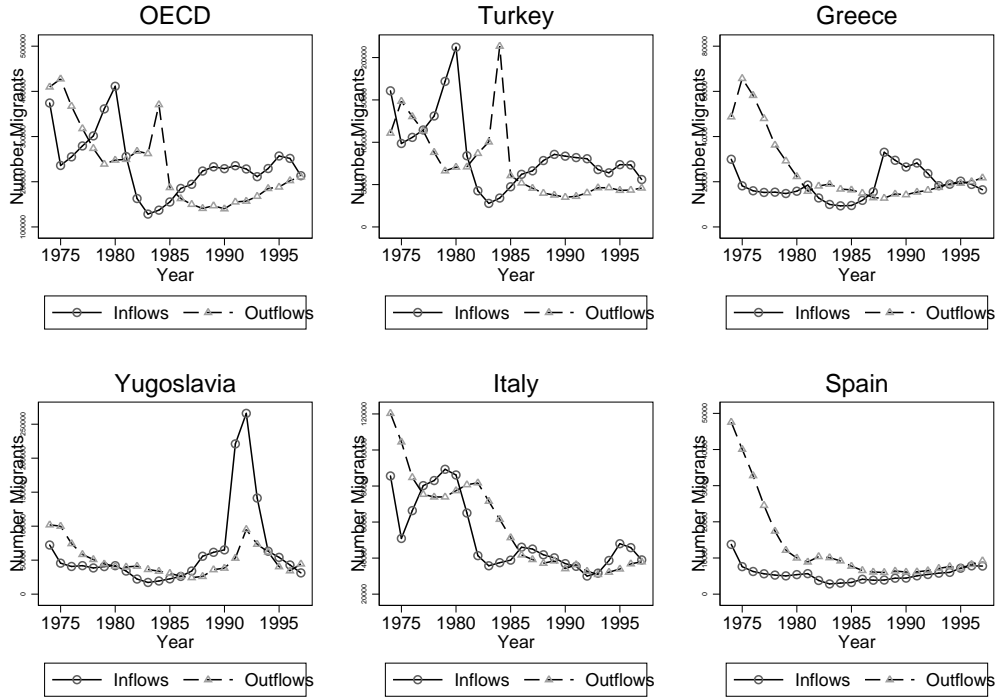


Figure 1: Germany: Cross-border-migration of non-nationals. 1974-1997

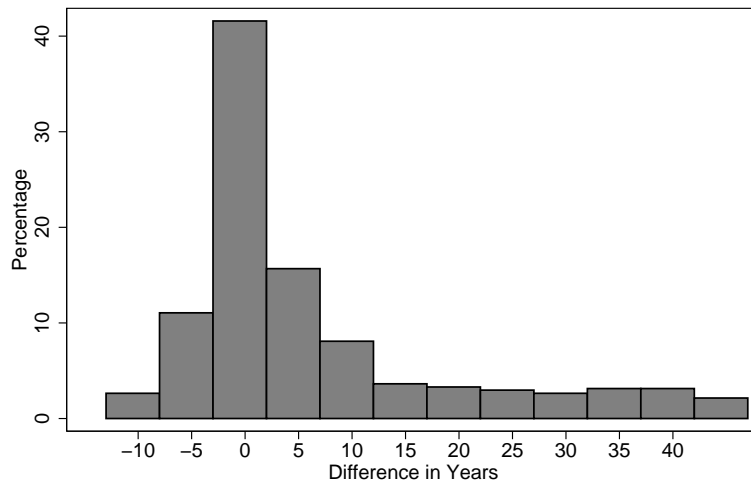
each year there was a complementary survey addressed to immigrants about various immigrant specific issues. One question which is asked refers to the migrant's return plans. The migrant is asked whether s/he intends to return to the home country, or to stay permanently in Germany. Apart from information about the intention whether or not to return home, the sample also contains information about the intended remaining time in the host country, in case migrants would like to return ². In Table 2, we have displayed cross-tabulations of intentions in subsequent years, where horizontal entries refer to year t and vertical entries to year $t - 1$. Of those who intend to return in year $t - 1$, about 82% still have the same intention in year t , but about 12% do not intend to return any more in year t . This indicates that there are quite substantial fluctuations in return plans over the migration cycle.

²In case migrants intend to remain permanently, we define intentions as time in host country until retirement.

Table 1: Descriptives

Variable	1984			2003		
	Mean	StdD	N.Obs.	Mean	StdD	N.Obs.
Age	37.27	11.98	2803	47.43	13.76	983
Age at Entry	23.66	10.1	2803	20.1	10.068	983
Years since Migration	13.61	5.53	2803	27.73	9.24	983
Year of Arrival	1970.38	5.53	2803	1975.26	9.24	983
Intended Stay	6.62	6.64	2803	8.61	7.59	983
Feel German (full or partly)	0.32	-	2803	0.48	-	983
Permanent Intention	0.28	-	2803	0.77	-	983
Turk	0.34	-	2803	0.47	-	983
Greek	0.18	-	2803	0.20	-	983
Yugoslav	0.15	-	2803	0.10	-	983
Italian	0.19	-	2803	0.18	-	983
Spanish	0.13	-	2803	0.04	-	983

Figure 2: Difference Between Return Intentions and Realized Stay



Source: GSOEP, 1984
 Difference Between Intended Number of Years of Stay in 1984 and Realised Stay Afterwards
 Conditional on Actual Return before 1998

Table 2: Variations in Return Plans

Intended to Return $t - 1$	Intends to Return t		
	Yes	No	Total
Yes	12463	2758	15221
(%)	81.88	18.12	100.00
No	2544	5802	8346
(%)	30.48	69.52	100.00
Total	15007	8560	23567

Table 3: Return Intentions and Realizations

Year of return	Intention to return in 1984		
	Yes	No	
No Return	1526	665	2191
85	145	18	163
86	53	11	64
87	51	8	59
88	55	11	66
89	40	7	47
90	25	9	34
91	16	6	22
92	24	3	27
93	24	5	29
94	30	8	38
95	24	1	25
96	17	6	23
97	14	5	19
Total	2044	763	2807

We also have information on completed migration spells until year 1997. If migrants drop out of the panel because they return to their home country, this information is recorded in the next wave of the panel. In table 3, we display return intentions and realizations as for 1984. Of those who planned to return in 1984, about 25 percent did indeed go back over the next 14 years. Of those who did not intend to return, 12 percent did in fact go back over the next 14 years period. These numbers indicate that intentions and realizations may vary quite considerably over the migration cycle. As we can see in Figure 2, almost sixty percent of the migrants who returned before 1998 either underestimated or overestimated their intended time of stay in Germany significantly.

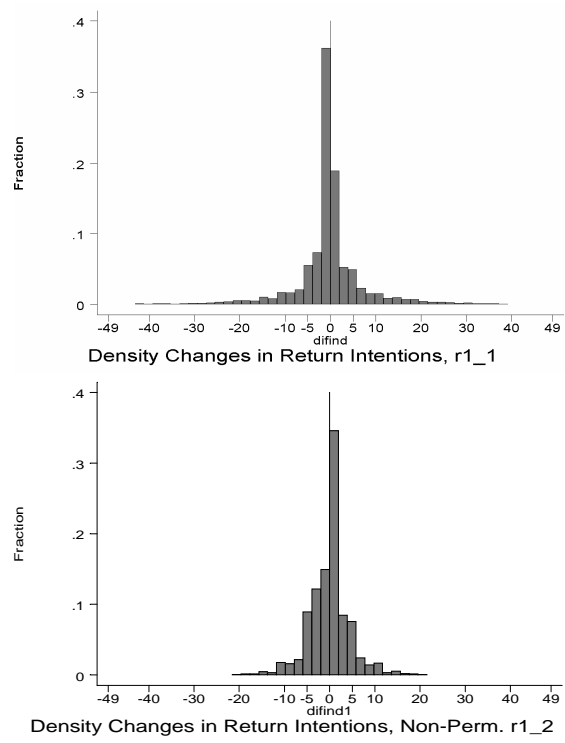
If a deterministic model was appropriate for explaining return plans, then responses should be updated each year in a systematic manner. For instance, if an individual responds in year t to have the intention to remain for 5 more years abroad, then s/he should respond in year $t + 1$ that s/he intends to remain only 4 more years, etc. This pattern does clearly not occur in our data. We can observe in Figure 3 the difference in intentions between two periods for all migrants (in the top graph) and only for temporary migrants (in the bottom graph). We should observe all observations concentrated in -1 if intentions were updated in a systematic way. This is clearly not the case.

3 The Model

In our model, the agent has in every period a choice of location between his country of origin and the host country. Returning to his/her country of origin is a permanent decision. In either of these locations, he derives a specific utility, which depends on expenditures in that location, and the time spent there. At each period in time, the agent allocates his income into consumption, c and savings, s . The stock of savings, S is transferable across countries.

Let $V(A, G, Y, \lambda, S, \eta_S, \eta_R)$ be the lifetime value of an individual of age A , who has been in the host country for G years and with a stock of asset

Figure 3: Density Changes in Return Intentions



S . Y is the GDP in the home country, relative to the host country. λ is a shock to preferences, while in the host country. η_S and η_R are two taste shocks, assumed to be iid and which follow an extreme value distribution. Let $V^{Stay}(A, G, Y, \lambda)$ be the value of staying one additional period in the host country and $V^{Return}(A, G, Y, S)$ the value of going back to the home country permanently at the beginning of the period. The value is then defined as:

$$V(A, G, Y, \lambda, S, \eta_S, \eta_R) = \max \{V^{Stay}(A, G, Y, \lambda) + \eta_S, V^{Return}(A, G, Y, S) + \eta_R\} \quad (1)$$

The agent compares at each period the value of staying for one additional period and the value of returning at the beginning of the period. The value of staying is defined as:

$$V^{Stay}(A, G, Y, \lambda) = u^{Stay}(G, \lambda, c^S) + \beta E_{Y, \lambda' | Y, \lambda, \eta_S, \eta_R} V(A+1, G+1, Y', \lambda') \quad (2)$$

and the value of returning as:

$$V^{Return}(A, G, Y, S) = \max_{c^R} u^{Return}(A - G, c^R) + \beta E_{Y' | Y} V^{Return}(A + 1, G, Y', S') \quad (3)$$

The utility derived in the host country u^{Stay} , depends on the time spent in this country, G , on the realization of the taste shock, λ and on the consumption in this country, c^S . The consumption in host is fixed at $c^R = 1 - \rho$, as ρ is the percentage of income devoted to savings in host country. The taste shock follows a Markov process, and the agent has rational expectation over future realizations λ' . In the home country, the agent derives utility from consumption c^R and from the time spent in that country $A - G$.

The agent migrates to the host country, either because he has a strong preference for the host country (a high λ), or because the host country offers a better technology to increase his savings S . Given the stochastic nature of the taste shocks, the agent does not know with certainty the date at which he plans to return. This can have important consequences on the optimal strategy. If the agent has a preference for the host country, he would still need to accumulate some savings S , at least in the early years when G is

not high enough to offset any big shocks on η_R . This introduces some inefficiency. Conversely, an agent might be "trapped" in the host country for longer than he had planned for, increasing his duration in the host country, G . This means that he would have more difficulties in going back. For some agents, this might even lead to a permanent settlement in the host country, although their first intention was to go back to their country of origin after a small number of years. The model is able to produce a probability of leaving the country which are either decreasing or increasing in the number of years spent in the host country.

Specification of Preferences: The utility functions are expressed as:

$$\begin{cases} u^{Stay}(G, \lambda, c^S) = \lambda c^{S\alpha} G^\gamma \\ u^{Return}(A - G, c^R) = c^{R\alpha} (A - G)^\gamma \end{cases}$$

where G is the duration in the host country and A is the age of the agent. λ measures the relative taste for German life. For most of the individuals, λ will be in $[0, 1]$, otherwise, there would be no incentive to go back as income is higher in the host country. The utility functions are such that the the marginal utility of consumption is reinforcing in the stocks. This is similar to addiction or habit formation.

The taste shock is assumed to follow an autoregressive process of order 1:

$$\lambda_t = (1 - \rho_\lambda)\mu_\lambda + \rho_\lambda\lambda_{t-1} + u_t \quad \text{with } u_t \sim \mathcal{N}(0, \sigma_u^2)$$

which we will approximate by a first order markov process (see Tauchen & Hussey (1991)).

Income Shocks: AR(1) process

$$Y' = (1 - \rho_Y)\mu_Y + \rho_Y Y + \epsilon_Y$$

$$\epsilon_Y \sim N(0, \sigma_Y^2)$$

Intentions We can compute the probability of returning to the home country at age A_t , conditional on still being in the country at age $A - 1_{t-1}$ as :

$$P_t^R = P^R(A_t, G_t, Y_t, \lambda_t, S_t) = \frac{\exp(V^{Return}(A_t, G_t, Y_t, S_t))}{\exp(V^{Return}(A_t, G_t, Y_t, S_t)) + \exp(V^{Stay}(A_t, G_t, Y_t, \lambda_t))} \quad (4)$$

due to the extreme value distribution of the shocks η_R and η_S .

We denote T^R as the random variable representing time until return. The probability at date t that the agent returns after k periods is :

$$P(T^R = t + k) = P_{t+k}^R \prod_{l=0}^{k-1} (1 - P_{t+l}^R) \quad (5)$$

We interpret the intention as the expected time the migrant will be willing to stay in the host country until return:

$$I_t = E_{\{\lambda_{t+k}, Y_{t+k}\}_{k=0}^{\infty} | \lambda_t, Y_t} \sum_{l=0}^{\infty} l P(T^R = t + l) \quad (6)$$

where the expectation is taken over all possible future paths for the taste shock λ_t and the relative wage Y_t . This expectation is non trivial to evaluate as it requires to calculate an infinite integral. Instead, we approximate it by simulations:

$$I_t(A_t, G_t, Y_t, \lambda_t, S_t) = \frac{1}{S} \sum_{s=1}^S \sum_{l=0}^{\infty} l P_s^R(T^R = t + l) \quad (7)$$

where $P_s^R(T^R = l)$ is the probability of returning in period l , computed with a given path indexed by s , $\{\lambda_{t+k}, Y_{t+k}\}_{k=0}^{\infty}$, for the taste shock and the relative wage.

From Intentions to Preferences: Finally, we denote I^{-1} the inverse of the intention function, which maps a given intention to a taste shock, conditional on age A , years since migration G , income Y and savings S .

$$\lambda = I^{-1}(A, G, Y, S, i) \quad (8)$$

We approximate the AR(1) process λ with a Markov chain with two values, λ high and λ low, following Tauchen(1986) procedure. Then, doing a linear interpolation, we define the λ that rationalizes the intention I as

$$\lambda = I^{-1}(A, G, Y, S, i) = \frac{i - i(\underline{\lambda})}{i(\bar{\lambda}) - i(\underline{\lambda})}(\bar{\lambda} - \underline{\lambda}) + \underline{\lambda} \quad (9)$$

Likelihood The likelihood of observing a sequence of intended durations is

$$P(i_0, i_1, \dots, i_t) = P(i_t|i_{t-1})\dots P(i_1|i_0)P(i_0) \quad (10)$$

The probability of observing an intention of i_t at arrival is

$$\begin{aligned} P(i_0) &= P(I(0, A_t, Y_0, \lambda_0)) = P(\lambda_0 = I^{-1}(0, A_t, Y_0, i_0)) = \\ &= \Phi\left(\frac{\lambda_0 - (1 - \rho_\lambda)\mu_\lambda}{\sqrt{\frac{\sigma_\epsilon^2}{1 - \rho_\lambda^2}}}\right) \end{aligned} \quad (11)$$

$$\begin{aligned} P(i_t|i_{t-1}) &= P(\lambda_t = I^{-1}(A_t, G_t, Y_t, i_t)|\lambda_{t-1} = I^{-1}(A_{t-1}, G_{t-1}, Y_{t-1}, i_{t-1})) = \\ &= \Phi\left(\frac{\lambda_t - (1 - \rho_\lambda)\mu_\lambda - \rho_\lambda\lambda_{t-1}}{\sigma_\epsilon}\right) \end{aligned} \quad (12)$$

4 Estimation Strategy:

For each year the individual is present in the sample, we observe the number of years this individual intend to stay, his age, the number of years since migration as well as the relative mean income in his home country with respect to Germany. This data forms the basis for our estimation method. We maximize the likelihood of observing the sequence of individual intentions. For a given vector of parameters θ , the model is solved and we can compute the probability that the individual will stay I years in Germany, conditional on having been there n years. The intention is stochastic as the individual faces taste shocks in each periods. Let's denote that probability $\pi(I, n)$.

These probabilities are computed numerically, by calculating all possible sequences for the taste shocks.

Obviously, individuals are different. We allow for two types of heterogeneity in the model. First, given the shocks to preferences, agents are ex post different in terms of intention to stay. Those with a high taste for German life, will eventually stay longer. However, there is certainly also an ex ante heterogeneity in the data. Prior to emigrating, immigrants have different views on how long they want to stay in Germany. To accommodate this heterogeneity, we allow different types of individuals in the model as in Heckman & Singer (1984). A type is defined as a particular process for the taste shocks, characterized by its mean, persistence and variance. To each type j ($j = \{1, \dots, J\}$) is associated a weight $\omega_j \in [0, 1]$ which measures the proportion of this type in the data. These weights are estimated along with the structural parameters. For an individual h of type j , the likelihood of observing a sequence of intentions I_l^h , $l \in \{t, t+1, \dots, t+\tau\}$, conditional on having stayed in Germany for i_l^h periods is:

$$L^h(j) = \prod_{l=t}^{t+\tau} \pi(I_l^h, i_l^h; j)$$

For the whole sample, the likelihood of observing the data, is:

$$L(\theta) = \prod_h \left(\sum_{j=1}^J L^h(j) \omega_j \right)$$

5 Estimation Results:

Table 2 displays the estimation results for our the data. We used all individuals who were Turk, Greek, Yugoslav, Italian or Spanish aged 17-65 in the period 1984-2003. This leaves 33255 observations. We choose arbitrarily the number of types to be equal to three.

Incorporating ex-ante heterogeneity between the migrants allows the individuals to differ in their preferences to stay in Germany prior to migration.

Table 2: Estimation Results

Parameter	Type1	Type2	Type3
γ	0.0922	0.0922	0.0922
α	0.4617	0.4617	0.4617
μ_λ	0.3843	0.5528	1.1897
ρ_λ	0.6186	0.6186	0.6186
σ_λ	0.1412	0.1412	0.1412
μ_Y	0.6188	0.6188	0.6188
ρ_Y	0.7521	0.7521	0.7521
σ_Y	0.1943	0.1943	0.1943
ω_j	0.3849	0.2350	0.3801

Note: Estimation done by maximum likelihood on 33255 observations

Each type has a different ex-ante taste for Germany: relative taste for consumption in Germany for type 1 is $\mu_\lambda = 0.3843$, for type 2 is $\mu_\lambda = 0.5528$ and for type 3 is $\mu_\lambda = 1.1897$.

As time in Germany pass on, immigrants face different realizations for their preference shocks. Those who draw adverse taste shocks revise their intended time in Germany downwards and return earlier. Those who face good shocks revise their intended length of stay upwards. This arises for two reasons. First, the preference shocks are persistent so a good shock today means that future shocks will be good as well. Second, as our model display addiction, the longer the individual have been in Germany, the higher are his intentions to remain there.

Figure 4 compares the observed intention of stay with the predicted one from our model. Observed and Predicted Intentions refer to Individuals aged 40-45 in 1984 who have stayed already 20 years in Germany. The model captures the updating observed in the data. We can see how migrants that stay in Germany revise their expected intentions upwards during their migration period.

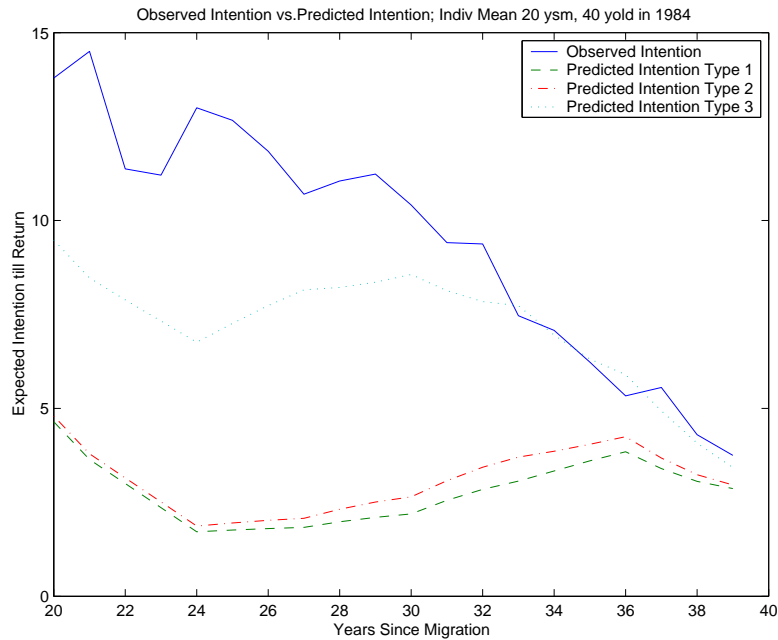


Figure 4: Predicted Intentions vs. Observed Intentions

6 Policy Analysis

Our next objective is to analyze the effect of different policy simulations:

- Temporary vs Indefinite Permits
Migrants will have different intentions to stay in the home country given the type of permit they hold. It should be interesting to know how a different permit influence their intentions.
- Uncertainty about Migration Policy
Changes in Migration Policy may lead individuals to have to revise their initial intentions of stay. Similarly, migrants will revise their intentions if the perceived uncertainty about migration policies increases.
- Subsidy to go back to Home Country
The subsidy should induce those individuals who want to return to anticipate their return. The real effect should be to help those migrants who want to return but that they are trapped in Germany.

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