Determining the shape of a migration wave*

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First version: August 2001

Revised version: February 22, 2002

Abstract

This paper presents a model of migration over time in which potential migrants are located on a Hotelling line according to their preferences for migration. We capture the externality of migrating for remnants through the destruction of networks in the source country and the evolution of networks in the destination country. We calibrate the model for the case of ethnic Germans who entered Germany in the 1990s, taking immigration restrictions into account. According to our model, immigration quotas mostly did not deter but defer migration.

JEL-Classification: F 22, H11, H79, J11, J15, R23

Keywords: migration decision, migration network, immigration quota, Hotelling model, ethnic Germans

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* I would like to thank Barbara Dietz from the Osteuropa Institute in Munich for providing the data. Participants of the EDP Jamboree and Andreas Wiggers provided helpful comments.

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1. Introduction

This paper is about the size and the shape of migration waves. If a new migration opportunity opens up, we typically observe migration to rise quickly, diminish and then taper off after several years or even decades. Two forces may determine the shape of migration waves. First, migrants themselves may differ with respect to the utility-maximizing point in time for migration. Depending on age, family status or earnings situation it may be optimal to postpone migration for a few years or to migrate immediately (Locher, 2000). Also, the migration decision may be interdependent – some migrants profit from being the first to come to the new country, whereas others build on networks that previous migrants have built up in the new country (Massey et al., 1993). As a consequence, overall migration extends over several years. Second, the shape of migration waves may be determined by immigration quotas. Immigration quotas are the most frequently used policy instrument to regulate immigration. For example, the three classical immigration countries, the US, Canada and Australia, all settle the number of visas in every category issued per year, before they decide whom to take.

The mechanisms that determine the shape of a migration wave may also determine its size. Hatton (1995), Hatton and Williamson (1994), Waldorf (1996) and Rotte and Vogler (2000) find that not only the stock of migrants, but also the number of migrants in the previous period has a positive effect on the number of immigrants in the current period. Thus, immigration quotas that change the distribution of immigrants over time may also change the number of overall migrants. For example, if the effect of the number of immigrants in the previous period on current migration is decreasing in the number of immigrants, a more equal distribution of immigrants over time leads to an increase in overall migration.

In this paper, we build a model of migration in which the decision to migrate depends on migration in the previous period. Potential migrants are distributed on a Hotelling line according to their preference for moving. The position on the line may reflect expected wage differences, migration costs, ethnic ties or just anything else that determines the preference for living in one country as opposed to another. As economic conditions in the source country or the destination country change, the utility of migration increases or decreases over time for all potential migrants. However, the relative utility of migration only depends on the position on the line and thus remains constant. The migration decision is interdependent, because people live in communities with those that are situated next to them on the Hotelling line. Thus, migration always changes both the community structure in the source and in the destination country and thus may induce further migration. To describe community equilibria, we use results from the political economy literature on the size and structure of nations, in particular Alesina and Spolaore (1997). Imposing an immigration quota deters migration, because it restricts the number of migrants per period. However, it may also defer migration, if the economic conditions in the source country or in the destination country change.

In the empirical part of the paper, we apply the model to the case of ethnic German immigration after the breakdown of the Eastern Block. Since 1989, about 2.8 Mio ethnic Germans immigrated to Germany. More than 95% of them come from five countries of origin, namely Poland, Romania, Russia, Kazakhstan, and Kyrgyzstan. Figure 1 presents the number of immigrants per year from 1985-2001. Polish and Romanian immigration peaked in 1989 and 1990, respectively. The peak in overall immigration is in 1990, when about 400,000 ethnic Germans entered Germany. After that, the number of immigrants decreased to around 220,000 per year in the early 1990s and to around 100,000 from 1998 onwards. Since July 1990, immigration has been severely restricted. First, there was an unofficial quota, as a longsome application procedure for recognition of being an ethnic German was introduced. Since 1992, there is also an official upper bound for the number of immigrants per year, which was binding from 1993-1995.

We show that the framework of the model fits quite well stylized facts of ethnic German migration. We also present simulations for the migration rates of ethnic Germans from each of the five countries mentioned above, including and excluding immigration restrictions. Overall, the restricted simulated migration rates fit the actual migration rate series quite well. Immigration restrictions deterred migration to a certain degree, because some applicants were forced to postpone migration until the economic situation in their county of residence had improved. However, postponement has been considerable, too. According to our simulations, migration of ethnic Germans without a quota would have peaked in 1992 with about 0.5 Mio immigrants, and would have decreased to zero in the second half of the 1990s.

The rest of the paper is structured as follows. In section 2, we discuss previous literature on network migration. In section 3, we present the model. Section 4 discusses ethnic German migration in the light of this model. In section 5, we simulate ethnic German migration waves. Section 6 concludes.

2. Related literature

The idea of networks has been formalized and tested empirically in several ways. Massey et al. (1993) argue that networks lead to a decrease in migration costs and the risks of migration. This is a very simple way to put it, and it is nice because it fits very well in the classical migration model in which migration takes place if the sum of discounted wage differences is greater than the migration cost.

Chau (1997) formalizes this idea. In her model, the wage difference is fixed and given. However, migration costs are the sum of a fixed component and a function including both an individual parameter and the number of previous migrants. Including an individual parameter in the cost function is necessary to create some heterogeneity, so that there are some people willing to migrate in the first period and others who are not. The fact that present migrants decrease the costs of future migrants, i.e. that they exert a positive externality on them, drives the two main results. First, the equilibrium amount of migration is lower than the socially optimal level. Second, there may be multiple migration equilibria. Carrington et al. (1996) have a similar model with endogenous wages. In their model, the expected wage difference increases in the number of migrants, because previous migrants help to find a job in the new country. Yet, the main results remain the same.

For the empirical testing, note that migration costs consist of a large number of components. Some of them, like distance to the home country, can be proxied in estimations. However, those components of migration costs which are likely to be most affected by the existence of networks are those which are the most difficult to measure. Psychic costs and the help someone can get in finding his way in the new country are not part of standard data sets.

What is often done in the empirical literature is to include the stock of migrants and the lagged dependent variable as explanatory variables in estimations of the migration rate. Rotte and Vogler (2000), for instance, show that the number of asylum seekers and other immigrants coming from a given country of origin has a positive impact on the inflow of asylum seekers and other immigrants in Germany. Hatton (1995) and Hatton and Williamson (1994) use both the stock of previous migrants and the lagged dependent variable as explanatory variables and find that both contribute to explaining the emigration rates from Europe to the New World at the turn of the last century. It seems that more recent immigrants are more helpful for newly arriving immigrants, so that it is not only the size of the stock of previous immigrants that matters, but also its composition. Given a certain size of the network, it works better the more recent immigrants are part of it. Waldorf (1996) uses the stock of guest workers and the average duration in Germany at time *t* to estimate the migrant stock at time *t*. In her estimations, the impact of migrants on the growth of the migrant stock diminishes in average duration of guest workers in Germany.

Usually, there is no structural model behind estimation of this reduced form. Hatton (1995) has a formal model of the migration decision, but he concentrates on the effect of uncertainty as suggested in the option value theory and on economic effects. Dependency on the previous stock and flow of migrants is assumed, but not based on a network model. The same is true for a model by Waldorf (1998).

Bauer and Zimmermann (1997a) have a good proxy for the existence of networks as a variable in their data set, i.e. whether an individual gets help from relatives or friends. They analyze the earnings assimilation of ethnic Germans, using data from the German Socioeconomic Panel (GSOEP). Those who get help have significantly higher earnings than those who do not. This result indicates that networks do not only reduce migration costs, they also widen the wage increase due to migration. Bauer and Zimmermann (1997b) show that immigrants whom we would expect to have more difficulties to find their way in the new country are more likely to use networks.

All above-mentioned papers have in common that they concentrate on the effect of previous on current migration through changes in conditions in the destination country. In contrast, we assume that migration may induce further migration not only because immigrant networks build up in the destination country, but also because networks in the country of origin are destroyed. The latter effect is of particular importance if migration rates are high. So far, about two thirds of the ethnic German population in the former Eastern Block has left. Thus, it does not make sense to stress high psychic costs of moving any more, because someone has to leave her friends, relatives, job, etc. The environment such a person is living in is changing drastically anyway, and it may be even less of a change to join in migration than to stay on one’s own. In such a case, the number of remnants is at least as important as a determinant of migration as the migrant stock in the new country.

3. A spatial model of migration

In this section, we present a model in which the evolution of a migration wave is determined in a Hotelling framework as used in the political economy literature.[1] In this literature, individuals are located on a Hotelling line according to their preferences for a public good. A community is represented by an interval on the line segment, and each community chooses its public good according to the preferences of the inhabitant in the middle of an interval. Alesina and Spolaore (1997) characterize the number and size of communities (which they call nations) under different political regimes. In this paper, we take the number and size of communities as given and concentrate on the transition between an equilibrium in which all people on the line are restricted to live in one country and an equilibrium in which they distribute between two countries. To do so, we describe the two-country equilibrium in 3.1 and the one-country equilibrium in 3.2. Section 3.3 describes the transition process.

3.1 The equilibrium for residence in two countries

Imagine a population of potential migrants, uniformly distributed on a Hotelling line of length 1, with $x = 0$ and $x = 1$ representing two nation states, which we label as A for $x = 0$ and B for $x = 1$. An individual's location on the line represents her inclination of living in A relative to her inclination of living in B. P_A is the part of the population residing in country A, P_B is the part residing in country B. The total population is normalized to one, i.e.

(1) $P_A + P_B = 1.$

The line is subdivided into several communities. Utility decreases in the distance between an individual's location on the line and the pole of the country she is living in, and in the distance between her location and the center of her community. The center of a community $\bar{x}$ is defined as the average x of a community. We assume that in each of the two countries, there are also a lot of citizens who never even consider migration. They are located at the respective pole, and there are so many of them that there is always a community center in each of the poles. Thus, those who are located very close to one of the poles live in a community whose center is in one of the poles The utilities of living in countries A and B are thus defined as

[1] For an overview over this literature and the use of a Hotelling framework see Bolton et al. (1996).

(2) $U^i_A = -|x^i - \overline{x^i}_A| - \alpha_A|x^i - 0| \quad = -|x^i - \overline{x^i}_A| - \alpha_A x^i \quad \alpha_A > 0$

(3) $U^i_B = -|x^i - \overline{x^i}_B| - \alpha_B|x^i - 1| + b \quad = -|x^i - \overline{x^i}_B| - \alpha_B(1 - x^i) + b \quad \alpha_B > 0$

with $\overline{x^i}_A$ and $\overline{x^i}_B$ as the center of the community the person is living in in country A and B, respectively. The parameter b in the utility function for country B, which may be negative, captures the additional utility of living in country B as opposed to A due to economic or political differences in the two countries. It also covers migration costs. We skip a time index here, but in principal, b is allowed to vary over time. The two weighting parameters, α_A and α_B, measure how important the country preference compared to the community preference is in each of the countries. The parameters are allowed to differ across countries, because it may be that one of the countries is much more federal than the other. In that case, the community is relatively more important than policies of the central government. This is reflected in a smaller α for this country.

To avoid that each utility-maximizing person makes up a community of her own, we set the minimum size of a community equal to $\gamma > 0$. For possibilities to determine the size of γ endogenously see Alesina and Spolaore (1997). In their model, each community provides a public good, which is produced at a certain cost. In a larger community, costs per person of providing the public good are lower, but tastes concerning the characteristics of the public good are less satisfied on average. In equilibrium, communities all have the same size, they are ordered one after the other on the Hotelling line,[2] and the public good provided is equal to the tastes of the person living in the center of the community. These results carry over to our model, except that the size of communities can be different in the two countries.

We denote the number of people living in each community by n_A and n_B, respectively. N_A and N_B is the number of communities in A and B. Using the three equilibrium conditions about size, location and structure of communities, we get

(4) $N_A = \max\left\{\left\lfloor \frac{P_A}{\gamma} - \frac{1}{2} \right\rfloor, 0\right\}$ [3]

(5) $N_B = \max\left\{\left\lfloor \frac{P_B}{\gamma} - \frac{1}{2} \right\rfloor, 0\right\}$

[2] If two persons with x^i and $x^{i'}$ live in the same community and $x^i > x^{i'}$, every person with x^j: $x^i > x^j > x^{i'}$ also lives in the community.

[3] $\lfloor x \rfloor$ means the biggest integer that is smaller or equal to x.

$$
\text{(6)} \qquad n_A = \begin{cases} \dfrac{P_A}{(N_A + 1/2)} & \text{if } N_A > 0 \\ 0 & \text{otherwise} \end{cases}
$$

$$
\text{(7)} \qquad n_B = \begin{cases} \dfrac{P_B}{(N_B + 1/2)} & \text{if } N_B > 0 \\ 0 & \text{otherwise} \end{cases} .
$$

So far, there are six unknowns, population, community size, and the number of communities of the two countries, but only five equations, (1) and (4) to (7). The sixth equation comes from the condition that the person located at the point of the line on which the populations of the two countries meet must be indifferent between residence in A and B. Calculating x^{i*} for which $U^i_A = U^i_B$, and setting this equal to P_A, we get

$$
\text{(8)} \qquad P_A = \max\left\{ \frac{1 + n_A N_A - n_B N_B - b + \alpha_B}{2 + \alpha_A + \alpha_B}, 0 \right\} .
$$

The six equations and the six unknowns determine an equilibrium in which the population of potential migrants splits up between the two countries.

2.2 The equilibrium for residence in country A only

Assume that the population of potential migrants is confined to live in country A only, i.e.

(9) $P_A = 1$.

The reason for this may be migration restrictions, or the fact that country B does not exist. The equilibrium is described by P_A, N_A and n_A, which can be calculated from equations (4), (6) and (9).

2.3 The transition process

The goal of this paper is to analyze the transition process from a one-country residence to a two-country residence equilibrium. Imagine that people first are confined to live in A, and that an exogenous shock all of a sudden allows them to migrate from A to B. The shock may be the foundation of a previously non-existent state B or the removal of migration barriers. The transition process works as follows: In every period, people first decide whether to stay in A or whether to move. If utility in B is higher than utility in A, the individual moves. After that, a restructuring of communities takes place, such that each community is at least of size γ again, and no one has an incentive to move to another community within her country of residence. Of course, the restructuring of communities changes utilities in both countries, so that in the next period, there may be migration again.

To see how many people migrate and who migrates, we show that if person i with x^i wants to migrate, any person j with x^j, $x^j > x^i$ also wants to migrate. To do so, we distinguish four cases and calculate the difference in the utility difference of being in B or in A for i and j. If this term is negative, the utility difference is higher for j, thus, if i migrates, j migrates, too.

(1) x^i and x^j live in the same community, $\overline{x}^i_A = \overline{x}^j_A$, with $\overline{x}^i_A < x^i < x^j$

$(U^i_B - U^i_A) - (U^j_B - U^j_A) = (2 + \alpha_A + \alpha_B)(x^i - x^j) < 0$

(2) x^i and x^j live in the same community, $\overline{x}^i_A = \overline{x}^j_A$, with $x^i < x^j < \overline{x}^i_A$

$(U^i_B - U^i_A) - (U^j_B - U^j_A) = (\alpha_A + \alpha_B)(x^i - x^j) < 0$

(3) x^i and x^j live in the same community, $\overline{x}^i_A = \overline{x}^j_A$, with $x^i < \overline{x}^i_A < x^j$

$(U^i_B - U^i_A) - (U^j_B - U^j_A) = (\alpha_A + \alpha_B)(x^i - x^j) - 2(x^j - \overline{x}_A{}^i) < 0$

(4) x^i and x^j live in a different community, $\overline{x}^i_A < \overline{x}^j_A$

$(U^i_B - U^i_A) - (U^j_B - U^j_A) = (1 + \alpha_A + \alpha_B)(x^i - x^j) + |x^i - \overline{x}_A{}^i| - |x^j - \overline{x}_A{}^j| < 0$[4]

The utility difference is larger in the first than in the second case, because in addition to the fact that country B fits j better than i, j improves her position in the community relative to i. Prior to migration, j is more distant to the center of their community than i, and after migration, she is closer. Generally, people who live to the right of their community center rather migrate than those who live to the left of it, because their loss due to an increased distance to their community center is smaller.

To calculate the migration rate, we have to find an $x^i_t{}^*$ which is indifferent between staying and moving in period t. The first section on the line where we look for $x^i_t{}^*$ is to the right of the community center which is the farthest on the right in country A. $x^i_t{}^*$ is given by

(10) $$x^i_t{}^* = \frac{\overline{x}^i_{A,t-1} + \overline{x}^i_{B,t-1} - b + \alpha_B}{2 + \alpha_A + \alpha_B} \qquad \text{for } x^i_t{}^* > \overline{x}^i_{A,t-1}$$

[4] Here, we get four different cases again, which we solve with an upper estimate.

(1) For $\overline{x}^i_A < x^i$ and $\overline{x}^j_A < x^j$, $(U^i_B - U^i_A) - (U^j_B - U^j_A) \leq (1/2 + \alpha_A + \alpha_B)(x^i - x^j) < 0$.

(2) For $\overline{x}^i_A > x^i$ and $\overline{x}^j_A > x^j$, $(U^i_B - U^i_A) - (U^j_B - U^j_A) = (\alpha_A + \alpha_B)(x^i - x^j) - n_A < 0$.

(3) For $\overline{x}^i_A < x^i$ and $\overline{x}^j_A > x^j$, $(U^i_B - U^i_A) - (U^j_B - U^j_A) = (\alpha_A + \alpha_B)(x^i - x^j) - (\overline{x}^i_A + \overline{x}^j_B) + 2x_i \leq 0$.

(4) For $\overline{x}^i_A > x^i$ and $\overline{x}^j_A < x^j$, $(U^i_B - U^i_A) - (U^j_B - U^j_A) \leq (\alpha_A + \alpha_B)(x^i - x^j) < 0$.

using the locations of the community centers of the previous period, t-1. If x^i_t* is not within the section in which we were looking for the solution, we conclude that everybody in that section migrates, and look for x^i_t* in the section to the left of the community center which is the farthest on the right in country A. Here, x^i_t* is given by

$$(11) \qquad x^i_t* = \frac{-\overline{x}^i_{A,t-1} + \overline{x}^i_{B,t-1} - b + \alpha_B}{\alpha_A + \alpha_B} \qquad \text{for } x^i_t* < \overline{x}^i_{A,t-1}.$$

Again, if x^i_t* is not within the section in which we were looking for the solution, we conclude that everybody in that section migrates. So we look for x^i_t* in the section to the right of the community center which is the farthest but one on the right in country A, using formula (10). We continue like this until we get an interior solution or end up at $x^i = 0$.

After migration, the process of community restructuring takes place. Due to migration, there will be either new communities in B, or the center of the community on the left border of B moves farther to the left. In any case, the situation in B will change in a way that increases the utility of living in B for those who stayed in A. This is what may induce migration in period t + 1. Note that this mechanism is in line with the fact that the previous period migration rate is a determinant for migration in the current period, which has been found in the empirical literature.

Figure 2 is an example to illustrate the migration process for a constant b. Period 1 depicts the old equilibrium, and in period 2 migration starts. The migration rate is at its maximum in period 2 and decreases quickly. The decline is not constant. In period 9, migration is even higher than in 8, because in period 8, the number of communities in A decreased by 1, whereas the number of communities in B increased. Overall, the new equilibrium is approached rather quickly. Generally, the smaller γ, the smoother is the transition process. The higher b, the larger is the share of the population residing in country B in the new equilibrium.

One assumption we make which might seem problematic is that people decide what to do without taking others' decisions into account. In a framework in which being located among others with similar preferences is so important to economic agents, this is somewhat paradox. We do not consider complete ignorance about others' actions as realistic. However, we take it as a benchmark to highlight the transition from one steady-state to another. The opposite benchmark, namely complete knowledge about what others do, would complete the transition to a new equilibrium in one period. Looking at the time series for migration waves that actually took place, it seems that the "complete ignorance" benchmark is closer to reality than the "complete knowledge" benchmark.

4. Ethnic German migration: A Case Study

In this chapter we look at an example for return migration, namely ethnic German migration from Eastern Europe and the former Soviet Union to Germany. First, we present some general facts about this migration wave. Then we compare the features of the migration wave with the features of the model presented in the last section.

4.1 General features of ethnic German migration in the 1990s

Since emigration from the Eastern European countries and the former Soviet Union has become possible through Mikhail Gorbachev's reform policy, about 2.8 Mio ethnic Germans migrated to Germany. The right to immigrate to Germany and obtain German citizenship for people of German ethnicity is guaranteed in the German basic law, article 116.[5] Whereas for many years everybody could first enter Germany and then claim to be of German ethnicity, the huge increase in ethnic German immigrants in the late 1980s made German policymakers change the law. Since July 1990, a person first has to apply for the status of an ethnic German. Only after her application has been approved, she can immigrate. The application procedure can take several years. First, the federal administration office in Cologne checks whether it approves the application. After approval, the federal administration office allocates all applicants on the 16 German *Bundesländer* (federal states), which check whether they agree to the approval. This longsome procedure reduced the number of immigrants per year substantially and operated as a nonofficial immigration quota. Since 1993, the maximum number of approvals per year has also been officially restricted to 200,000 from 1993 to 1999 and to 100,000 since 2000.[6] Table 1 presents the number of immigrants from 1987-2001 and the number of applications. There are much more

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[5] The legal status of persons of German descent is called "affiliation to the German people" *(deutsche Volkszugehörigkeit).* People of German ethnicity come to live in Poland due to the West shift of Poland after World War II. Ethnic Germans in Romania and the former Soviet Union are descendants of migrants from Germany. See Brubaker (1998) and Kurthen (1995) for a discussion of the German concept of citizenship and its historical roots and Baaden (1997) for an overview of the history of ethnic Germans.

[6] To put it correctly, from 1993 to 1999, the number was restricted to the average of the number of immigrants in 1992 and 1993. From 2000 onwards, it has been restricted to the number of immigrants in 1999. In both cases, actual migration may exceed the limit by 10%.

applications than immigrants. The difference in the number of applications and actual immigrants may be due to rejections of applications, due to non-migration in spite of approval, or due to queuing of applications. Unfortunately, it is not possible to get numbers to evaluate the relative importance of the three phenomena. As an indication, note that in August 2001, 380,000 applications were in process (Press release of the Ministry of Interior, August 7, 2001).

Once the application finally has been approved, an ethnic German may enter Germany and become a citizen. She may bring a spouse, parents, and children, who are also entitled to get the German citizenship, and thus qualify for the benefits of the German welfare system as well.

4.2 Features of the model versus stylized facts of ethnic German migration

Before calibrating the model using data on ethnic German immigration, we show that the framework of the model fits ethnic German immigration quite well. To do so, we use German administration data and two data sets on ethnic Germans from the *Osteuropa-Institut* in Munich.

In the model, potential migrants are situated on a line, with their location representing their inclination to migrate. At the same time, communities are in accordance with this ordering, i.e. people living together in a network or a community have similar inclinations to migrate. We use the degree to which someone is attached to her German roots as a proxy for location on the Hotelling line. Thus, those who mixed more with the Russian population are expected to migrate to Germany later. Table 2 presents the share of ethnic Germans among all immigrants who come as either ethnic Germans or as their non-German family members from 1993 to 2000.[7] In 1993, 47% of immigrants have been ethnic Germans themselves. The respective percentage share decreased to 26% in 2000. Unfortunately, we do not have data on ethnic attitudes, sorted by communities, so that we could see whether people sort into communities according to their attitudes (or the other way round). However, we have evidence that migration takes place community by community. In a data set on 879 early ethnic German immigrants from the former Soviet Union who were questioned soon after their arrival in Germany in late 1989 and early 1990, respondents are asked what percentage of people had already left their village. 25.2% of respondents say that more than 50% of the German population in their former town of residence had

[7] Numbers for previous years are not available.

already left for Germany, and 15.3% say that more than 70% had already left. This was at a point in time when the emigration of ethnic Germans from the former Soviet Union only just started, as can be seen in figure 1. Still, a number of cities already experienced migration rates that were by far higher than 50%. Thus, we can consider communities to be ordered as in the Hotelling model, as people from the same village tend to migrate at the same time and the degree of affiliation to German roots is declining over time.

To further investigate the migration decision, we have to draw back on data about migration intentions. We use a data set collected by the *Osteuropa-Institut* Munich in cooperation with the sociological institute of Novosibirsk State University. The data set was collected in six traditional settlement areas of ethnic Germans, three of them in Russia, three of them in Kazakhstan in April and May 1991.[8] Obviously, it is not possible to look at who migrates and who does not if there is only information about remnants. Thus, we construct two variables to proxy for migration. The first one is the intention to migrate. 18% of respondents in the sample say that they do not intend to migrate, 31% say that they do not know, [9] and 52% say that they would like to migrate. It seems that the self-reported answers overestimate migration at least in the short run. Asked whether they have already filed an application for immigration to Germany, only 22% say that they did, of whom 4% have got an affirmative answer. 78% of respondents have not done anything to realize their potential migration plans so far.

We use the two proxies as dependent variables in ordered logit and logit regressions using both a sample restricted to the working population, i.e. people of age 25-60 who report that they work and have a positive wage, and the whole sample. Table 3 gives summary statistics for the variables we use in our analysis. We use five sets of variables, personal and family characteristics, labor market characteristics, proxies for ethnic ties, proxies for networks in Germany, and some variables that are supposed to correct for differences in life circumstances like a dummy for living in a city. We allow standard errors not be independent across people who live in the same village.

Table 4 presents the results. First look at the impact of personal and family characteristics. In the working age sample, the intention to migrate decreases with age

[8] For more details on the data see Dietz (1995), pp. 178.
[9] See Locher (2001) for a justification of that ordering.

at a declining rate. Kids increase the intention to migrate. A higher income slightly increases the intention to migrate, whereas people who feel that they can use their education in their current job are less inclined to migrate. These results are in line with the literature and with common sense. Next, look at the variables that proxy ethnicity. They play an important role. The coefficients for having German as native language, being member of a church (mostly Protestant), and being member of the Wiedergeburt[10] are all positive and highly significant. Being married to a German is significant at the 10% level. Having relatives in Germany increases the intention to migrate as well, whereas the coefficient for expecting help in case of migration is insignificant. For the whole sample, results are similar, save that the age coefficients are insignificant.

The logit estimations using filing of an application as the dependent variable have similar results as well. However, the impact of ethnic ties and a network in Germany is even stronger, whereas personal, family and job characteristics do not seem to matter. To justify the ordering of potential migrants on the Hotelling line according to the ties they have to German roots, it is important to note that this seems to be a crucial determinant for the migration decision indeed.

Although it is those who are most affiliated to Germany who are most inclined to migrate among the remnants, the degree to which new immigrants feel attached to Germany decreases over time. In the beginning of this section, we presented German administrative data on the declining share of ethnic Germans among new immigrants from 1993 to 2000. To show that the same phenomenon existed before, we compare some summary statistics from the two data sets by the *Osteuropa-Institut* Munich. In the data set on very early immigrants, 91% of those who are married have a German spouse. 70% say that they speak German as their native language, and 87% say that they are member of a religious group but not Russian orthodox. In the data set on ethnic Germans that stayed in Russia and Kazakhstan in 1991, only 61% of those who are married have a German spouse. 61% say that they speak German as their native language, and 32% say that they are member of a religious group apart from the Russian Orthodox Church. This change in observable characteristics can be seen as further evidence for early migration of those who feel more as Germans.

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[10] *Wiedergeburt* (English: "Re-birth") is a union of ethnic Germans, which tried to reestablish the autonomous Volga republic. The "autonomous Socialist Soviet Republic of the Volga Germans" was founded in 1924 and dissolved in 1941.

To summarize this section, we provided evidence that ethnic ties towards the German culture are a major determinant for migration taking place at all and taking place early. As members from the same community tend to migrate at the same time, ordering of communities along the Hotelling line seems to be a reasonable assumption.

5. Ethnic German migration: A calibration

In this section, we calibrate the migration time series for ethnic Germans from five countries of origin, taking immigration restrictions into account, and compare them to the migration time series that would have resulted from the same parameters, but without migration restrictions. The aim of the calibration exercise is to show that the model presented in this paper is able to generate time series that are similar to the time series we observe in reality. The aim of calculating the respective unrestricted migration time series is to give an idea of how the size and the shape of the migration wave has been changed through the restrictions, given that the mechanism of the model is true.

To do this, we first convert the yearly immigration data presented in table 1 into migration rates.[11] As the size of the base population, we use numbers based on the 1992 Census for Romania and the 1999 Census for Kazakhstan, and estimations of the German Federal Government and the minority representations in the respective countries.[12] The Polish German minority is estimated to consist of 1.2 Mio people, the Romanian one of 0.3 Mio people, the FSU one of 3 Mio people. Within the FSU, the Kazakh part consists of 1 Mio people, the Russian part of 1.2 Mio people, and the Kyrgyz part of 0.1 Mio people. Romania, Kyrgyzstan and Kazakhstan show the highest emigration rates. To calculate γ, we assume the minimum size of a community to be 100,000 people. This is what sociologists and ethnologists consider to be the minimum size of an ethnic group to survive. As there are a lot of movements of ethnic Germans across countries within the FSU, in particular from the new-founded nation states to Russia, we treat them as one big community with a common γ.

[11] Note that we define the migration rate as the share of the total population in country A and B that migrates within one period, not as the share of the population in country A that leaves per unit of time.
[12] In the 1989 Soviet Census, the number of ethnic Germans is about 30% lower than the numbers we use (Dietz, 1995). However, the Census only counts those who state that their nationality is German. So people who do not state their true nationality and non-German spouses, who are also entitled to immigrate to Germany, are not included there.

In our model, there is a shock before which migration is impossible and after which it is unlimited. We take the first year in which migration was unrestricted to be 1988 for Poland, 1989 for the Soviet Union, and 1990 for Romania. In Romania, fortunately the emigration restriction was lifted really close to the turn of a calendar year (22nd of December 1989). For the other countries, there is not such a clear turning point, which also is close to a New Year. Also, emigration restrictions had already loosened in the last years of the Eastern Block, in particular for Poland and Romania. This can be seen in figure 1. We take migration from 1987 onwards into account for the starting value of the populations in the country of origin and Germany.

We assume $\alpha_A = \alpha_B = 0.2$, except for Russia, for which we use 0.05 for 1989 to 1991. This is supposed to reflect the expectation of an autonomous republic. Strong autonomy makes the country a person lives in relatively less important, because it diminishes the country's impact on life. We specify b using the difference in GDP growth rates for the country of origin and Germany. For Russia, Kazakhstan and Kyrgyzstan we use a 3-year-average, because GDP growth rates are extremely volatile. Furthermore, we add 0.15 to the parameter b from 1992 onwards for Kazakhstan and Kyrgyzstan.[13] This is supposed to reflect the decrease in utility of living in one of these countries after the foundation of the Kyrgyz and the Kazakh national state in August and in December 1991, respectively. Ethnic Germans, who feel attached towards the German and to the Russian, but not towards the Kazakh or Kyrgyz nationality, became complete strangers in their country of residence.[14] Allowing for b to change over time makes return migration possible. In fact, there is return migration in our predicted migration time series, whereas we can never observe this in the data, because we only have data on immigrants to Germany.

Last, we need to introduce the immigration restrictions imposed by Germany, i.e. a maximum migration rate per country and year. From 1993 onwards, we use the

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[13] Instead of a constant, we also tried to add the yearly or the accumulated number of Russian emigrants from Kazakhstan to the parameter b. In 1989, 6.2 Mio Russians lived in Kazakhstan, who made up for 37% of the population. By 1996, the Russian population had decreased by 10%, whereas the Kazakh population had increased by almost 20% (Heleniak, 1997; 2002). Results do not change much, so we do not present them here.

[14] Ethnic Germans feel more attached to the Russian than to the Kazakh culture. For example, most ethnic Germans speak Russian, whereas only very few speak Kazakh. Yet in another data set by the *Osteuropa Institut* Munich on ethnic Germans in Russia and Kazakhstan collected in 1994, respondents living in Kazakhstan are asked in detail about their ties toward Russian, German, and Kazakh. In the sample, 21% of the respondents say that they speak mostly German within the family, 60% say that they speak mostly Russian, and 20% say that they speak both. None of them says that they speak Kazakh. Furthermore, asked about their Kazakh language abilities, 93% say that they do not speak Kazakh at all or that they understand only a few words.

maximum number of immigrants admitted per year and assume that the share of country allowances is equal to the share of actual immigrants that came from this country in the respective year. Before 1993, we do not even have a maximum number. We just know that due to the introduction of the application system in July 1990, there was considerable queuing for immigration, and that in the beginning of the 1990s, there may still have been some restrictions to emigration in the FSU. From 1989 to 1992, we therefore impose the number of actual immigrants as maximum number of immigrants allowed to enter.

Figures 3 to 7 present the results. For each country, we present results both with and without restrictions. Figures 3a and 3b depict the unrestricted migration rates for Poland and Romania, figures 3b and 4b the respective restricted migration rates. For the FSU countries, restricted and unrestricted migration rates are depicted in the same figures, namely 5, 6, and 7. The restrictions are that migration rates lie between zero and a certain upper bound imposed by German immigration regulations. The latter are never binding for Poland and Romania.

Figure 3 depicts the unrestricted simulated migration rate for Poland. We slightly overestimate emigration in 1988. There is no restriction imposed on emigration here, though there probably still was one in reality. From 1989 to 1996, the true emigration rate was slightly higher than the estimated one. As we observe neither return migrants nor the return of return migrants in my data, the only thing we can do is to restrict migration to zero as in figure 3b.[15] However, in this case actual migration was lower than predicted migration from 1997 to 2000. In the Romanian case, depicted in figures 4a and 4b, we also slightly underestimate the migration rate until 1996. If we do not restrict the migration rate to be positive, the simulated migration rate is much more volatile than the real one. In 1990, the real rate of migration was around 0.35, whereas we simulate it to be around 0.25. The underestimation may be because we do not take panic migration into account. Yet, we are able to replicate the pattern of migration, with a strong peak in emigration in 1990. This is due to the small size of the total population. The Romanian ethnic German population is by far the smallest we look at, and there have been only two

[15] An estimated 200,000 Polish ethnic Germans have a double citizenship. Therefore, they can move between the two countries without them being registered in immigration statistics (Informationen zur politischen Bildung, 2000, p. 9).

communities before 1990, such that the average distance to the center of a community is large.

As regards the CIS countries, first look at the three unrestricted time series in figures 5, 6 and 7. They all have a big peak in 1992, though they behave differently before. Afterwards, migration rates diminish to quasi zero by 1996 and become negative. The peak is later than for the two European countries, because the huge decline in growth rates during transition took place later for the CIS countries than for Eastern Europe. Yet, the shapes of the migration waves look very similar to the Eastern European ones. After a huge peak, migration rates drop to zero very quickly. According to the simulations, the total number of ethnic German immigrants in 1992 would have been almost 500,000 or twice the amount of actual immigrants. As opposed to that, the times series of the actual migration rates look rather flat. Up to 1994, actual migration is lower; afterwards, it is higher than simulated unrestricted migration.

The restricted time series are able to replicate this feature. It is not surprising that the simulated restricted time series are close to the actual series until 1995, because both series are driven by immigration restrictions. However, when the restrictions are not binding any more, actual migration rates decrease only slowly. This is also the case for the simulated restricted series, although they still tend to underpredict migration in the second half of the 1990s.

Comparing restricted and unrestricted simulated migration rates, note that due to the restriction, there is both deterrence and procrastination of migration. As to deterrence, the overall predicted number of immigrants is lower in the restricted case than in the unrestricted case. By 2000, 58% of the Russian population would have left if migration had been unrestricted. In the restricted case, it is only 50%. In Kazakhstan, 96% would have left in the unrestricted case, 83% in the restricted case. The gap is largest for Kyrgyzstan, where 90% would have left in the unrestricted case and 75% in the restricted case. The deterrence comes from the fact that the source countries recovered economically in the second half of the 1990s. This means that b became smaller. So some of those who could not migrate in the beginning of the 1990s did not want to migrate any more when they finally were allowed to do so. However, there is also a lot of procrastination, as the restricted simulated migration rates decrease much more slowly than the unrestricted ones.

6. Summary and Conclusions

We present a model for the evolution of a migration wave. Potential migrants are ordered on a Hotelling line according to their preferences for moving. As they live together in communities, and migration alters the community structures both in the source and in the destination country, migration may induce further migration. In particular, migration leads to the construction of a new community or network in the destination country and to the destruction of an old community or network in the source country, so that migration gets more attractive for those left over. Using both the model and immigration quotas to calibrate migration rates of ethnic Germans in the 1990s we are able to replicate the actual time series quite well. Due to the fact that the economic situation in the source countries slightly improved by the end of the 1990s, immigration quotas did not only defer, but also defer migration.

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Tables and Figures

Table 1: Number of ethnic German immigrants

Year	FSU	Kazakh-stan	Russia	Kyrgyz-stan	Poland	Romania	Total	Appli-cations
1987	14,488				48,419	13,990	78,523	
1988	47,572				140,226	12,902	202,673	
1989	98,134				250,340	23,387	377,055	
1990	147,455				113,253	107,189	397,075	128,844
1991	147,320				40,129	32,178	221,995	561,352
1992	195,576	114,382	55,875	12,618	17,742	16,146	230,565	402,375
1993	207,347	114,382	67,365	12,373	5,431	5,811	218,888	241,178
1994	213,214	121,517	68,397	10,847	2,440	6,615	222,591	237,291
1995	209,409	117,148	71,685	8,858	1,677	6,519	217,898	260,556
1996	172,181	92,125	63,311	7,467	1,175	4,284	177,751	168,758
1997	131,895	73,967	47,055	4,010	687	1,777	134,419	147,577
1998	101,550	51,132	41,054	3,253	488	1,005	103,080	100,421
1999	103,599	49,391	45,951	2,742	428	855	104,916	117,101
2000	94,558	45,657	41,478	2,317	484	547	95,615	106,895
2001	97,434	46,178	43,885	2,020	623	380	98,484	83,812

Sources: German Statistical Yearbook, table 6.40, several years, Baaden (1997), p. 20, Federal Administration Office Cologne, applications in 1990 only for July-December.

Table 2: Percentage of total ethnic German immigrants (including family members) that personally proved German ethnicity

Year	1993	1994	1995	1996	1997	1998	1999	2000
Percentage	47.08	60.92	55.44	47.68	39.71	34.05	29.49	26.34

Source: Federal Administration Office cologne

Table 3: Description of variables

Mean (standard deviation)	Variable name	Description of variable
644	Number of observations	Including only people between 25 and 60 in the survey year who are working
37.1 (8.17)	Age90	Age of the respondent in 1990
1440 (647)	Age90sq	Age squared of the respondent in 1990
3.72 (1.15)	Education	Levels of education degrees in the Soviet system, increasing from 0-6
0.862 (0.346)	Married	Respondent is married
0.748 (0.434)	Kids	Dummy for having children
286 (161)	Income	Average monthly labor income
3.53 (1.09)	Match	Measure in how far education and experience can be used at present job, increasing from 1 to5
0.465 (0.500)	Married German	Married to a person who is of German nationality
0.592 (0.492)	Native German	Being German native speaker
0.312 (0.464)	Religion	Being member of a church, excluding Russian orthodox (mainly protestant churches)
0.172 (0.378)	Wiedergeburt	Member of Wiedergeburt (union of ethnic Germans, tried to reestablish the autonomous Volga republic)
0.702 (0.458)	Relative German	Respondent has relatives in Germany
0.357 (0.480)	Help relatives	Respondent expects help from relatives in Germany in case of migration
0.333 (0.472)	Car	Respondent owns a car
0.592 (0.492)	City	Respondent lives in a city or urban area
0.495 (0.500)	Russia	Respondent is from Russia

Table 4: Estimation results for the inclination to migrate

	Ordered logit dependent variable: intention to migrate		Logit dependent variable: filed an application or not	
	Working population	Whole sample	Working population	Whole sample
Age90	-0.303** (0.061)	-0.063 (0.041)	-0.173 (0.093)	0.018 (0.049)
Age90sq	0.003** (0.001)	0.000 (0.001)	0.002 (0.001)	-0.000 (0.001)
Education	-0.110 (0.096)	-0.075 (0.078)	-0.155 (0.148)	0.030 (0.091)
Married	-0.339 (0.256)	-0.205 (0.202)	-0.336 (0.371)	0.422 (0.311)
Kids	0.357* (0.182)	0.184* (0.163)	-0.102 (0.266)	-0.257 (0.228)
Income	0.001* (0.000)		0.001 (0.001)	
Match	-0.233** (0.066)		-0.119 (0.092)	
Married German	0.430 (0.234)	0.358 (0.193)	0.768* (0.347)	0.648* (0.305)
Native German	0.852** (0.230)	0.776** (0.165)	0.291 (0.296)	0.253 (0.257)
Religion	0.804** (0.247)	0.754** (0.213)	1.19** (0.209)	1.13** (0.211)
Wiedergeburt	0.800** (0.280)	0.801** (0.229)	0.877* (0.435)	1.08** (0.367)
Relative German	1.29** (0.263)	1.04** (0.206)	1.55** (0.440)	1.17** (0.361)
Help relatives	0.308 (0.211)	0.333 (0.173)	0.795** (0.218)	0.859** (0.263)
Car	0.334** (0.104)	0.458** (0.127)	0.603** (0.224)	0.504** (0.143)
City	0.706** (0.268)	0.621** (0.224)	0.395 (0.255)	0.276 (0.219)
Russia	-0.390 (0.274)	-0.352 (0.244)	-0.578** (0.203)	-0.677** (0.217)
Constant	Ancillary parameters not reported	Ancillary parameters not reported	-1.68 (1.91)	-4.22** (0.92)
Observations	639	1,002	642	1,008
Pseudo R^2	0.18	0.13	0.26	0.23

Note: Robust standard errors in parentheses, * significant at 5% level; ** significant at 1% level, clustering for villages

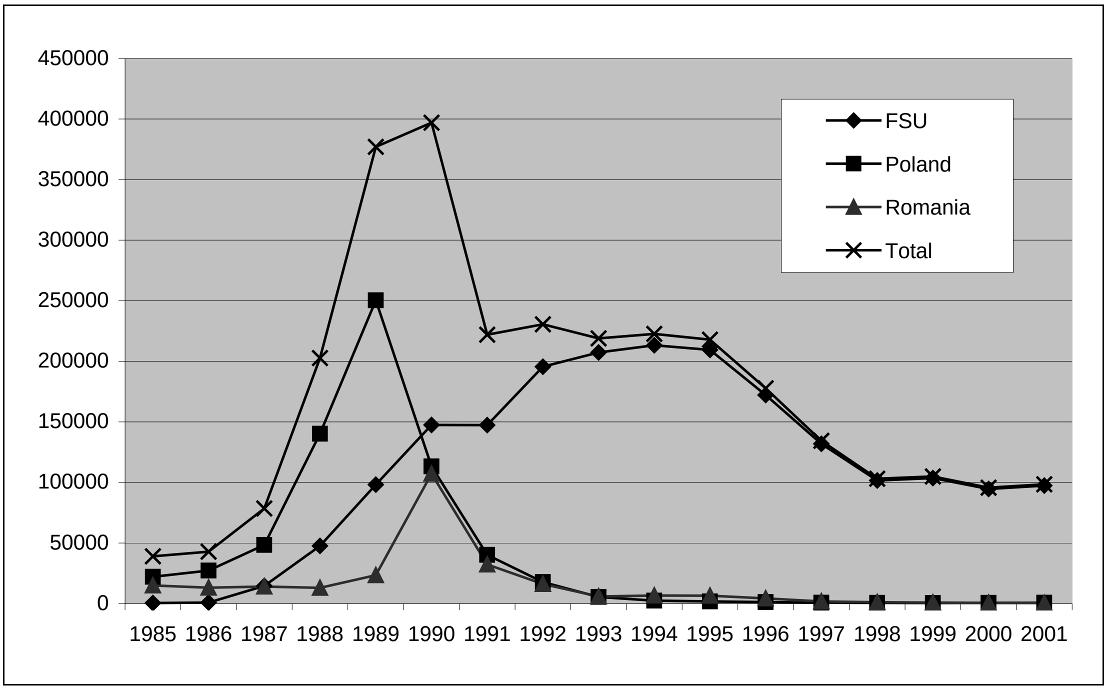

Figure 1: Number of ethnic German immigrants per year, 1987-2000

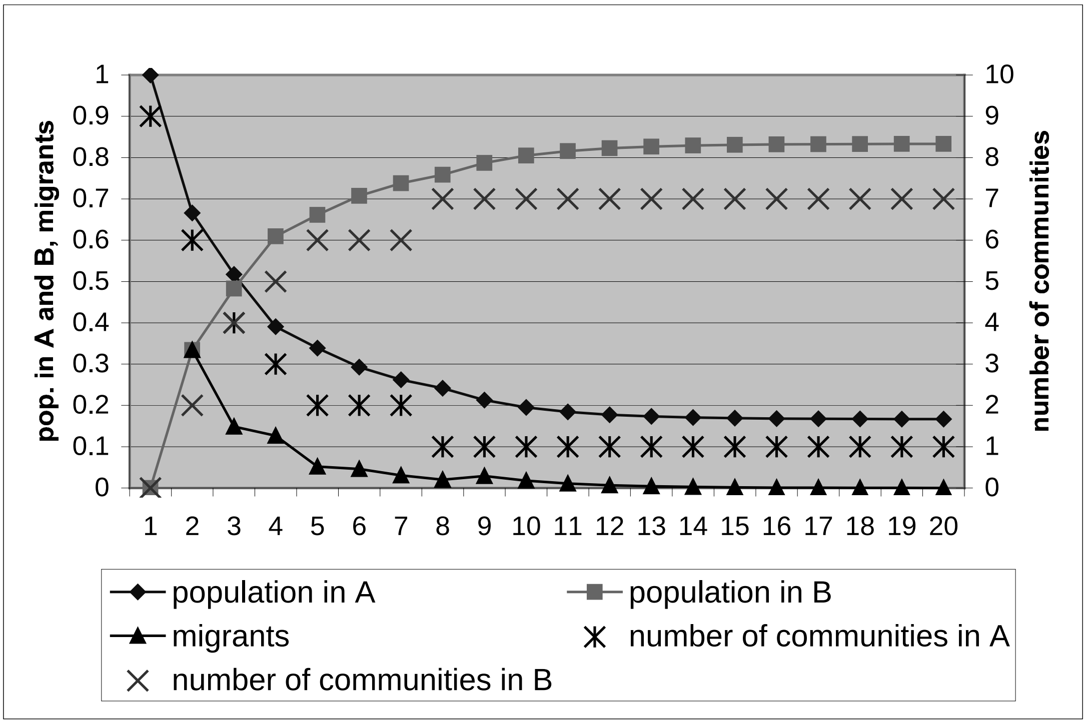

Figure 2: Migration for $\gamma = 0.1$, $\alpha_A = \alpha_B = 0.3$, $b = 0.2$

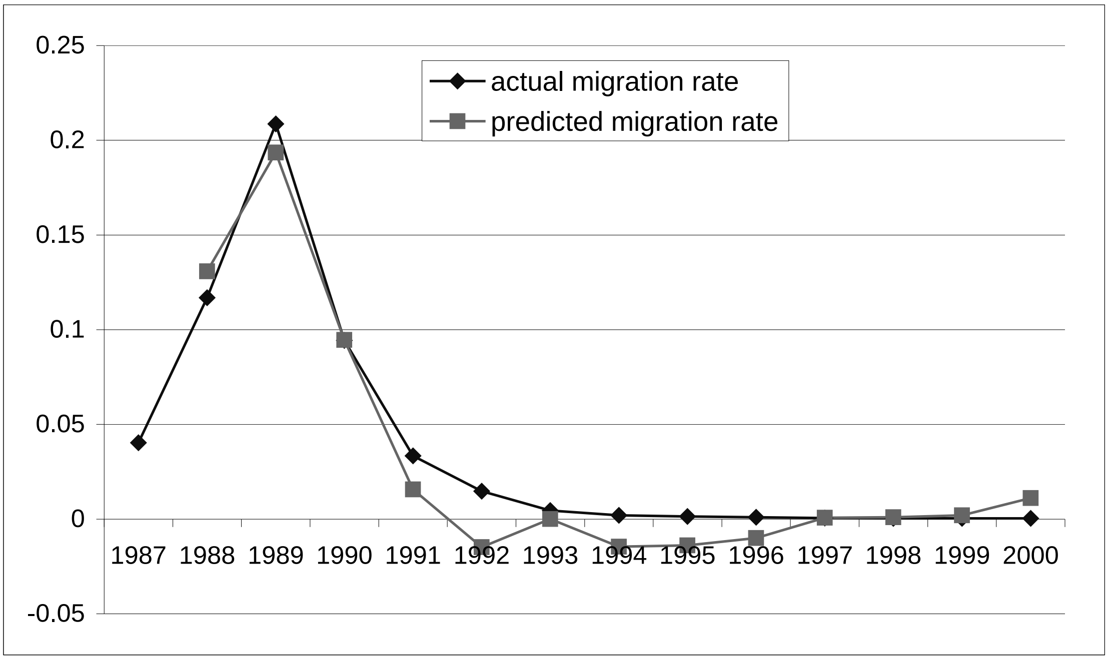

Figure 3a: Actual and predicted *unrestricted* emigration rate from Poland; $\gamma = 0.083$, $\alpha_A = \alpha_B = 0.2$, b = difference in GDP growth rates/100

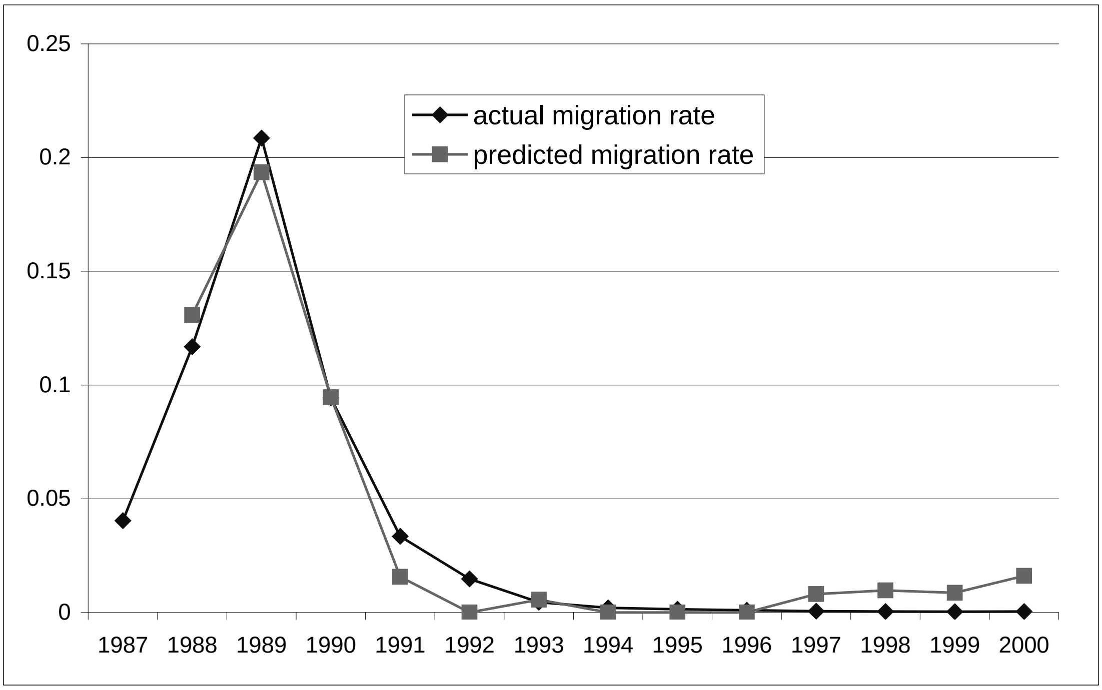

Figure 3b: Actual and predicted *restricted* emigration rate from Poland; $\gamma = 0.083$, $\alpha_A = \alpha_B = 0.2$, b = difference in GDP growth rates/100

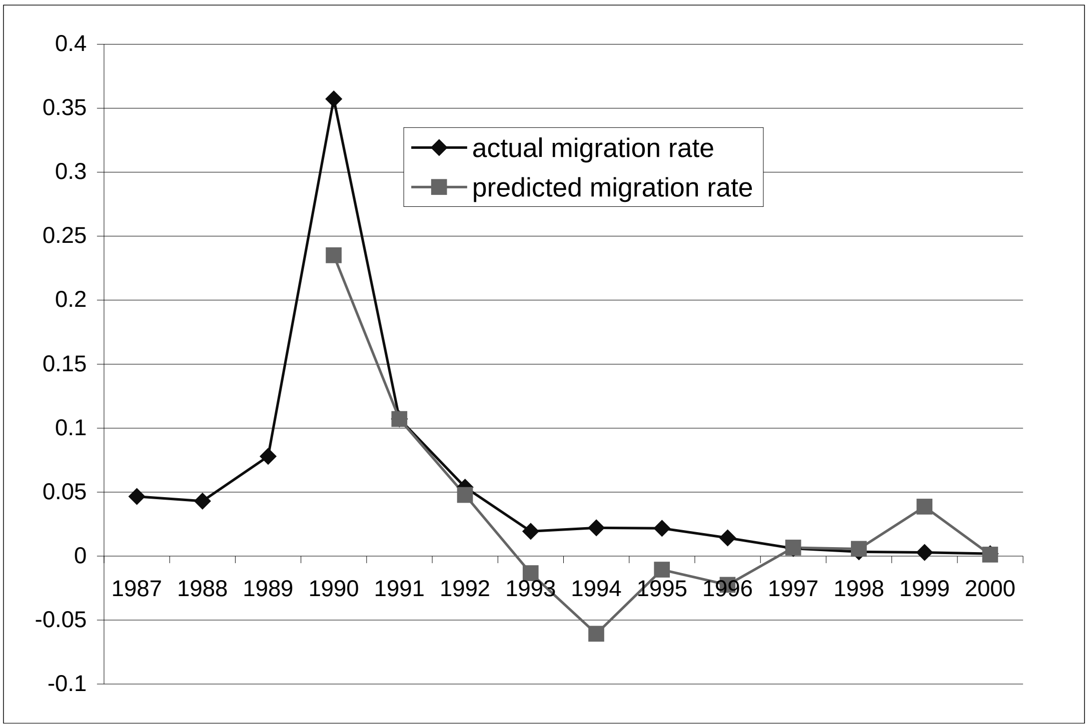

Figure 4a: Actual and predicted *unrestricted* emigration rate from Romania; $\gamma = 0.33$, $\alpha_A = \alpha_B = 0.2$, b = difference in GDP growth rates/100

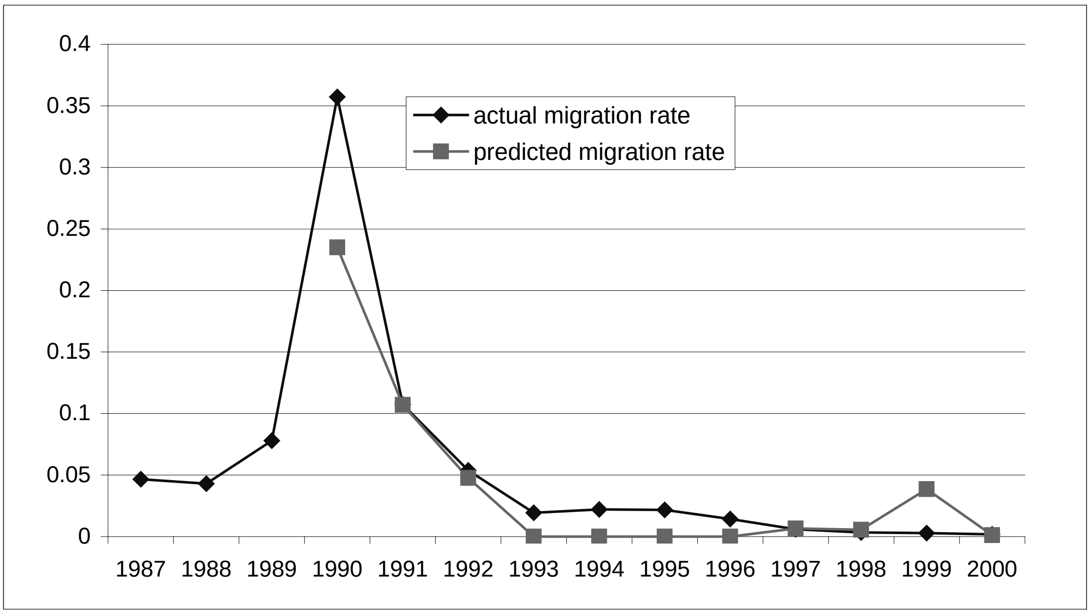

Figure 4b: Actual and predicted *restricted* emigration rate from Romania; $\gamma = 0.33$, $\alpha_A = \alpha_B = 0.2$, b = difference in GDP growth rates/100

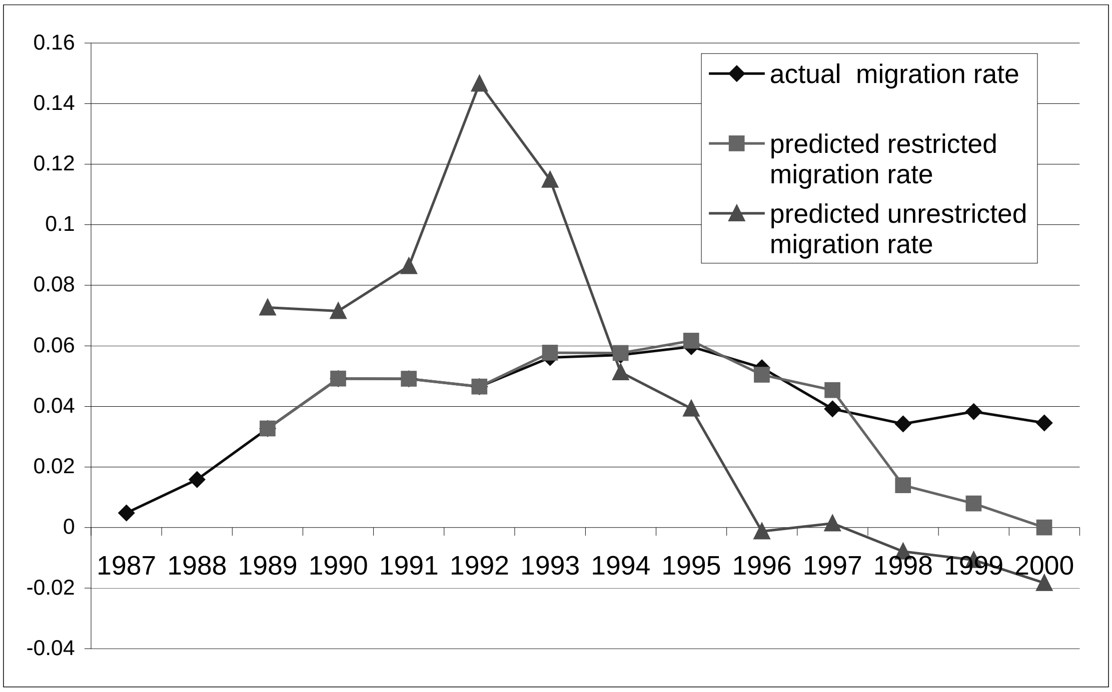

Figure 5: Actual and predicted emigration rate from Russia; $\gamma = 0.03$, $\alpha_A = 0.05$ (1989-1991), $\alpha_A = 0.2$ (1991-2000), $\alpha_B = 0.2$, b = three-year average of difference in GDP growth rates/100

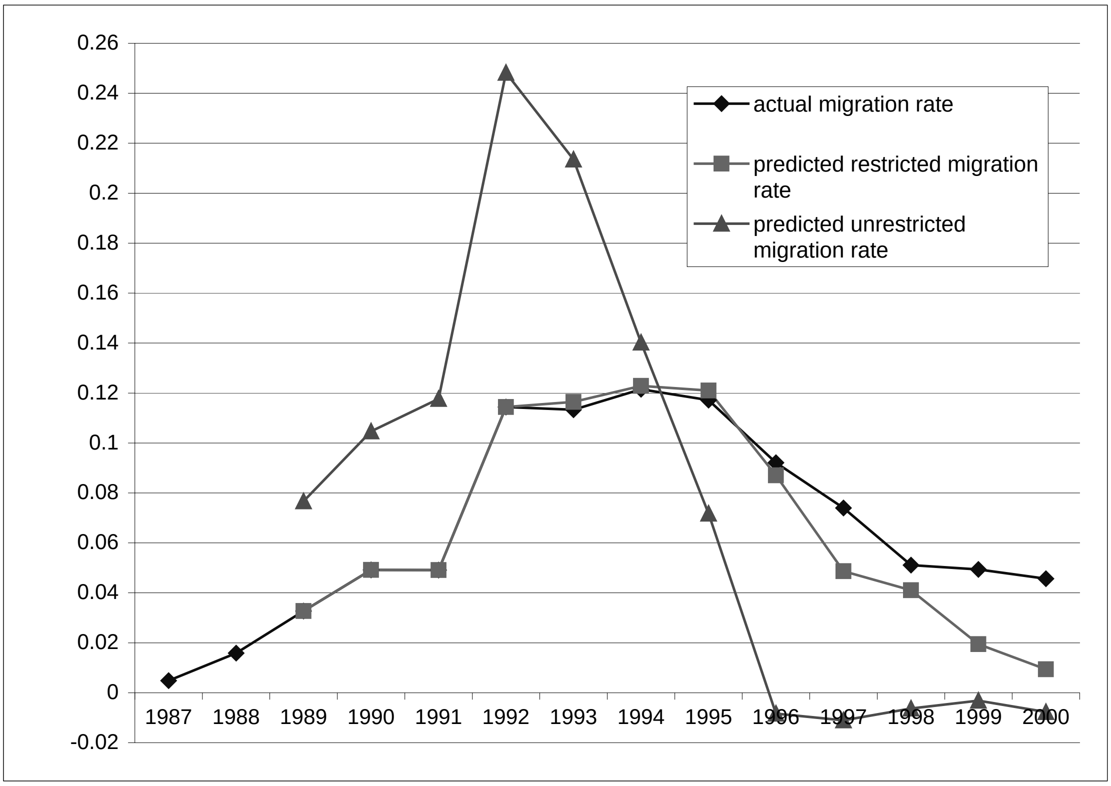

Figure 6: Actual and predicted emigration rate from Kazakhstan; $\gamma = 0.03$, $\alpha_A = 0.2$, $\alpha_B = 0.2$, b = 0.15 (since 1992) + three-year average of difference in GDP growth rates/100

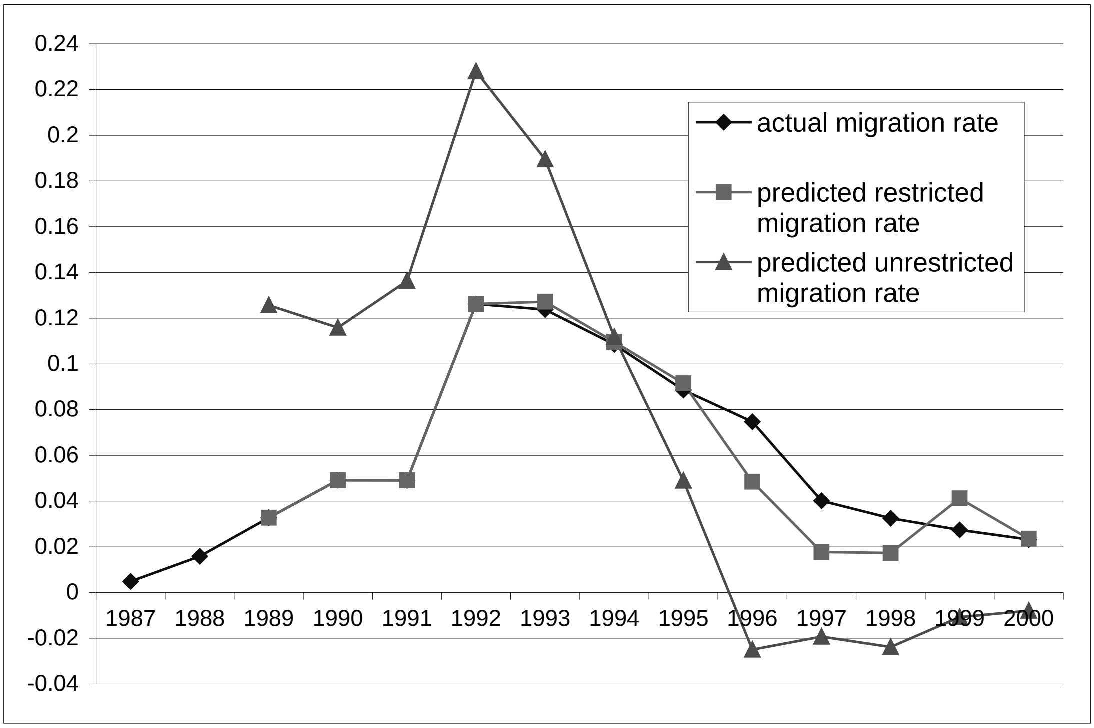

Figure 7: Actual and predicted emigration rate from Kyrgyzstan; $\gamma = 0.03$, $\alpha_A = 0.2$, $\alpha_B = 0.2$, b = 0.15 (since 1992) + three-year average of difference in GDP growth rates/100