From Immigration to Integration: Four Essays on Economic Aspects of the Transition Process

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1 Introduction

The transition of a person from one nation to another is a long and complex process. It includes the move from one country to another as well as the integration into a new society with a different value system. This process is of extraordinary interest for economic research. At all stages, it has substantial economic consequences for the individual who passes through it and for other people in the sending and immigration country, possibly even in the whole world. A large number of economic factors influences whether an individual enters this process and how the process proceeds.

An individual's plans to migrate to another country can already have far-reaching economic consequences. First, the individual invests time and money in collecting information on potential destination countries. Second, and more importantly, she adjusts her behavior and her economic decisions in anticipation of a later migration; for instance, she learns the language of the immigration country or aspires a higher educational degree to be eligible for a certain immigration program. Economic research has shown that the option to migrate has a substantial effect, not only on the welfare of the potential emigrant, but also on the welfare of the whole population in the emigration country.

The transition from one nation to another is generally not finished within one generation. Children and grandchildren of immigrants often still form separated groups in the society of the immigration country. In most cases, not only the value systems of these groups, but also their qualification struc-

tures and economic outcomes largely differ from the native population. In the end of a successful transition, or integration respectively, the descendants of immigrants are a non-distinguishable part of the society in the immigration country and have the same economic prospects as others. This does not necessarily mean that they have to abandon their cultural heritage. Their heritage can also become a part of the cultural heritage of the immigration country. Nevertheless, integration is not always successful. In some cases, descendants of immigrants still build separated population groups after centuries. The integration of immigrants into the society of the immigration country has social and economic consequences. Better integrated people generally have better perspectives on the labor market and pay higher taxes.

In the (economic) literature on the transition of people from one country to another, three areas can be distinguished: The first branch analyzes the determinants of migration and tries to answer the questions why people migrate and how migration flows react to social, political and economic changes. The second branch deals with effects of migration. The effects of emigration and immigration on wage structures, unemployment patterns and national budgets as well as welfare in different countries are in focus of this literature. The third branch is the integration literature. It analyzes the economic situation of people who have already migrated and examines the process of their integration into society and labor market of the immigration country.

In my doctoral thesis, I analyze four specific aspects of the transition process of immigrants from one nation to another. The first is the determinants of the location choice of a migrant. Potential migrants generally have the choice between a large range of different immigration countries. From a theoretical perspective, migrants should choose the country which offers them the best living – the place where their expected utility is highest. To understand (and predict) migration flows, knowledge about the determinants of the expected utility from living in different countries and the relative importance of these determinants is necessary. Chapter 2, which is based on joint work with Silke Übelmesser and Martin Werding, presents new empirical evidence on the effects of various economic factors on the location choice of migrants.

The empirical analysis in chapter 2 is based on large microdata-sets from Germany, France, the UK and the US and uses a multinomial choice approach. We find that not only wages and unemployment rates, but also education and health system and labor market institutions, such as employment protection and union coverage, are important determinants of the location choice.

The second aspect that is analyzed in my thesis are the effects of immigration on native welfare. There is already a large number of papers that analyze the welfare effects of immigration. However, the bulk of them assumes that immigration does not affect the economic decisions of natives, for instance with respect to education. In most cases, natives can build expectations on future inflows and stocks of immigrants in the country. As immigration affects the labor market, information on future immigration can be highly relevant for the educational decisions of natives. In chapter 3, I show that allowing for the native educational structure to adjust to immigration changes the effect of immigration on native welfare. Under the assumption of a perfect labor market, the welfare effect from immigration is reduced substantially. Much depends on the formation of expectations. The expectations that natives have on (future) immigration when they decide about their education need not necessarily be correct. I find that the higher the expected immigration relative to the realized immigration, the lower is native welfare. Thus, not only immigration per se, but also expectations about it are relevant for native welfare.

Differences in the economic situation of immigrants and natives are the third aspect of the transition process that I analyze. In European countries, and in particular in Germany, immigrants have a higher probability to be unemployed than natives. In addition, immigrant unemployment in Germany reacts more to changes in the labor market situation, such as cyclical fluctuations, than does native unemployment. In chapter 4, I decompose the difference between immigrant and native unemployment into a baseline component, which denotes the (hypothetical) difference for a certain situation in the labor market, and a situation component, which captures the stronger reaction of immigrant unemployment to changes in the labor market. The situation component can fully be explained by differences in human capital

endowment between immigrants and natives. As to the baseline component, discrimination of immigrants and/or a lack of social networks relevant for labor markets also play a role. Nevertheless, lower educational degrees and lacking language skills explain more than 7/8 of the baseline component.

The fourth aspect of the transition process that is analyzed in this thesis is naturalization policy. Naturalization requirements, such as language tests, are a mechanism to select "new citizens". In addition, as naturalization is generally attractive for immigrants, these requirements also provide an incentive for immigrants to enhance their investments in education. Through higher taxes and lower welfare benefits, a higher educational level of immigrants also increases welfare of natives. In chapter 5, I discuss how an immigration country should set these requirements to maximize native welfare. The optimal level of requirements depends on the ex-ante distribution of qualifications within the immigrant population and further aspects of naturalization that affect native welfare, such as the right to vote. I find that, for plausible parameter set-ups, the requirements that maximize native welfare are neither such high that no immigrant can reach them nor such low that all immigrants meet them.

To complete the picture, I give a short overview of the existing literature on the transition process of immigrants in the introductory chapter. Moreover, I discuss the relationship between the four analyzed aspects and the steps of the transition process in general in a concluding chapter.

1.1 Determinants of migration

Migrants have very different reasons for leaving their home country and moving to another country. First of all, one should distinguish between people who migrate voluntarily and people who migrate involuntarily. Displacement, wars, political persecution and famines may force people into (involuntary) migration. In most cases, people cannot anticipate such events, but have to flee at a moment's notice. Thus, they cannot properly prepare their migration. They do not have the time to plan the financing of the move and to collect information on potential destination countries. Therefore, most refugees

go to the nearest neighboring country. In these neighboring countries, their economic situation is often much worse than in their home countries. Thus, most of these migrants only stay abroad until the situation in their home country allows for their return.

Some refugees, especially victims of political persecution, also come to Europe or the US and ask for asylum there. As migration over a long distance leads to substantial costs, fugitives in great need generally do not have this option. Unlike in neighboring countries, the economic situation of refugees in Europe and the US is often better than their situation in the home countries. Thus, they have little incentive to migrate back. Cortes (2004) states that refugee migrants in the US have even longer time horizons in the country than other migrants. Immigration policy with respect to refugees or asylum seekers is generally far less restrictive than with respect to other immigrants. Hence, migrants have a strong incentive to apply for asylum, also in cases where their refugee status might be questionable. This makes it difficult to properly distinguish refugees from voluntary migration in empirical investigations. The existing literature on the migration patterns of refugees or asylum seekers is scarce. In econometric analyses, Hatton and Williamson (2006) and Hatton (2009) find that immigration policy with regard to refugees as well as violence in the home country are important determinants of refugee migration.

Voluntary migration is a wholly different phenomenon. Patterns and determinants of voluntary migration have gained much interest by economic research. Beginning with the seminal papers by Sjaastad (1962), Todaro (1969) and Harris and Todaro (1970), an extensive theoretical research has focused on migration incentives. Wage differentials between home and immigration country and differences in unemployment rates or employment probabilities have been identified as important determinants. Nevertheless, comparing the wages that immigrants earn in their home countries and in immigration countries is not trivial. The position of a person in the income distribution of the immigration country can strongly differ from her position in the home country, see Borjas (1987). High skilled immigrants often do not find jobs in their former occupations, but have to accept jobs in occupa-

tions far below their qualifications. A further complication is that potential immigrants in most cases may not be able to anticipate their wages in the immigration country, see McKenzie et al. (2007). It is then their expectations and not the actual wage in the immigration country which is decisive for the migration decision.

Wage differentials are not the only factor that influences the migration decision. In many cases, immigration legislation in potential immigration countries is even more important. It determines whether a migrant has the option to legally enter a certain country. Furthermore, if this is the case, the legislation influences the migration costs. This happens primarily through charges for application and necessary documents. If migrants cannot enter legally, they still may have the option to immigrate illegally. However, illegal immigrants have large disadvantages compared to legal immigrants. They often have to hide from public authorities. They may have to accept low wages, as employing them is also illegal. And they cannot participate in the social system of the country. Perhaps most importantly, they have no health insurance. Nevertheless, the economic situation of illegal immigrants in Europe and the US is often still much better than their situation in the home countries. Thus, many people who do not have the option to migrate legally do migrate illegally. Due to obvious data restrictions, it is very difficult to assess the numbers of illegal migrants or even analyze their migration patterns. Hanson (2006) discusses some approaches to measure illegal immigration to the US.

A further determinant is the distance between the home and the immigration country. Distance includes the geographical, but also the cultural distance between the countries. Cultural distance relates to the similarity of religions, moral concepts, customs, conventions and languages, see Geis et al. (2010). The existence of people from the same clan, town, region or home country also influences the migration decision and destination choice of migrants. These migrant networks form a community where a new migrant easily finds social contacts after arrival. In these networks, the cultural values from the home country are generally preserved, hence cultural distance carries less weight. In addition, migrant networks deliver information on des-

tination countries to potential migrants, so that migrants can better organize their migration. Furthermore, if family members are part of the network, migrants are possibly eligible for family reunification programs. In many cases, family reunification is the only legal way to migrate to a country. In other cases, it simplifies the admission. Munshi (2003) and Pedersen et al. (2008) provide in depth discussions of the economic relevance of migrant networks.

The living conditions in potential destination countries normally also have a strong effect on the migration decision. These conditions are to a great extent determined by the environment and the climate in the immigration countries. Most people prefer regions with many sunshine hours and a lovely landscape, see Graves (1980) for a discussion. The institutional setting in the country also affects the living conditions. In chapter 2, we analyze the effects of different institutions, especially labor market institutions, on migration decisions. An important finding is that employment protection has a strong positive effect on migration. Good health care and education systems as well as generous family aid also have a positive effect. Actually, the expected income in the immigration country as well as migrant networks are also part of the living conditions. Nevertheless, the concept of living conditions is not sufficient to explain the migration decisions, as it does not consider migration costs.

Factors that influence migration decisions and migration patterns are an interesting field of research on their own. In addition, knowledge about these factors can be helpful for evaluating immigration policy reforms. How many and what type of migrants will come after the reform is always a crucial question in such evaluations. Up to now, most policy evaluations base their predictions of potential immigration flows on historical experiences. A typical example for this are estimations of the migration potential after the EU Eastern enlargement in 2004. Most of these estimations are based on the migration flows from Southern European countries to the other EU countries after the permission of freedom of movement. The estimated potentials in these studies vary strongly. For the same time period and the same destination countries, they differ up to the factor 10, see Fertig and Schmidt (2001)

and Flaig (2001).[1]

1.2 Welfare effects of immigration and emigration

Considering the aggregate welfare of all people in the world, basic economic theory implies that migration leads to a welfare gain. Assuming perfect information, people who migrate definitely gain from migration. Otherwise, they would not migrate. The effects on other people in emigration and immigration countries are less clear. However, if they lose more than the migrants gain, they would be willing to pay the would-be migrants for not migrating. These payments would be pareto-efficient, as the non-migrants would have to pay the migrants less for non-migrating than they would gain from their non-migration. In the real world, however, such payments are not feasible. First, non-migrants do not know who the potential migrants are. Second, migrants cannot credibly commit themselves not to migrate. Thus, it is possible that migration leads to a loss in aggregate welfare. Normally, policy makers as well as the public in immigration and emigration countries are not interested in the effects of migration on the overall welfare in the world but in the effect on the welfare of the (native) population in their respective countries. Thus, economic research focuses either on the effect of immigration on native welfare or the welfare effect of emigration. In the following, I discuss welfare effects of migration on people who migrate, on people who stay in the emigration country and on natives in the immigration country.

As stated above, the decision of migrants to live in another country should generally imply that migration increases their welfare. However, there is a possible combination of conditions for which migrants go and stay abroad, although they suffer a welfare loss from this. Migrants generally cannot base their migration decision on real knowledge about the conditions in the immigration country, but have to form expectations about it, see McKenzie

[1] Zaiceva (2006) gives an overview over the studies.

et al. (2007). If these expectations are overly positive, it may happen that people migrate to a country where their welfare is lower than in their home country in the long run. Generally, after recognizing this, migrants consider correcting their "wrong" migration decision and migrate back. But if migration is costly, return migration need not be financially feasible or profitable any more. In this case, migrants are "trapped" in the immigration country. Nowadays, transportation costs are relatively low, so that this can hardly occur any more. Thus, the welfare effect of migration on the migrants should be unambiguously positive. Nevertheless, the economic migration literature has not yet quantitatively analyzed the effect of migration on the welfare of the migrants.

The effect of migration on the welfare of people who stay in the emigration country is less clear. It surely depends on the population group that emigrates. The typical emigration countries are less developed countries with a large share of low skilled people and only few highly qualified workers. Emigration of low skilled people is generally regarded as unproblematic. Due to the reduction in population, an outflow of immigrants normally reduces overall GDP in the emigration country. However, GDP per capita need not decrease. In most less developed countries, unemployment among low skilled people is extremely high, so that emigration of some low skilled people need not even lead to a reduction in production and overall welfare. In contrast to low skilled emigration, high skilled emigration is generally regarded as an economic blow to the country. In low developed countries, high skilled workers are often the limiting factor in production. Hence, their emigration can lead to strong reductions in GDP and GDP per capita. In addition, economic growth may also depend on the availability of high skilled workers, hence high skilled emigration can negatively affect the development of a country in the long run. Bhagwati and Hamada (1974) have coined the term "brain drain" for the emigration of high skilled people from less developed countries.

Nevertheless, there are conditions under which the emigration of high skilled workers from less developed countries can be welfare enhancing. A substantial theoretical literature has emerged that analyzes these conditions.

The main argument of this literature is the following: Wages abroad are higher than in the emigration country and being high skilled is a precondition for emigration. Thus, the option to emigrate generates an incentive for people to invest in their education and become high skilled. Under certain conditions, this option can generate more additional high skilled workers than will ultimately emigrate. In this case, the number of high skilled workers in the emigration country increases due to the option to emigrate. This can lead to an increase in the welfare per capita, see Vidal (1998) for a discussion. Following Stark et al. (1997) this phenomenon is sometimes called "brain gain". Beine et al. (2008) analyze the empirical relevance of this phenomenon. They find that in some emerging countries a "brain gain" may exist. However, in the least developed countries the negative effect of the "brain drain" is clearly pervasive.

Determining the welfare effects of emigration from developed countries is more complex. The effect of emigration on economic success and growth, in general, depends on the occupational fields of the emigrants and not only on the fact of being high or low skilled. For instance, the economic impact of attorneys and engineers is completely different. Thus, the welfare effect of emigration depends not only on the educational level, but also on the occupational fields of the emigrants. In the last resort, only empirical research can tell us about the characteristics of emigrants that determine the welfare gains or losses caused by their emigration. Due to data limitations, empirical analyses of the welfare effects of emigration are still relatively rare.

The effect of immigration on native welfare has been an important topic in economic research for years. In a seminal paper, Berry and Soligo (1969) have shown that immigration into a perfect labor market leads to a gain for the native population, provided that the characteristics of immigrants do not exactly match the ones of natives. However, labor market frictions that lead to unemployment (such as minimum wages, efficiency wages or search costs) can fundamentally change these results, see *e.g.* Brecher and Choudhri (1987). In particular, immigration of low skilled people can then lead to a welfare loss. If migration leads to changes in the international division of labor and in trade, this also affects the welfare effects of immigration, see

Felbermayr and Kohler (2007). These changes may result from the changes in labor endowment in immigration and emigration countries.

Apart from adjustments in trade and the international division of labor, immigration can lead to further adjustment processes. Immigration affects the educational structure of natives, as long as natives are able to anticipate future immigration. The effects of emigration on the educational decisions of people in the emigration country and the educational structure there has gained much interest in economic research. In contrast, the effects on the educational structure in the immigration country has hardly been investigated up to now. In chapter 3, I develop a theoretical model in order to analyze the effect of immigration on the educational structure of natives and to determine how this adjustment affects the effects of immigration on native welfare. In this model, the welfare effect of immigration into a perfect labor market is still positive. However, the adjustment of the native educational structure substantially lowers it. The adjustment of the native educational structure actually depends on the expectations of natives about future immigration, and not on the realized immigration. As shown in chapter 3, if expected immigration exceeds realized immigration, this leads to a welfare loss. Therefore, when analyzing the welfare effects of immigration, one has to consider expectation formation by the native population.

There may be further adjustment processes to an inflow of immigrants. Natives possibly do not move to, or even move away from cities with high shares of immigrants, see Peri (2007). Immigration can also affect the consumption patterns of natives, as natives get acquainted with typical products from the home countries of immigrants. An assessment of the importance of these adjustment processes is first and foremost an empirical question. Nevertheless, profound theoretical knowledge of these processes is necessary to correctly design empirical investigations. Educational adjustment is a good example for this. If educational adjustment is left unconsidered, the decrease or smaller increase in the number of high skilled natives is ascribed to external factors and the long run increase in the number of high skilled workers due to high skilled immigration is overestimated. In most cases, this leads to an overestimation of the welfare gains from high skilled immigration.

There are myriads of empirical papers on the welfare effects of immigration. Most of them focus on the question how immigration affects wages and employment probabilities of native workers, see Longhi et al. (2005a) and Longhi et al. (2006). Papers on the effect of immigration on other groups of natives, such as capital owners and pensioners, are scarce. Unfortunately, these papers, and especially the newer and more elaborate ones, do not find mutually consistent results. One can basically distinguish between two results or views, each of which is found in numerous studies using manifold estimation approaches and propagated by an outstanding migration researcher. The view of David Card is that immigration has either a small positive effect on the wages of native workers or no effect at all. George Borjas argues that immigration has a substantial negative effect on the wages of native workers. The two sides vehemently criticize the works of each other, see *e.g.* Card (2009) and Borjas et al. (2008). Nevertheless, there is no apparent difference in the quality of the papers of the two sides. The issue seems impossible to resolve through conventional empirical research alone.

1.3 Economics of integration

In advanced economies, the economic situation of immigrants is often much worse than the situation of natives. As shown in Geis et al. (2010), in the three large European economies France, Germany and the UK, immigrant unemployment was about twice as high as native unemployment in 2005. In the US, the difference in the unemployment rates is smaller, but there are substantial differences in the wage level between immigrants and natives. These differences can to some extent be explained by differences in the qualification structure. On average, immigrants have much lower formal degrees than natives. In addition, many immigrants have problems with the language of the immigration country, so that they cannot optimally use their skills. The full use of qualifications that immigrants have acquired in the home country can be connected with further problems. For instance, the formal recognition of foreign degrees is often a long process.

Nevertheless, differences in qualifications in the broadest sense are not

the only possible explanation for the worse labor market situation of immigrants. It can also result from discrimination. On the one hand, this can be classical discrimination: employers are not willing to employ immigrants, employees are not willing to work together with immigrants, and consumers are not willing to buy goods from immigrants (see Becker, 1971). On the other hand, in hiring decisions natives may also be preferred to immigrants, because employers cannot assess the (foreign) certificates of immigrants. Employers may simply decide against immigrant applicants because of the low average educational level of immigrants (statistical discrimination). There are numerous empirical papers that analyze in how far the worse labor market situation of immigrants can be explained by differences in labor market relevant characteristics, and in how far it must be ascribed to discrimination. Most of them focus on wages and find that discrimination plays a role (see Nielsen et al., 2004).

In chapter 4, I analyze the differences in the unemployment rates between immigrants and natives in Germany. I find that human capital measures, such as formal qualifications and language skills, cannot fully explain the difference between immigrant and native unemployment. However, controlling for social networks, this difference vanishes. Immigrant unemployment is not only higher than native unemployment, but also reacts more to cyclical fluctuations (see Dustmann et al., 2010). I find that this stronger sensitivity of immigrant unemployment can be fully explained by lower qualifications of immigrants. A further interesting result of chapter 4 is that the labor market performance differs over immigration groups. This is in line with the literature. Large immigrant groups from relatively less developed countries, as people from Turkey in Germany, people from the Maghrebian countries in France and people from Mexico in the US, generally have huge problems on the labor market. Immigrants from highly developed countries, in turn, often outperform natives. Thus, one should differentiate between immigrant groups when analyzing differences between immigrants and natives.

The integration of immigrants into the labor market and the society of an immigration country is not finished shortly after their arrival but a long-lasting process. During this integration process, immigrants improve their

fluency in the language of the immigration country, unless it is their native language. They collect knowledge on legal rules, conventions and customs. Furthermore, they socialize with natives and build a social network. The accumulation of human capital specific to the immigration country generally improves the situation of immigrants on the labor market. This improvement, in turn, also affects natives' welfare. Immigrants with more human capital pay higher taxes.

Beginning with the seminal work of Chiswick (1978), a branch of the empirical migration literature analyzes the process of the integration of immigrants into the labor market. These papers generally find that with the time spent in the immigration country the wages of immigrants increase and their employment probabilities decrease. A remarkable exception is Schmidt (1997), who does not find such a deterministic time trend for immigrants in Germany. My own results in chapter 4 confirm his finding. An interesting extension of the empirical integration research is the family investment hypothesis presented by Baker and Benjamin (1997). They find that, in the first years after the immigration of couples, the wife is the main income earner. During this time the husband accumulates immigration country specific human capital. Afterwards, the husband again assumes the role of the main income earner. Nevertheless, Blau et al. (2003) convincingly refute this finding.

Policy makers can influence the integration of immigrants into labor market and society of an immigration country. For instance, integration policy measures can help immigrants to improve their language skills more rapidly. Integration policy can follow two different approaches. First, it can reduce the costs of integration for immigrants by offering them specific integration measures, *e.g.* language courses. Second, it can increase their gains from integration by setting specific incentives. In chapter 5, I discuss how naturalization legislation can be used to improve the skill structure of immigrants and thus also their integration. Most developed countries require the certification of skills, primarily language tests, for naturalization. Immigrants who do not fulfill these requirements anyway have an incentive to increase their skill level, if naturalization improves their situation (right to vote, pass-

port, etc.). In turn, the skill structure of immigrants affects native welfare: Higher skilled immigrants earn higher wages, pay more taxes and are less likely to receive social assistance. In chapter 5, I develop a model that allows to determine an optimal requirement level for naturalization, *i.e.* a level that maximizes native welfare. This level induces some educational effort on the part of the immigrants that would otherwise not have occurred.

Naturalization requirements are not the only policy measure with which an immigration country can affect the skill structure of its immigrants. Immigration countries could, for instance, also offer rewards for immigrants who learn the language rapidly. Potential policy measures to improve the skill level of immigrants have not yet been in the focus of social science and economic research. Thus, we do not yet have a clear view of the (integration) policy measures that suitably affect the skill structure of immigrants. Political leaders in countries with large, low skilled immigrant populations, as France, Germany and the UK, often (rightly) complain of problems with the integration of immigrants. Thus, research on integration policy measures is not only of academic but also of high political relevance. Due to the demographical change, Western countries will probably be forced to allow for substantial inflows of new immigrants in the future. Thus, a rapid integration of immigrants will become ever more important in the future.

2 How do Migrants Choose Their Destination Country?

2.1 Introduction

Why do people migrate to other countries, and how do they choose their destination country? From an economic perspective, the answer to these questions is simple. People migrate because their expected utility from living abroad (corrected for the disutility from moving) is higher than the expected utility from living in their home country. They choose the destination country where their expected utility is highest. If the determinants of expected utilities from living in different countries were known, migration policies could be tailored to the needs of each country that wants to attract (specific groups of) migrants. However, expected utilities cannot be measured and, in spite of many years of intensive research, knowledge about their determinants is far from complete.

Our aim in this paper is to shed more light on factors that may affect

This chapter is based on joint work with Silke Überlmesser and Martin Werding. The idea for the paper was developed in a joint discussion process. Data preparation and estimations were exclusively done by me. The final text was written in a process of proposals and revisions by all three authors.

the migration decision and in particular the choice between different destination countries. Our analysis is based on a multinomial-choice framework where this choice is explained by various socio-economic and institutional characteristics of potential immigration countries. We effectively focus on the most important groups of potential explanations which can be meaningfully captured in our empirical framework: expected net income in different destination countries, social networks, labor-market institutions and publicly provided goods, such as health and education systems.

Over the last few years, a series of papers has emerged that analyze the determinants of migrants' location choices (*e.g.*, Pedersen et al., 2008; Mayda, 2007; Docquier and Marfouk, 2008). All these papers are based on international macro-data panels.[1] They find that, besides unemployment rates and GDP per capita (taken to measure expected income), distance plays an important role for migration decisions. In addition, a common language and colonial ties appear to have a positive effect on the choice of a particular destination country. In this literature, institutional features of destination countries are captured in a rough fashion only, *e.g.*, by broad types of "welfare-state regimes" (see Pedersen et al., 2008; Mayda, 2007), and labor-market institutions are entirely neglected. Also, the use of aggregate data carries a number of problems, as the determinants of migration can mostly be measured only in terms of averages over the total population or all immigrants, while possibilities to differentiate between different groups of migrants are generally limited.[2] If the determinants or their relative importance differ across groups, macro-level analyses need not lead to clear-cut results. Therefore, we want to follow another route and base our analysis on micro-data.

Unfortunately, there is no large international micro-data base which could be used for our purposes.[3] We therefore construct our own data set, merging

[1]See Lundborg (1991) for an earlier study based on cross-section data.

[2]Docquier and Marfouk (2008) differentiate between high-skilled and low-skilled migrants, whereas the other researchers look at total migration between two countries.

[3]The European Labour Force Survey would be such a data base but, in its publicly

micro-data from four of the most important immigration countries, namely France, Germany, the UK and the US.[4] We combine these micro-data with data representing a number of institutions that potentially affect location decisions. Given the nature of our data, we are effectively estimating the effects of these institutions on migrants' decisions for a certain destination country conditional on two points: First, that they are willing to migrate at all; and second, that they end up living in one of these four destination countries.[5]

From a technical point of view, Constant and D'Agosto (2008) is the paper which is probably closest to ours. Based on a data set covering Italian scientists living abroad, they analyze the determinants of their choice of a destination country. In contrast to our approach, however, they only use individual characteristics as explanatory variables and no general features of the destination countries. There is a number of papers using similar approaches to determine the regional distribution of immigrants within their destination countries (*e.g.*, Aslund, 2005; Bartel, 1989; Jaeger, 2000; Bauer et al., 2005, 2007). Since political and economic institutions do not vary much across regions of one country, while they may differ substantially across countries, this literature is of limited relevance for us.

To date, the impact of institutions on migration decisions has hardly been studied in a systematic way.[6] Thus, our results offer interesting and potentially important new insights regarding the determinants of migration. Our more conventional findings are that wages and migrant networks have a pos-

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accessible form, it contains no information on the origin of migrants.

[4]Defoort (2006) states that, together with Canada and Australia, these countries attract 77% of all migrants to the OECD world.

[5]For an analysis of the unconditional migration decision, one would also have to observe populations and institutions in the source countries, and one should probably be able to add more destination countries.

[6]Borjas (1999b) investigated the role of welfare benefits for migration within the US, which led to his "welfare-magnet" hypothesis. More recently, Docquier and Marfouk (2008) found a positive effect of social expenditure and health expenditure on international migration. We are not aware of any studies investigating labor-market institutions as potential determinants of migrants' location choices.

itive effect on the probability to migrate to a particular country, while the unemployment rate has a negative effect. The income tax wedge negatively affects migration, and the same applies to generous pension benefits, while good education systems and good health-care systems appear to have positive effects. In addition, we find that among the labor-market institutions we are considering, union coverage and unemployment benefits have negative effects on the migration decision, while employment protection appears to have mixed effects. In any case, the impact of labor-market institutions becomes less negative, or even positive when considering migrants' decisions to stay in their destination country compared to their decision to migrate. This points to "insider-outsider problems" related to these institutions. All these results are derived from a multitude of estimates with differing specifications, and they are rather robust against a number of changes related to the basic specifications.

The paper is organized as follows. In the next section, we explain how our data set is constructed. Section 2.3 discusses potential determinants of migration decisions and, in particular, the role of institutions for these decisions. In section 2.4, we set out our estimation strategy. Estimation results derived from our full sample and some sub-samples are presented in section 2.5. Section 2.6 concludes.

2.2 Our data set

To construct our data set, we proceed in two steps. First, we merge micro-data from four immigration countries, namely France, Germany, the UK and the US. Second, we complement these micro-data with information regarding economic and institutional features of the immigration countries which potentially have an impact on migrants' location choices.

Our micro-data are combined from large official surveys of the British, French, German and US population. The source of our French data is the *Enquête Emploi en Continu 2005*, a representative survey of about 0.5% of the French population. The data for Germany are taken from the *Mikrozensus 2005*, a representative 1% survey of the German population (0.7% in the

Scientific Use File we are using). The British data are from the *Labour Force Survey* for the first quarter of 2005, a survey of about 0.2% of the population in the UK. For the US, we use the *American Community Survey 2005*, a representative 1% survey of the US population. In order to analyze the motives of individuals to migrate, flow data would actually be preferable to stock data. However, existing flow data generally contain much less information and are less precise than stock data. Therefore, we rely on data of the latter type, implying that we actually analyze decisions to migrate to another country *and stay there* until the sampling period.

An important preliminary step is to find a proper definition of migrants. Immigrants could be defined as persons holding one or more foreign nationalities. Yet, this approach is problematic as naturalization policies of the four countries differ substantially. For instance, German policies are much more restrictive in this respect than American ones. Looking at individuals with foreign nationalities could thus lead to biased results. Defining immigrants by their country of birth circumvents this problems. However, since foreign-born individuals whose parents are both natives are then classified as immigrants, this definition can also lead to problems (*e.g.*, if a considerable share of the foreign-born population are children of armed forces positioned abroad). Therefore, we define immigrants as foreign-born individuals, but re-classify persons with two native parents as natives.[7] The effect of this re-classification on the overall number of immigrants is small, but their composition changes notably (see Geis et al., 2010, for more details).

In the case of Germany, we have to deal with two specific issues. First, in the German data the country of birth of immigrants is not recorded. We therefore use the nationality, respectively the nationality before naturalization, as a proxy for the country of birth. The second issue is related to the "(*Spät-*)*Aussiedler*" legislation. According to this legislation, persons with German ancestors (who sometimes emigrated centuries ago, mainly to countries in Eastern Europe) can acquire the German nationality immediately upon arrival in Germany. After the fall of the "Iron Curtain", a large num-

[7]For the UK, respectively, we re-classify persons who state to be "ethnically British".

Table 2.1: Individual Characteristics

Variable	Statistic	France	Germany	UK	US	Total
Age	mean	38.6	42.0	37.1	39.9	40.0
	(variance)	(10.6)	(13.2)	(10.5)	(12.1)	(12.2)
Level of education	median ISCED-Level	2	3+4	3+4	3+4	3+4
Sex	share of males	45.6	52.0	47.6	50.8	49.8
Born in the EU	share (%)	17.2	19.3	19.1	3.8	6.7
in Eastern Europe	share(%)	5.9	31.2	4.9	5.3	8.8
in Western Asia	share (%)	10.1	13.9	4.5	3.7	5.3
in Eastern Asia	share (%)	8.2	7.5	40.9	30.5	26.7
in Africa	share (%)	54.5	3.1	23.6	4.2	6.6
in Latin America	share (%)	3.9	1.8	5.9	52.4	42.6
Number of observations (in millions)		1.3	4.3	1.8	16.6	23.9
Unweighted number of observations		6,890	21,073	3,240	127,186	158,389

Note: Here, only immigrants who arrived 1985 or later are considered.

ber of "*Spät-Aussiedler*" came to Germany (Koller, 1997). Yet, in spite of their quantitative importance, official statistics in Germany hardly collect any data on this group. In our data set, we are able to identify them as immigrants,[8] but we cannot assign them a country of birth.

In our econometric analysis, we include individual information regarding sex, age, the educational level and the source country. Table 2.1 summarizes some descriptive statistics regarding the sample derived from the four data sets that is used in our regressions.[9]

For the home countries of immigrants, we apply the following classification: EU countries, non-EU Europe (including Russia and Turkey), West Asia (from Lebanon to Iran), East Asia and Oceania, Africa, Latin America,

[8]Alternative explanations for why Germans with German parents should have "migrated" to Germany are highly unlikely. For instance, since World War II Germany had hardly any armed forces positioned abroad. Also, all persons with German nationality who came to Germany before 1949, mostly as refugees from former parts of the country, are automatically defined as natives.

[9]An in-depth analysis of the characteristics of immigrants in France, Germany, the UK and the US based on the same data set can be found in Geis et al. (2010).

Canada[10] and "unclassified."[11] Unfortunately, a more detailed differentiation is not possible, due to existing classifications in the German and French data sources. Moreover, immigrants from one of our four destination countries are excluded from the econometric analysis. The reason is that the choice between staying at home and migrating to another country is obviously different from choosing a certain destination country given that one has decided to migrate.

While information about age and sex is well-standardized across all four data sets, standardization is not trivial for the level of education. Here, we classify educational attainments of our observations based on the International Standard Classification of Education (ISCED) of 1997. For the German data, we use the algorithm proposed by Schroedter and Lüttinger (2006) and for the American data the mapping between years of schooling and ISCED levels given in Institute for Education Sciences (2007). The French data already contain education levels in the ISCED classification. For the British data, our re-classification follows the LFS User Guide (see Office for National Statistics, 2007), with two deviations.[12] Also, we do not use all ISCED levels, but form four categories: no secondary educational attainment (ISCED 0-1), lower-secondary educational attainments (ISCED 2), upper-secondary and post-secondary, non-tertiary educational attainments (ISCED 3-4) and tertiary educational attainments (ISCED 5-6). Differentiations between ISCED 3 and 4 or between ISCED 5 and 6 are hardly comparable across countries.

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[10] In the case of Germany, Canadians are excluded, as we cannot distinguish them from US Americans.

[11] By far the largest part of them being German "*Spät-Aussiedler*".

[12] First, we classify people who state to have been in school, but have not acquired any formal degree as ISCED 1, not ISCED 2. Second, we do not classify people who state to have "other qualifications" as ISCED 3, but assign them the median ISCED level of people with the same age and the same (last) occupation. For this, we use the SOC (Standard Occupational Classification) 2000 unit-level classification which distinguishes between 353 different occupations (see Office for National Statistics, 2000). An assignment of educational levels is necessary, as most foreign degrees are recorded as "other qualification" in the British LFS.

We restrict our analysis to people who have migrated after 1985, since the economic and institutional variables we are interested in are not (completely) available for earlier years. Furthermore, we do not consider migrants aged younger than 25 at the time of the survey in our econometric analysis. For younger individuals, we cannot properly determine their formal qualifications, as many of them have not reached their final educational attainments. Given all these corrections, our data base should be representative for those groups of migrants we are effectively looking at (using the relevant weights from the original data sources).

In terms of economic and institutional determinants of migration decisions, we consider the following aspects to be important: wages, unemployment rates, and taxes (*i.e.*, expected net wages), immigrant networks, labour-market institutions (specifically, employment protection, union coverage, and unemployment benefits), the generosity of public pension schemes and the quality of education and health systems. In our empirical estimates, we include these data for the year of immigration as well as for the year 2005.[13] Where appropriate (and possible) we calculate information regarding these determinants for the year 2005 from our micro-data, as this allows us to reflect their variation by gender, education levels, income groups, country-of-origin groups, *etc.* For the year of immigration, we mainly use country-wide averages taken from longer time series. Table 2.2 gives an overview over definitions and sources of these variables. The following section is meant to discuss the potential role of these determinants in more detail.

2.3 Determinants of migration

From a theoretical point of view, migrants should choose the destination country which offers them the highest expected utility. Thus, factors that determine expected utility should also determine whether an individual de-

[13]This is part of our empirical strategy meant to deal with possible selectivity of our data through return migration (see Section 2.4). An exception is the size of immigrant networks; using 2005 data for this variable would obviously raise an endogeneity issue.

Table 2.2: Socio-economic and Institutional Variables

Name	Time	Definition	Source	Min.	Max.
Wage	2005	Immigrant wages in US-$ (PPP) as derived in Geis et al. (2010)	Our micro-data base, own calculations	10.66	39.47
	immig. year	Wages in manufacturing relative to base year 2005 times average wages in 2005	OECD Main Economic Indicators database, own calculations	15.79	29.46
Unemployment rate	2005	Unemployment rates for immigrants (ILO definition) differentiated by gender and skills	Our micro-data base, own calculations	3.55	28.69
	immig. year	Total unemployment rate of individuals aged 25 to 54	OECD Main economic indicators database	3.99	12.91
Network	immig. year	Share of persons with the same country of birth in total population of the immigration country (if $> 0.2\%$)	OECD International Migration Statistics database, own calculations	0.00	4.45
Employment protection	2005	Employment protection legislation indicator; range 0 (not restrictive) – 6 (extremely restrictive)	OECD Employment Outlook 2004	0.2	3.1
	immig. year	Employment protection legislation indicator; range 0 (not restrictive) – 6 (extremely restrictive)	OECD Employment Outlook 2004	0.2	3.2
Union Coverage	2005	Share of workers covered by collective wage agreements	OECD Employment Outlook 2004	14	93
	immig. year	Share of workers covered by collective wage agreements	OECD Employment Outlook 2004	14	95
Unemployment benefits	2005	Benefit replacement rate in the first five years of unemployment	OECD Benefits and Wages 2007	13.8	39.4
	immig. year	Benefit replacement rate in the first five years of unemployment	OECD Benefits and Wages 2007	11.1	43.5

Name	Time	Definition	Source	Min.	Max.
Tax wedge	2005	Income tax plus employees' social security contributions divided by households' current receipts.	Nickell (2006)	14	39.4
	immig. year	Income tax plus employees' social security contributions divided by households' current receipts.	Nickell (2006)	11.5	39.4
Pension benefits	2005	Gross pension replacement rates	Fenge and Werding (2004)	30.6	67.4
	immig. year	Gross pension replacement rates	Fenge and Werding (2004)	16.6	71.7
Infant mortality	2005	Deaths under 1 year per 1000 children born	OECD Health at a Glance 2007	3.6	6.8
	immig. year	Deaths under 1 year per 1000 children born	OECD Health at a Glance 2007	3.6	10.6
Education scores	2005	PISA-Scores in Sciences	OECD PISA 2006	489	516
	immig. year	Trend in scores from education tests	Hanushek and Woessmann (2009)	485	530
Family expenditure	2005	Share of public family expenditure in GDP	OECD Social Expenditure database	0.62	3.20
	immig. year	Share of public family expenditure in GDP	OECD Social Expenditure database	0.47	3.20

cides to migrate and which destination country the migrant chooses. In this section, we discuss factors specific to the different destination countries that are likely to affect expected utilities of migrants and derive hypotheses regarding their effects.

Probably the most important determinant of the expected utility of an individual living in a certain country is the income expected there. In the economic literature, income differentials have always been considered as the main driving force behind migration (see, *e.g.* Sjaastad, 1962; Todaro, 1969). The major source of variation in income across countries is wage income, while capital income need not be affected at all by a change in the country of residence when abstracting from relevant differences in taxation. Expected wages of individuals in different countries depend on two components, *viz.* the wage that an individual would earn in each country and the probability to find employment there. Both components typically depend on the qualifications of an individual, with high-skilled people earning higher wages and being less likely to become unemployed than low skilled people. For the estimations, it would be optimal if expected wages could be observed directly for each individual. But this is obviously impossible. We therefore proceed as follows: For 2005, we use our micro-data to calculate hourly gross wages and unemployment rates for immigrants, differentiated by gender and level of education (for a detailed description of the procedures applied, see Geis et al., 2010). For the years of immigration, unemployment rates are only available at the aggregate level. Similarly, macro-level data for these years allow us to calculate average hourly gross wages only (*i.e.*, labor compensation per employee divided by average working hours) without any further differentiation. Even though they are not a very precise measure for individual wage income, average wages should still be more informative than GDP per capita, which is used in most similar studies.[14]

Benefits meant to replace wages, especially in the case of unemployment, are another important component of expected income. Accounting, in much detail, for unemployment benefits that potential immigrants would get in

[14]See, *e.g.*, Pedersen et al. (2008); Mayda (2007); Docquier and Marfouk (2008)

the case of unemployment is difficult. In most cases, benefit entitlements are contingent on earlier wages and on the duration a person has been employed in the country. Often, benefits decrease over time, with the time pattern of the decrease again depending on the duration a person has been employed. For our set-up, the most convincing measure for unemployment benefits that is available is the average replacement rate for the first five years of unemployment as provided by the OECD (2004).

Old-age pensions also have a strong impact on expected income. The effect on migration is, however, not clear. Generous pension schemes may attract, but also deter, migrants depending on the "implicit" (*i.e.*, net) taxes they imply. Also, potential migrants could fear the political risk that generous systems might be scaled back or even discontinued in the context of ageing societies. Furthermore, redistributive features of national pension systems may affect migrants with different skills in different ways (see Werding and Munz, 2005). We therefore include pension replacement rates (as calculated in Fenge and Werding, 2004) in our estimations to see whether, and how, pensions affect migration choices.

Quite generally, the various types of earnings replacement schemes do not necessarily increase the expected income of immigrants, since they are financed by (implicit or explicit) taxes or compulsory contributions. Taken in isolation, the tax system reduces expected income of migrants. To control for this impact, we take the ratio of income taxes and social security contributions over income as a measure for the tax wedge (Nickell, 2006), effectively covering a large part of the tax burden falling on immigrants, but neglecting sales or value-added taxes.

Health systems, education systems and the like may also affect migration decisions. These systems can affect expected income, and they can also have direct effects on expected utility. Having access to good physicians in cases of illness, *e.g.*, generally increases the quality of life irrespective of the costs involved. Measuring the quality of health care or education systems is difficult. Expenditures are often used as a measure, but can be distorted through inefficiencies. Therefore, we use infant mortality in our regressions as a measure of health outcomes and test scores, such as those derived from the

PISA study, as a measure of the quality of education. As a historical measure of the quality of education, we use the interpolation of test scores proposed by Hanushek and Woessmann (2009). In addition, availability of child care and public family allowances could also affect the choices of migrants. We therefore use public family expenditure as a further control.

Like unemployment benefits and pensions, systems providing health care, education, *etc.* also have to be financed. Thus, they can have a negative net effect for migrants. For education and family benefits this is obvious. Immigrants who have no children and do not intend to have children in the future have no (direct) benefit from these systems, but they have to pay for them through their taxes. If we were able to perfectly control for individual tax burdens, this negative effect should vanish, *i.e.*, it should be fully absorbed by the tax measure. However, our control is imperfect in this regard,[15] so that the negative impact may show up on the benefit side.

Not all instruments of public policies that may affect migrants' choices require taxes. Labor market institutions, such as employment protection or powerful unions, are also likely to affect the attractiveness of living in a certain country, either directly or indirectly via their effects on wages and employment prospects of immigrants. However, the direction of these effects is not clear. On the one hand, employment protection and union power normally lead to more stable jobs and could thus be attractive for immigrants. On the other hand, these labor market institution may also hinder immigrants to enter the labor market. In fact, they are often said to give rise to "insider–outsider" problems in labor markets (see Lindbeck and Snower, 1986). Since potential immigrants are outsiders in this respect almost by definition, these institutions could negatively affect their choices. We therefore include measures of employment protection legislation and union coverage (from OECD, 2004) in our estimation without having a clear expectation

[15]Most importantly, our tax measure bundles wage taxes and social security contributions. With the exception of pension systems, we are unable to control for benefit entitlements (that may vary by age, sex, the number of children, *etc.*) which are effectively linked to current contributions. Also, inefficiencies involved in the various components of public expenditure may not be fully reflected in the variation of tax rates.

regarding their effects.

Expected utilities of individuals living in different countries are not only affected by economic factors but also by social ties. In particular, entering a network of earlier immigrants from the same country or region can be important for individuals (see, *e.g.*, Munshi, 2003). The impact of migrant networks on migration decisions has an economic interpretation, as networks may reduce uncertainties and migration costs in many ways. Up to a point, they even reflect features of national immigration policies, as the latter contain family re-unification programs in most countries. Therefore, we use the share of persons from the same source country in the population of the destination country as a measure of the strength of the migrant network. Due to data limitations, we can actually do so only for immigrant groups representing at least 0.2% of the population. This need not be a problem, however, as smaller groups are probably lacking the critical mass to deliver the benefits of a network. Since the effects of networks on migration decisions may not be linear – additional persons are probably more important in smaller networks than in larger ones – we also include the square of this measure.

Immigration policies are extremely complex and case-specific in all four destination countries, so that it is very difficult to measure their impact directly.[16] In fact, we did not find a reliable proxy for them which could be used in our empirical work.[17] Other factors, such as climate, geographical aspects, but also xenophobia among the native population, may also play a role for migrants' location choices. Nevertheless, we think that we have included the most relevant factors in our empirical work given our focus.

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[16]The new MIPEX index, *e.g.*, does not cover the United States and only provides information about the policies effective in 2005, not for earlier years.

[17]In addition to estimates based on our full sample, we will also present results for the sub-sample of skilled migrants. As restrictions to migration are typically less important for this group than for low-skilled migrants, one can consider this as a robustness check showing, among other things, how crucial it is to directly control for immigration policies.

2.4 Estimation strategy

For the estimation, we use a combination of a Conditional and a Multinomial Logit Model (CMNL).[18] The basic idea of the model is that among a range J of options – in our case, among destination countries – individuals choose the one that offers them the highest utility, V_{ij}; here, i denotes the individual and j the option. Utility, in turn, depends on option-dependent explanatory variables, X_{ij}, and on option-invariant ones, Z_i. Assuming a linear relationship and adding an error term, utility levels are represented by the following equation:

$$V_{ij} = X'_{ij}\beta + Z'_i\gamma_j + \epsilon_{ij} \tag{2.1}$$

The observed variable y_{ij} indicates which option an individual has chosen. Thus, for $k \in J$, $y_{ik} = 1$ and $y_{i\neg k} = 0$ if $V_{ik} = max_j(V_{ij})$. Furthermore, it is assumed that the error terms, ϵ_{ij}, are independent and log-Weibull-distributed. The density of this function is $e^{(-\epsilon_{ij} - e^{-\epsilon_{ij}})}$. It can be shown that the probability function has the following form (see Amemiya (1981)):

$$p_{ij} = Prob(y_{ij} = 1|X, Z) = \frac{e^{X'_{ij}\beta + Z'_i\gamma_j}}{\sum_{l=1}^{J} e^{X'_{il}\beta + Z'_i\gamma_l}} \tag{2.2}$$

For the estimation, this CMNL has to be transformed into a pure Conditional Logit Model. Following Cameron and Trivedi (2005), we use the following probability function for the estimation:

$$p_{ij} = Prob(y_{ij} = 1|X, Z^*) = \frac{e^{X'_{ij}\beta + Z^{*'}_{ij}\gamma^*}}{\sum_{l=1}^{J} e^{X'_{il}\beta + Z^{*'}_{il}\gamma^*}} \tag{2.3}$$

where Z^* is the Kronecker product of Z and a $J \times J$ identity matrix I, $Z^* = Z \otimes I$, and $\gamma^* = [\mathbf{0}', \gamma'_2, \ldots, \gamma'_J]$; $\gamma_1 = \mathbf{0}$ is a normalization. The model is estimated by maximum likelihood. The resulting first-order condition is

[18] Although this combination is well-known in the econometric literature, it has no particular name. It is sometimes called Mixed or Multinomial Logit Model, but these labels also refer to other models.

given by:

$$\sum_{i=1}^{N}\sum_{j=1}^{M} y_{ij}(\mathbf{x}_{ij} - \bar{\mathbf{x}}_i) = 0 \tag{2.4}$$

with $\bar{\mathbf{x}}_i = \sum_{l=1}^{m} p_{il}\mathbf{x}_{il}$. The marginal effects of changes in the option-dependent explanatory variables can be calculated as follows (cf. Cameron and Trivedi, 2005):

$$\frac{\partial p_{ij}}{\partial \mathbf{x}_{ik}} = p_{ij}(\delta_{ijk} - p_{ik})\beta \tag{2.5}$$

The equation gives the effect of a change in the independent variable for option k on the probability that option j is chosen; δ_{ijk} is equal to 1 if $j = k$ and 0 otherwise. For a given coefficient β that we estimate, there are thus 16 marginal effects, four for each destination country. For lack of space, we will display only the four marginal effects for $j = k$ in the tables summarizing our estimation results. For instance, we display the marginal effect of an increase in wages in the US on the probability to migrate to the US, not on the probability to migrate to one of the other countries.[19]

Our empirical set-up involves two potential problems that we have to deal with through our estimation strategy. The first problem arises from potential selectivity of our data set through re-migration. The second one is due to the small number of destination countries from which we have taken our micro-data.

As we are using cross-section data, we observe migrants only at one point in time. Our observations are thus actually the outcome of two decisions, namely the decision to migrate to a certain destination country and the decision not to leave this country again, at least not before the observation period. Incentives to immigrate may differ between migrants who are going to stay in a country for a long time and immigrants who stay only temporarily. With our approach, we effectively focus on long-term immigrants who are generally also more interesting for policy makers. Still, for this group the incentives to immigrate and the incentives to stay on may differ. To deal

[19]We could also calculate a single marginal effect using some sort of representative country (with average characteristics).

with this, we include in our regressions variables for the socio-economic and institutional determinants of migration for the year of immigration *and* for the year 2005. Historical values for the year of immigration are meant to capture determinants of the migration choice, whereas the 2005-values control for the reasons to stay in the country.

Another challenge for our estimations is the low variation in our institutional variables, many of them being truly country-specific. Considering all of them in a single regression is not possible, as this would lead to multi-collinearity. On the other hand, more detailed information is not available, and adding more destination countries to our data set is all but easy. Therefore, we choose to expand the number of estimations using a multitude of combinations of the variables representing the various institutions captured by our data.

The following individual-specific variables are included in *all* our regressions: gender, age (and age squared), level of education and region of the country of birth. Furthermore, all regressions contain information on wages, unemployment rates and the (squared) size of migrant networks, as these are variables which are conventionally found to have a strong impact on migrants' location decisions. In a first step, institutional variables that mainly vary by countries are then included one by one in the regressions. As there could also be interactions between these institutions, we repeat the estimations with all possible pairs and triplets of institutions (while including four or more institutional variables in a single estimation would lead to multi-collinearity problems). Similar approaches have been proposed in other areas, for instance, by Sala-i Martin (1997) for an analysis of economic growth or by Hegre and Sambanis (2006) to explain civil wars.

When aggregating the estimation results from the single regressions, we look at the medians of our estimators and the medians of the marginal effects. Average figures as an alternative way of representing our results are affected by outliers. To interpret our results, measures for the dispersion and significance of the estimates would be helpful. However, the literature

does not offer us appropriate, canonical measures.[20] To get an idea of the variation of estimates, we construct an aggregate standard error, adding the square of the average standard error from the regressions and the variance of estimators across regressions and extracting the root.[21] As a rough indicator for the significance of our results, we also determine for each variable the share of regressions in which the estimated coefficient is significantly positive or negative at the 1%-level. If 90% or more of our estimates yield coefficients that are highly significant and have a uniform sign, we take the result to be solid; if the same applies to at least 75% of our estimates, we take the result to be worth being discussed.

2.5 Estimation results

Table 2.3 displays the median results derived from the full sample and the full set of our estimations, *i.e.*, all permutations in which we control for one, two or three institutional variables in addition to wages, unemployment rates and networks (squared). Due to space limitations, estimates for individual-level characteristics are not reported. Results for the variables included in all specifications are much in line with expectations. For instance, we find the expected positive effect for wages and the expected negative effect for unemployment rates. Except for wages per hour at immigration, this holds on a 1%-level of significance in all 93 regressions. The smaller share of significant regressions for historical wages could be due to the lower precision of this

[20]The extreme-bound criterion proposed by Leamer (1985), adding two standard deviations to the estimates located at the extreme ends of the distribution of all estimators, is too restrictive for our purpose. Our series of estimations are mechanically created and, hence, may contain outliers through mis-specifications that are severely punished by this criterion. Our results would look strong in terms of the criterion proposed by Sala-i Martin (1997). However, this criterion appears to be inappropriate in our eyes, as it concentrates on the significance of single estimates, but attaches no weight to the variation of coefficients over specifications, which is quite large in our case.

[21]This should be a feasible approach as $E(x - x' + x' - x'')^2 = E(x - x')^2 + E(x' - x'')^2 + 2E[(x - x')(x' - x'')]$ and $E[(x - x')(x' - x'')] = 0$. Here, $E(x - x')^2$ is the squared average standard error of the regressions and $E(x' - x'')^2$ is the variance of estimators across specifications.

Table 2.3: Baseline estimates

Variable	Number of regressions	Median estimate	Aggr. standard error	Median marginal effects				Share of significant regressions (1%-level)	
				France	Germany	UK	US	positive	negative
Wage per hour at immigration	93	0.026	0.034	0.089	0.170	0.137	0.256	71%	27%
... in 2005	93	0.017	0.004	0.058	0.111	0.090	0.168	100%	0%
Unemployment rate at immigration	93	-0.083	0.023	-0.280	-0.535	-0.430	-0.808	0%	100%
... in 2005	93	-0.064	0.007	-0.214	-0.408	-0.329	-0.618	0%	100%
Size of network at immigration	93	2.791	0.017	0.074	0.142	0.115	0.215	100%	0%
Squared size of network at immigration	93	-0.561	0.007	-	-	-	-	0%	100%
Employment protection at immigration	29	0.033	0.249	0.109	0.207	0.167	0.313	59%	34%
... in 2005	29	1.538	22.540	5.228	9.972	8.018	15.083	72%	28%
Union coverage at immigration	29	-0.015	0.009	-0.053	-0.101	-0.081	-0.153	0%	100%
... in 2005	29	0.066	0.776	0.221	0.425	0.342	0.641	79%	21%
Unemployment benefits at immigration	29	-0.042	0.011	-0.140	-0.268	-0.216	-0.407	0%	100%
... in 2005	28	-0.053	0.422	-0.165	-0.316	-0.254	-0.478	43%	57%
Tax wedge at immigration	29	-0.008	0.004	-0.140	-0.268	-0.216	-0.407	3%	97%
... in 2005	29	-0.101	0.110	-0.347	-0.663	-0.536	-1.001	14%	86%
Pension replacement rate at immigration	29	-0.014	0.030	-0.046	-0.088	-0.071	-0.132	28%	69%
... in 2005	29	0.052	0.308	0.180	0.344	0.278	0.521	72%	28%
Infant mortality at immigration	29	-0.073	0.069	-0.245	-0.469	-0.377	-0.707	14%	83%
... in 2005	29	-1.148	5.027	-3.931	-7.491	-6.028	-11.321	21%	79%
Education scores at immigration	29	0.023	0.020	0.075	0.143	0.116	0.217	90%	10%
... in 2005	29	0.100	0.217	0.333	0.636	0.511	0.961	86%	14%
Family expenditures* at immigration	29	0.761	0.075	0.037	0.145	0.065	0.184	100%	0%
... in 2005	29	-1.101	2.109	-0.054	-0.217	-0.094	-0.271	21%	79%

* Here, marginal effects refer to an increase by 0.01 percentage points in the share in GDP.

variable (average hourly gross wages). Immigrant networks have a positive effect, which is significant in all regression, but their impact is decreasing, as the squared network variable has a negative sign. This indicates that networks really facilitate immigration to a country; however, when the network is already large, a further increase in its size hardly has an additional positive effect.

Other results are less clear *a priori*, hence potentially more interesting. In the majority of regressions employment protection has a positive and significant effect on the decision to migrate and to stay in a specific destination country. Positive effects become stronger when considering the year-2005 figures compared to the year-of-immigration figures, but we are not inclined to take this as a clear-cut result. By contrast, historical figures for union coverage and unemployment benefits affect the decision to immigrate negatively in a highly significant way. Upon their arrival, immigrants appear to be "outsiders" where unions are strong, and they are hardly entitled to receive any benefits if they cannot find a job or drop out of employment very soon. Interestingly, union coverage has a positive influence on the decision to stay in the destination country in more than three quarters of the cases, while the effect of the benefit level is rather mixed based on year-2005 figures. Overall, this indicates that migrants prefer destination countries with less strong protection against labor-market risks when deciding about where to migrate. It also implies that (some) immigrants observed in our data set have become "insiders" in the labor market of their destination countries benefitting from union coverage, in particular.

We also find negative and significant effects of the income tax wedge on migration decisions in almost all regression. This is clearly what one should expect given that we separately control for public services which are potentially related to higher taxes. Pension replacement rates produce mixed effects in our "baseline" estimates based on the full sample, with a higher share of coefficients that are significantly negative for the year of immigration and a higher share of coefficients that are significantly positive for 2005. Both these effects apply to more than two thirds of our estimates, but they could be more pronounced to be considered fully trustworthy.

For the other systems of public benefits included in our model, we find that good health-care and education systems have a positive effect on migration decisions, which is significant in about 80% to 90% of the regressions.[22] Family expenditure is also a positive and (highly) significant determinant of the decision to migrate, while their impact becomes negative in about 80% of the cases regarding the decision to stay. This is surprising at first sight. Note, however, that we effectively use an input measure here – unlike the output measures employed for health care and the education system. If family benefits are organized inefficiently and migrants realize this while living in the country, this could provide one explanation for the change in the sign.

To assess the quantitative importance of our estimates, we also calculate the median of the marginal effects (see equation (2.5)) derived from the estimations.[23] For instance, a marginal increase in the unemployment rate in France negatively affects the decision to migrate there by 0.280, while parallel increases in Germany and the UK reduce immigration by 0.535 and 0.430, respectively. The effect is largest for an increase in the unemployment rate in the USA (-0.808).[24] Considering the impact of unemployment rates in 2005 on decisions to stay, we find smaller effects. This could indicate that, after some years spent in the destination country, migrants are more integrated, thus hit less strongly by adverse developments in the labor market. In terms of marginal effects, wages are also more important regarding the decision to migrate than with respect to the decision to stay. Things are different with regard to the tax wedge. Being more integrated, both socially and

[22]Of course, we expect higher quality of the health-care system to *decrease* infant mortality.

[23]Note that these marginal effects do not reflect indirect effects of changes in institutions. For instance, an increase in unemployment benefits is often linked to a decrease in (net) wages. Our marginal effects show the effects of institutions in *ceteris-paribus* terms and give us an idea of the importance of these institutions for the choice of a particular destination country.

[24]Note that the ranking of marginal effects across our four countries reflects cross-country differences in the level of each variable and differences in migrants' probabilities to live in a particular destination country. Therefore, marginal effects cannot be used for comparisons across countries, but rather for evaluating the relative importance of different determinants for migrants' choices regarding a single country.

economically, may imply that (progressive) taxes become more burdensome. Marginal effects for the different branches of public policy considered here also give us an impression of their relative importance for the decision to migrate to a specific destination country. A marginal improvement in the quality of health care (measured via a marginal decrease in infant mortality) is more effective in attracting immigrants compared to a better education system or higher family expenditure.[25]

To check for the robustness of our results, we also consider a number of sub-samples. Specifically, we repeat our estimations for the sub-group of individuals who migrated after 1995 (see table 2.4), *i.e.*, within a maximum period of 10 years, to reduce the potential selection of our sample through re-migration. We also study the results for skilled migrants (see table 2.5), running regressions only for migrants whose qualifications are classified as ISCED 3-6. Here, the point is that skilled migrants can be expected to be relatively free in their choice of a destination country, while low-skilled people often face more restrictive immigration policies and thus have a more limited choice of destinations. In either of these cases, the estimates are much in line with the estimates for the total sample, both in terms of the direction of effects and in terms of their level of significance. In the case of more recent migrants, exceptions may be due to the fact that the variation in institutional variables, hence the difference between historical and current figures, now becomes smaller. Whether this, or other (*e.g.*, time or cohort) effects, explain that the positive effects of employment protection at immigration are now significant, while the negative effects of union coverage disappear is thus hard to tell. In the case of skilled migrants, historical variables that are based on rough average figures, such as wages and the tax wedge, may not be suited to fully capture their effects for this sub-group. They clearly perform weaker now. At the same time, the lower share of significant results for educational scores at immigration may have a material interpretation, the

[25]Note, however, that we cannot assess the cost-effectiveness of any of these policy measures, as we cannot tell how one Euro spent is transformed into a decrease of infant mortality (by one in 1000 births) or a (one-point) increase in education scores.

quality of education in the destination country probably being less important for individuals who *are* high skilled already when they arrive.

A result that is common to both sub-samples is that the negative effects of pension replacement rates at the time of immigration are now clearly significant, while their positive effects regarding the decision to stay become more pronounced at least for skilled migrants. The negative effects can be explained by the fact that more generous pension systems may be subject to higher political risks and, in any case, involve higher contributions. Only if immigrants enter regular employment for a sufficient period of time, do they qualify for generous pension benefits. Otherwise, high benefit levels actually mean high (implicit) taxes for migrants. Positive effects of year-2005 pension replacement rates for skilled migrants could also reflect that more generous pension systems tend to have a stronger tax–benefit link (see Koethenbuerger and Profeta, 2008), so that skilled individuals find themselves better off staying in countries with higher pensions that are less redistributive. Of course, the two differing effects could also indicate changes in national pension policies, with recent pension reforms increasing the credibility of generous entitlements, or in the way these are perceived by migrants who become more familiar with the system over time.[26]

2.6 Conclusions

The decision to migrate to a particular country is a complex process and may be affected by various factors. Economists conventionally expect wages and unemployment rates to have an impact on this decision. In this paper, we show that the institutional setting in potential destination countries may

[26]In additional series of regressions, we normalized the population of each country to 50 million by adjusting the sample weights (in order to avoid distortions through the different sizes of our four countries), we dropped the German "(*Spät*)-*Aussiedler*" (to leave out individuals enjoying a highly preferential treatment in the migration law of just one country), and we restricted the sample to migrants arriving in 2000 or later. In all of these cases, the results are essentially unchanged compared to those presented here, underlining the robustness of our estimates.

Table 2.4: Estimates for individuals who have migrated after 1995

Variable	Number of regressions	Median estimate	Aggr. standard error	Median marginal effects France	Germany	UK	US	Share of significant regressions (1%-level) positive	negative
Wage per hour at immigration	93	0.040	0.038	0.144	0.264	0.259	0.428	91%	4%
... in 2005	93	0.023	0.003	0.082	0.151	0.147	0.244	100%	0%
Unemployment rate	93	-0.103	0.029	-0.373	-0.685	-0.667	-1.106	0%	100%
... in 2005	93	-0.053	0.006	-0.196	-0.359	-0.350	-0.580	0%	100%
Size of the network at immigration	93	2.708	0.015	0.080	0.146	0.143	0.237	100%	0%
Squared network size at immigration	93	-0.510	0.005	-	-	-	-	0%	100%
Employment protection at immigration	29	0.122	0.117	0.434	0.797	0.781	1.294	93%	3%
... in 2005	29	-0.676	18.811	-0.638	-1.173	-1.146	-1.893	48%	52%
Union coverage at immigration	29	0.002	0.015	0.006	0.010	0.010	0.017	59%	38%
... in 2005	29	0.036	0.531	0.132	0.242	0.236	0.392	76%	24%
Unemployment benefits at immigration	29	-0.031	0.012	-0.113	-0.207	-0.202	-0.336	0%	100%
... in 2005	28	-0.084	1.641	-0.304	-0.558	-0.545	-0.903	32%	64%
Tax wedge at immigration	29	-0.011	0.002	-0.113	-0.207	-0.202	-0.336	0%	100%
... in 2005	29	-0.031	0.150	-0.116	-0.212	-0.207	-0.343	31%	69%
Pension replacement rate at immigration	29	-0.078	0.034	-0.282	-0.520	-0.507	-0.853	0%	100%
... in 2005	29	0.026	0.200	0.094	0.174	0.169	0.280	69%	28%
Infant mortality at immigration	29	0.093	0.157	0.311	0.570	0.557	0.923	62%	38%
... in 2005	29	-1.320	8.438	-4.783	-8.775	-8.577	-14.207	7%	90%
Education scores at immigration	29	-0.024	0.042	-0.086	-0.158	-0.155	-0.255	14%	83%
... in 2005	29	0.039	0.664	0.143	0.263	0.256	0.425	79%	14%
Family expenditures* at immigration	29	0.442	0.155	0.025	0.075	0.036	0.103	97%	0%
... in 2005	29	0.271	1.495	0.018	0.046	0.022	0.064	59%	41%

* Here, marginal effects refer to an increase by 0.01 percentage points in the share in GDP.

Table 2.5: Estimates for high skilled immigrants

Variable	Number of regressions	Median estimate	Aggr. standard error	Median marginal effects				Share of significant regressions (1%-level)	
				France	Germany	UK	US	positive	negative
Wage per hour at immigration	93	-0.004	0.036	-0.013	-0.028	-0.022	-0.045	40%	55%
... in 2005	93	0.079	0.025	0.247	0.559	0.425	0.895	100%	0%
Unemployment rate at immigration	93	-0.084	0.022	-0.255	-0.577	-0.437	-0.921	0%	100%
... in 2005	93	-0.158	0.053	-0.494	-1.120	-0.851	-1.790	2%	98%
Size of the network at immigration	93	2.585	0.009	0.064	0.146	0.111	0.233	100%	0%
Squared network size at immigration	93	-0.536	0.004	-	-	-	-	0%	100%
Employment protection at immigration	29	0.015	0.256	0.047	0.107	0.081	0.172	55%	38%
... in 2005	29	1.645	32.175	5.161	11.689	8.925	18.682	72%	28%
Union coverage at immigration	29	-0.015	0.009	-0.048	-0.108	-0.083	-0.173	0%	100%
... in 2005	29	0.059	1.132	0.186	0.421	0.318	0.673	69%	28%
Unemployment benefits at immigration	29	-0.040	0.013	-0.124	-0.281	-0.213	-0.448	0%	100%
... in 2005	28	-0.066	0.771	-0.240	-0.542	-0.411	-0.866	43%	57%
Tax wedge at immigration	29	-0.003	0.004	-0.124	-0.281	-0.213	-0.448	24%	69%
... in 2005	29	-0.151	0.132	-0.473	-1.068	-0.812	-1.707	7%	93%
Pension replacement rate at immigration	29	-0.028	0.029	-0.089	-0.201	-0.152	-0.321	3%	93%
... in 2005	29	0.156	0.399	0.489	1.104	0.836	1.765	83%	17%
Infant mortality at immigration	29	-0.089	0.079	-0.276	-0.625	-0.475	-1.000	7%	90%
... in 2005	29	-1.187	7.923	-3.876	-8.757	-6.641	-13.996	34%	66%
Education scores at immigration	29	0.017	0.018	0.053	0.120	0.091	0.192	72%	24%
... in 2005	29	0.093	0.343	0.289	0.654	0.497	1.045	83%	14%
Family expenditures* at immigration	29	0.811	0.068	0.061	0.156	0.062	0.200	100%	0%
... in 2005	29	-2.211	2.592	-0.162	-0.428	-0.167	-0.542	14%	86%

* Here, marginal effects refer to an increase by 0.01 percentage points in the share in GDP.

also play an important role. Effectively, our results indicate that wages and unemployment rates alone are not sufficient to fully explain location choices of people who migrate internationally.

Besides the conventional effects of wages and unemployment rates, which are positive respectively negative, we observe a positive, but declining effect of the size of immigrant networks which has also been studied in many earlier contributions. In addition, we find that labour-market institutions, such as union coverage and unemployment benefits, have negative effects for decisions to migrate to specific countries, while they may play a positive role regarding decisions to stay there. Results regarding employment protection are rather mixed, but again the effects tend to become more positive for migrants already in the country. We take these results to point to "insider–outsider" problems related to these institutions – with migrants who stay on in a country increasingly becoming "insiders".

Among the other institutional features we are considering, a higher tax wedge has a negative effect, unambiguously deterring (potential) migrants. We also find that the quality of health-care and education systems have a positive effect, while the impact of pension replacement rates is negative regarding decisions to migrate to a given country and tends to be positive regarding decisions to stay there.

Being aware of the shortcomings of our analysis due to data limitations, we think that by combining micro-data from four major destination countries we provide new insights as to whether and how institutions play a role for migration decisions.

3

Does Educational Choice Erode the Immigration Surplus?

3.1 Introduction

Public opinion commonly regards high skilled immigration as beneficial for the domestic economy. Many developed countries, especially Anglo-Saxon ones, pursue an immigration policy that is targeted at attracting high skilled immigrants. For instance, in 2002 the UK has launched the Highly Skilled Migrant Programme (HSMP) that grants free entry for high skilled immigrants, independent of an employment contract.[1] Most economists also regard immigration, and especially high skilled immigration, as welfare enhancing. Building on the seminal results of Berry and Soligo (1969), Borjas (1995) has shown that immigration into a perfect labor market leads to a welfare gain for the native population as a whole, provided that it changes the skill composition of the labor force and wages are flexible. Thus, as the market for high skilled labor generally does not exhibit large frictions, high skilled immigration should have a positive effect on native welfare.[2] In principle,

[1] Zaletel (2006) gives an overview over the HSMP and various other immigration programs for high skilled workers.

[2] Kemnitz (2009) shows that with certain labor market distortions high skilled immigration can also lead to a welfare loss. Moreover, changes in international trade due to

such an immigration surplus may also occur for low-skilled immigration, although the prevalence of labor market imperfections, like minimum wages, arguably makes it a less likely outcome for low-skilled than for high-skilled immigration. Empirical evidence on the wage effects of immigration is however mixed.[3]

The notion of an immigration surplus rests on the assumption that immigration has no influence on the skill composition of the native labor force. If immigration occurs in a single, unexpected event, then this assumption seems reasonable. Education decisions are generally made in early stages of life, with a strong element of persistence regarding the level and nature of skills that people bring to the labor market. Hence, the skill composition of the native work force is exogenous to unexpected immigration shocks, in which case the conventional calculus of the immigration surplus seems valid.

However, immigration seldom occurs as a one-time, unexpected shock. Instead, it takes the form of a rather steady yearly inflow of people which is mainly governed by the rules of existing immigration policy. Existing immigration policy is common knowledge, hence future immigration flows will typically be anticipated and are likely to affect natives' education decisions. Thus, the skill-composition of the native labor force that will prevail by the time immigration occurs is not exogenous to the size and composition of the (anticipated) inflow of labor. A key tenet of the conventional theory of the immigration surplus is thus put into question. In this paper, I readdress that theory, developing a simple model of overlapping generations that allows me to take into account the educational adjustment to anticipated immigration when calculating the immigration surplus.

Intuitively, if immigration policy is such that natives anticipate a future inflow of high-skilled workers, and if educational decisions are responsive to expected returns to education from educational wage premia, then we should expect this policy to have a negative impact on education. If immigration

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immigration can also reduce the immigration surplus, see Felbermayr and Kohler (2007).

[3]As discussed in Longhi et al. (2005b) and Hanson (2009), estimated wage effects of immigration vary substantially over different studies.

policy is generally geared towards enhancing the skill level of domestic labor supply, then this type of endogenous adjustment of native households would tend to undermine this objective. Does it also erode the well-known immigration surplus? Do such anticipation effects generally favor an immigration policy by announcement, or should the government take natives by surprise? In this paper, I try to give tentative answers to these questions.

It is somewhat surprising that existing literature has so far hardly addressed these questions. There is a long tradition of literature that is concerned with possible "brain drain" from high-skilled emigration in less developed countries. Emphasizing anticipation effects in educational decisions, more recent literature has argued that this concern is misguided in that the prospect of emigration may in effect raise the expected return on education, thus enhancing the sending country's stock of human capital, potentially increasing welfare even of non-migrating natives, (see *e.g.* Mountford, 1997; Stark and Wang, 2002; Vidal, 1998).

In contrast, the mirror image question of educational response to high-skilled immigration in the receiving country has so far received very little attention. Fuest and Thum (2001) analyze the effects of low skilled immigration on the native education structure and native welfare. For this, they model a labor market with a unionized and a competitive sector and two types of workers, low skilled and high skilled; high skilled workers are entrepreneurs in their model. In the competitive sector, the earnings of low skilled workers and entrepreneurs equal their marginal productivities, whereas there is Nash-bargaining in the unionized sector. Fuest and Thum (2001) find that, with educational adjustment, immigration does not affect native welfare, unless the degree of unionization changes. The argument behind this is the following: The educational choice implies that the expected incomes of high and low skilled people are the same and educational adjustment implies that immigration does not change these incomes. For the case that immigration decreases the degree of unionization, they find a positive effect on native welfare. This is due to the fact that a decrease in the degree of unionization leads to a redistribution of income from workers to entrepreneurs and all entrepreneurs are natives. Unlike the present paper, Fuest and Thum (2001) do

not model an education market, but use fixed education costs. They assume that education costs affect the education decision of natives but not native welfare.[4]

Lumpe and Weigert (2009) analyze the effects of high skilled immigration in a search-theoretic framework. They find that it increases the average educational level of natives. Considering their modeling of the labor market, this result is not surprising. They assume that workers with different skill levels are perfect substitutes. Skill differences between workers are perfectly compensated by wage differences. The profits of a firm employing a worker increase with the worker's skill level. But by assumption, firms cannot select high skilled workers. Instead, they rely on hiring of the next best workers. In this environment, the gain that a firm may expect from a job offer is increasing in the average level of skills in the labor force. Thus, an increase in the average educational level due to high skilled immigration leads to a disproportional increase in the number of job offers. This, in turn, lowers for all individuals the probability of becoming unemployed, independently of their skill levels. If unemployment benefits remain unchanged,[5] this amounts to an increase in the expected wages for natives. Finally, the higher expected wage rate creates an enhanced incentive to undergo education.

On the empirical side, Ramcharan (2002) analyzes empirically the effect of immigration on the increase in college education in the US in the early 20th-century. In states with large inflows of low skilled immigrants from Europe, the number of college students increased earlier than in others. Ramcharan's estimations indicate that there is a causal relation.

In this paper, I look at anticipated immigration in a two-period overlapping generations model. The young generation does not work, but may

[4]An additional weak point of their paper is that high skilled income differs over the two sectors. The share of high skilled workers in each sector is set fixed. With skill adjustment, it is not plausible that the additional high skilled workers do not change the distribution over sectors.

[5]Lumpe and Weigert (2009) has a weak point in the handling of unemployment benefits (and education subsidies). It does not model a budget constraint and consequently allows for unlimited deficit spending.

engage in education which, in turn, requires high skilled labor input of the old generation. Individuals differ in terms of innate abilities that determine the required educational effort for an individual to enter the next period as a skilled worker. Given the wage profile for high and low skilled workers, this determines a cut-off level of abilities separating individuals who undergo education from those who enter the next period as unskilled workers. The ability distribution across individuals then determines the skill composition of the work force in the next period. The cost of education consists of wages paid to high skilled teachers. The young generation pays for this cost when entering the labor force in the next period. In equilibrium, these payments must be equal to the educational investment made by the following young generation. I assume frictionless labor markets, hence wages reflect marginal productivities of high and low skilled workers, respectively. The economy is assumed to produce a single final good, whereby the two types of workers are imperfect substitutes in production.

In this framework, natives' expectations about future immigration determine the threshold level that an individual needs to surpass for education to be worthwhile. High skilled immigration increases low skilled wages and decreases high skilled wages. Thus, the expectation of high skilled immigration moves the threshold to the left, so that less natives acquire high skills. This adjustment reduces the traditional immigration surplus, which is based on complementarities between natives and immigrants. Nevertheless, the welfare effect of high skilled immigration still tends to be positive. The same holds for low skilled immigration. The expectations of young natives about future immigration do not necessarily coincide with the ultimately realized inflow of people. As the expectations affect the threshold level for the educational decision of young natives, they affect native welfare. The higher expected immigration relative to realized immigration, the lower native welfare.

In developed countries, labor markets are generally not frictionless. Therefore, I introduce a minimum wage in the model to check for the stability of the results. With respect to high skilled immigration, the results from the model with a frictionless labor market are confirmed. An adjustment of the

native educational structure still reduces the immigration surplus. If expected immigration exceeds the ultimately realized immigration, a welfare loss can be the consequence of the adjustment. Low skilled immigration does not affect the native educational structure and has an unambiguous negative effect on native welfare. Thus with frictions on the labor market, the results from the perfect labor market still tend to hold for people who are only indirectly affected by the frictions, whereas they do not hold for people who are directly affected. The paper is organized in the following way: In the second section, the baseline model is derived. In section 3.3, I analyze how an adjustment of the native education structure to (expected) immigration affects native welfare. In section 3.4, a minimum wage is introduced and section 3.5 concludes.

3.2 Model setup

My analysis is based on a simple overlapping generations model. At each point in time the population consists of two cohorts: young individuals in education and working age individuals in the labor market.[6] When the individuals are young, cohort t consists of a continuum $i \in [0,1]$ of native individuals with mass $N(t)$. When they are in the labor market, a mass $M_H(t)$ high skilled and a mass $M_L(t)$ low skilled immigrants adds to the native workforce. Subsequently, generations are dated such that $N(t)$ denotes the native generation born at the beginning of period $t-1$. In $t-1$, when they are young, natives have to decide either to acquire high skills or to stay low skilled. At this point in time, they are all uneducated. In making this decision, they maximize their future income less the education costs. In doing so, they know the working mechanisms of the labor market, their own innate ability and the innate abilities of all other natives. The only thing they cannot perfectly foresee at this stage is future immigration. Thus, they have to base their education decision on expectations about it.

[6] Adding a cohort of old people would have no influence on the results.

To acquire high skills, young natives need teaching. For low skills, no schooling is necessary.[7] The amount of teaching that an individual i needs to acquire high skills depends on her innate ability $a(i)$; the higher innate ability, the less educational input is necessary. I define the amount of teaching that an individual needs to acquire high skills as $s(i) = s[a(i)]$ with $s' < 0$. s is measured in units of educational input, provided by high-skilled people (teachers). To keep the model tractable, I have to make some further simplifying assumptions on a and s. The continuum of native individuals $i \in [0, 1]$ is ranked according to innate ability, so that $a'(i) > 0$ holds. Depending on the rank of an individual i, the functional form $a(i) = i$ is assumed for innate ability. For the necessary educational input to become high skilled, the functional form $s(i) = 1 - a(i) = 1 - i$ is assumed. The innate abilities $a(i)$ of natives in cohort t are uniformly distributed over the interval $[0; 1]$. Thus, for the cumulative distribution function (cdf) of the innate abilities $G(a)$, which measures the percentage of individuals with ability a or lower, $G(a) = a$ holds. As $s(i) = 1 - a(i)$, s is also uniformly distributed over the interval $[0; 1]$ with cdf $K(s) = s$.

It does not pay for all young natives to acquire high skills. For individuals with a low level of innate ability, the individual education costs are larger than the (discounted) difference between high an low skilled incomes. I define the cutoff-level of innate abilities for which education costs equal the difference between high and low skilled income in cohort t as $a^*(t)$. $a^*(t)$ separates individuals i for whom $a(i) < a^*(t)$ holds, *i.e.* who are born in period $t - 1$ and remain uneducated, from those who obtain education. With the assumed functional form of $s(a)$, the share of people undergoing education is $1 - a^*$. I write $i^*(t)$ for the solution to $a(i) = a^*(t)$, *i.e.*, $i^*(t) = a^*(t)$, and $s^*(t) = 1 - a^*(t) = 1 - i^*(t)$. Thus, from the $N(t)$ natives in cohort t, the fraction $a^*(t) = i^*(t)$ remains uneducated, while $1 - a^*(t) = 1 - i^*(t)$ decides to become educated. If $i^*(t)$ is known, one can calculate the teaching

[7] In developed countries, not even a low educational level is reached without teaching. Nevertheless, assuming uniform teaching requirements for all individuals to acquire a low educational level does not change the results.

demand in the immigration country in period $t-1$ as

$$N(t)\int_0^{i^*(t)} s(i)\mathrm{d}i = \frac{[s^*(t)]^2}{2}N(t). \tag{3.1}$$

Notice that, with a uniform ability distribution, $s(i) = 1-i$ and $s^*(i) = 1-i^*$ hold.

To keep the model tractable, I assume that the amount of schooling of an individual $s(i)$ does not affect the time she is active in the labor market. Schooling only affects intensity of education. Low skilled individuals do not spend more time on the labor market than high skilled.[8] This means, that the young generation born in $t-1$ is either taking education, or else doing nothing. We can also assume, without altering the model in an important way, that these individuals engage in some "autarcic" subsistence activity. High skilled immigrants acquire their skills abroad. High and low skilled immigrants arrive in period t and start working right away. Thus, overall low and high skilled labor supply are equal to

$$L(t) = a^*(t)N(t) + M_L(t) \tag{3.2}$$

$$H(t) = [1-a^*(t)]N(t) + M_H(t) = H_P(t) + H_E(t). \tag{3.3}$$

From the high skilled labor force, $H_E(t)$ individuals are engaged in teaching, and $H_P(t)$ are engaged in production. Note that $H_E(t)$ denotes high-skilled teachers educating generation $N(t+1)$.

Teaching of cohort t takes place in period $t-1$. Teaching technology is such that one unit of teaching for cohort t requires $1/S$ units of high-skilled labor of cohort $t-1$, namely teachers educated in the previous period.

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[8] Most other papers assume that the teaching intensity for high and low skilled people does not differ, but that high skilled people enter the labor market later than low skilled people. Dropping the assumption that all individuals of one cohort enter the labor market at the same time would enormously complicate our model. As the necessary schooling for a high educational level differs over individuals, the cohort structure would become inscrutable. Even teacher and student could then belong to the same cohort. Not being able to use different education times is a disadvantage of my model. However, in exchange it allows me to consider the education market explicitly.

High skilled people can freely choose between doing teaching or working in production, so that the wage of teachers equals the wage of high skilled workers in production: it is given by $w_H(t)$. Thus, schooling cost for an individual of cohort t with ability i is equal to

$$c(i,t) = w_H(t-1)\frac{[1-a(i)]}{S}. \tag{3.4}$$

For the marginal individual in t, schooling cost is

$$c^*(t) = w_H(t-1)\frac{s^*(t)}{S}. \tag{3.5}$$

As cohort t consists of $N(t)$ natives, the aggregate expenditure on education in period $t-1$ is equal to

$$E(t-1) = w_H(t-1)\frac{[s^*(t)]^2}{2S}N(t). \tag{3.6}$$

In addition, equilibrium on the education market requires that

$$H_E(t-1)S = \frac{[s^*(t)]^2}{2}N(t). \tag{3.7}$$

High skilled individuals have to finance their education on their own. As natives do not have an income until they enter the labor market, I assume that education is financed through borrowing. Thus, an individual of cohort t with ability i undergoing education in period $t-1$ will have to pay $c(i,t)r(t)$ for education in period t.

Apart from education, I assume a single good with a constant returns to scale production function $Y(t) = F(H_P(t), L(t), X_1(t), \ldots, X_j(t))$, which fulfills the Inada conditions.[9] Besides high and low skilled labor, there are other production factors X that are not further specified and whose supply is fixed. At this stage, I assume perfect labor markets. Thus, all input factors are compensated according to their marginal productivities. In section 3.4, I

[9] As not necessarily implied by the Inada conditions, $\partial^2 F/\partial H_{ft}\partial L_t > 0$ is additionally assumed.

relax the assumption of perfect labor markets and introduce a minimum wage in the model. Assuming perfect labor markets, the existence of further production factors X besides labor has no effect on the analysis. However, their existence substantially alters the results when a minimum wage is present.

For the goods market equilibrium to hold in my model, relatively restrictive assumptions on $r(t)$ are necessary. As high skilled individuals have to repay educational credits, they can only spend $w_H(t)H(t) - r(t)E(t-1)$ for goods. Thus the goods market equilibrium is given by:

$$Y(t) = w_H(t)H_P(t) + w_L(t)L(t) + \sum_j w_{xj}(t)X_j(t) + w_H(t)H_E(t) - r(t)E(t-1). \tag{3.8}$$

By Euler's homogeneous function theorem, output has to equal the sum of the input factors weighted with their marginal productivities. Thus

$$w_H(t)H_E(t) = r(t)E(t-1) \Leftrightarrow r(t) = \frac{w_H(t)H_E(t)}{E(t-1)} \tag{3.9}$$

has to hold. Noting (3.6) and (3.7), we can write

$$r(t) = \frac{w_H(t)}{w_H(t-1)} \frac{H_E(t)}{H_E(t-1)} = \frac{w_H(t)}{w_H(t-1)} \left[\frac{s^*(t+1)}{s^*(t)}\right]^2 \frac{N(t+1)}{N(t)}. \tag{3.10}$$

Thus, $r(t)$ reflects the aggregate growth of teachers' income, or equivalently, the aggregate growth of educational expenditure.

Mechanically, the variable $r(t)$ can be seen as something like a goods market clearing relative price, or an educational cost-premium that ensures equilibrium in the goods market. There are two alternative intuitive interpretations of this equation. One is to say that "savings" of high skilled people in period t, educated in period $t-1$, must finance educational investment made in period t. These investments depend on the educational margin $s^*(t+1)$ chosen by cohort $t+1$, born in t, and on the cost of education in period t, which in turn depends on the teachers' wage $w_H(t)$ and their productivity $S(t)$. We can also borrow from the terminology of financing old age pension systems by calling this a "reverse pay as you go" system of financing education: In period t, the old, working age generation finances the education

undertaken by the young cohort who is educated then. There is a positive externality that the marginal individual exerts on all individuals who will end up educated in period t: By enhancing the aggregate savings of period t, an expansion of $s^*(t)$ would reduce the educational cost premium implied by the "reverse pay as you go" system.

In the following, I analyze the educational decisions of cohort t, who decides on education in period $t-1$ and who is active on the labor market in t. For this analysis, it is crucial what information is available to individuals in period $t-1$ and how they build expectations about unknown factors. I assume, of course, that they have full information on the cost of an educational input which is equal to $w_H(t-1)/\,S$. I also assume that each individual knows her ability $a(i)$ and the abilities of all other native individuals. Moreover, young natives know the working mechanisms of the labor market, the functional form of $F(\ldots)$ and that wages equal the marginal products of labor. However, in period $t-1$ they have no information on immigration inflows in t. Thus, they have to build expectations about it. These are given by $M_H^e(t)$ and $M_L^e(t)$, with superscript e indicating that values are based on expectations in period $t-1$ about unknown period t values. As production and wages are affected by the labor supply of immigrants in t, the information that young natives have on them in $t-1$ are also based on expectations. The education criterion for young natives to become high skilled is $w_H^e(t) - r^e(t)c(i,t) \geq w_L^e(t)$. All individuals with an ability that ensures this inequality will take out education, while the rest remains uneducated, since the return to education would not cover their costs.

For the individual at the (educational) margin, acquiring high skills and staying low skilled has to lead to the same future welfare. Thus, the cut-off value of innate ability $a^*(t)$ that individuals of cohort t must surpass in order to find education worthwhile is determined by

$$w_H^e(t) - r^e(t)\frac{w_H(t-1)}{S}[1-a^*(t)] = w_L^e(t) \tag{3.11}$$

where (3.5) was inserted for $c^*(t)$. This leads to

$$s^*(t) = 1 - a^*(t) = \frac{w_H^e(t) - w_L^e(t)}{w_H(t-1)} \frac{S}{r^e(t)}. \tag{3.12}$$

$r(t)$ does not only depend on period t variables but also on variables from period $t+1$, namely $s^*(t+1)$ and $N(t+1)$. We assume that young individuals have no information on period $t+1$ and expect these factors to be constant over time after period t. Thus, $s^{*e}(t+1) = s^*(t)$ and $N^e(t+1) = N(t)$. (3.10) simplifies to $r(t) = w_H(t)/w_H(t-1)$ and (3.12) becomes

$$s^*(t) = 1 - a^*(t) = \left[1 - \frac{w_L^e(t)}{w_H^e(t)}\right] S. \tag{3.13}$$

The effect of immigration on native education may now be derived by totally differentiating the following system of equations:

$$\begin{aligned}
s^*(t) &= \left[1 - \frac{w_L^e(t)}{w_H^e(t)}\right] S && (3.14)\\
w_L^e(t) &= F_L[H_P^e(t), L^e(t)] && (3.15)\\
w_L^e(t) &= F_H[H_P^e(t), L^e(t)] && (3.16)\\
H_P^e(t) &= M_H^e(t) + N(t)\left[[s^*(t)] - \frac{[s^*(t)]^2}{2S}\right] && (3.17)\\
L^e(t) &= [1 - s^*(t)]N(t) + M_L^e(t) && (3.18)
\end{aligned}$$

Note that in (3.17) we have replaced $s^*(t+1) = s^*(t)$. (3.17) incorporates equilibrium on the teachers market, given by (3.7).

Proposition 1. *The expectation of high skilled immigration leads to a decrease in the share of high skilled natives. The expectation of low skilled immigration increases it.*

Proof. Rewriting (3.14) as $s^*(t)w_H^e(t) = (w_H^e(t) - w_L^e(t))\, S$ and totally differentiating it leads to

$$[w_H^e(t)\mathrm{d}s^*(t) + s^*(t)\mathrm{d}w_H^e(t)] = [\mathrm{d}w_H^e - \mathrm{d}w_L^e]S \tag{3.19}$$

with

$$\begin{aligned} \mathrm{d}H_P^e(t) &= \mathrm{d}M_H^e(t) + \left[1 - \frac{s^*(t)}{S}\right] N(t)\mathrm{d}s^*(t) && (3.20)\\ \mathrm{d}L^e(t) &= -N(t)\mathrm{d}s^*(t) + \mathrm{d}M_L^e(t) && (3.21)\\ \mathrm{d}w_L^e &= F_{LL}\mathrm{d}L^e(t) + F_{LH}\mathrm{d}H_P^e(t) && (3.22)\\ \mathrm{d}w_H^e &= F_{HL}\mathrm{d}L^e(t) + F_{HH}\mathrm{d}H_P^e(t) && (3.23) \end{aligned}$$

Inserting (3.21)-(3.23) into (3.19) and setting $\mathrm{d}M_L^e(t) = 0$ we find:

$$\frac{\mathrm{d}s^*(t)}{\mathrm{d}M_H^e(t)} = \frac{(S - s^*(t))F_{HH} - SF_{HL}}{w_H^e(t) - N(t)[\frac{(S-s^*(t))^2}{S}F_{HH} - 2(S - s^*(t))F_{HL} + SF_{LL}]} \quad (3.24)$$

Setting $\mathrm{d}M_H^e(t) = 0$ leads to:

$$\frac{\mathrm{d}s^*(t)}{\mathrm{d}M_L^e(t)} = \frac{(S - s^*(t))F_{HL} - SF_{LL}}{w_H^e(t) - N(t)[\frac{(S-s^*(t))^2}{S}F_{HH} - 2(S - s^*(t))F_{HL} + SF_{LL}]} \quad (3.25)$$

□

Intuitively, proposition 1 is fairly straightforward: Anticipated additional high-skilled migration raises $w_L^e(t)/\, w_H^e(t)$, and from (3.14) this provides a direct incentive for the marginal individual to abstain from education. This then has an opposing effect on future endowments and wages, which restores equilibrium with a lower $s^*(t)$. For changes in anticipated low-skilled immigration, the argument is analogous. Nevertheless, assuming perfect substitutability between low and high skilled labor, proposition 1 would not hold any more. The cutoff-ability level $a^*(t)$ would then be given by the relative productivity of low skilled labor compared to high skilled labor (see (3.13)).

3.3 Welfare effects of the educational adjustment

The effects of (expected) immigration in period t on native welfare of cohorts $t-1$ and t is summarized in lemma 1. Native welfare equals total production

less the wage sum paid to immigrants. A change in expected high (low) skilled immigration in t can be connected with a change in ultimately realized high (low) skilled immigration. However, this is not necessarily the case and the extents can differ. I capture this by writing ε_H and ε_L for the ratios of actual to anticipated immigration of the two types of labor. If natives correctly anticipate future immigration, $\varepsilon_H = \varepsilon_L = 1$ holds. For $\varepsilon_H = \varepsilon_L = 0$, no immigration takes place in the end.

Lemma 1. *The effects of expected high and low skilled immigration in period t on native welfare W in periods $t-1$ and t are given by:*

$$\begin{aligned}
\frac{\partial W(t-1)}{\partial M_H^e(t)} &= -\left[w_H(t-1) - F_{HH}M_H(t-1) - F_{HL}M_L(t-1)\right] \\
&\quad \times \frac{s^*(t)}{S} N(t) \frac{\partial s^*(t)}{\partial M_H^e(t)}, \qquad (3.26) \\
\frac{\partial W(t-1)}{\partial M_L^e(t)} &= -\left[w_H(t-1) - F_{HH}M_H(t-1) - F_{HL}M_L(t-1)\right] \\
&\quad \times \frac{s^*(t)}{S} N(t) \frac{\partial s^*(t)}{\partial M_L^e(t)}, \qquad (3.27) \\
\frac{\partial W(t)}{\partial M_H^e(t)} &= -\left[F_{HH}M_H(t) + F_{HL}M_L(t) - F_{HL}M_H(t) - F_{LL}M_L(t)\right] \\
&\quad \times N(t) \frac{\partial s^*(t)}{\partial M_H^e(t)} + \left[w_H(t) - w_L(t)\right] N(t) \frac{\partial s^*(t)}{\partial M_H^e(t)} \\
&\quad - \left[F_{HH}M_H(t) + F_{HL}M_L(t)\right] \varepsilon_H, \qquad (3.28) \\
\frac{\partial W(t)}{\partial M_L^e(t)} &= -\left[F_{HH}M_H(t) + F_{HL}M_L(t) - F_{HL}M_H(t) - F_{LL}M_L(t)\right] \\
&\quad \times N(t) \frac{\partial s^*(t)}{\partial M_L^e(t)} + \left[w_H(t) - w_L(t)\right] N(t) \frac{\partial s^*(t)}{\partial M_L^e(t)} \\
&\quad - \left[F_{HL}M_H(t) + F_{LL}M_L(t)\right] \varepsilon_L \qquad (3.29)
\end{aligned}$$

Proof. The proof is given in Appendix A. □

From lemma 1, several propositions can be deduced. First, the effect of (additional) immigration on native welfare without educational adjustment is non-zero and depends on the structure of the immigrant population. If no low (high) skilled immigrants are already in the country, the effect of high (low) skilled immigration is positive.

Proposition 2. *Without adjustment of the native educational structure, the effect of (additional) high skilled immigration on native welfare is positive, if* $M_H(t) > -\frac{F_{HL}}{F_{HH}} M_L(t)$. *For* $M_H(t) < -\frac{F_{HL}}{F_{HH}} M_L(t)$, *it is negative. The effect of (additional) low skilled immigration is positive, if* $M_L(t) > -\frac{F_{HL}}{F_{LL}} M_H(t)$.

Proof. Without educational adjustment, immigration does not affect the share of high skilled natives, $\frac{\partial s^*(t)}{\partial M_H^e(t)} = \frac{\partial s^*(t)}{\partial M_L^e(t)} = 0$, and cohort $t-1$ is not affected by the immigration. Hence, the overall welfare effect $W^*(t)$ equals the welfare effect in t, $W(t)$. Moreover, $\varepsilon_H = 1$ ($\varepsilon_L = 1$) holds, as realized immigration is analyzed. From lemma 1, the welfare effect of additional high (low) skilled immigration is thus given by:

$$\frac{\partial W^*(t)}{\partial M_H(t)} = \frac{\partial W(t)}{\partial M_H(t)} = -F_{HH} M_H(t) - F_{HL} M_L(t) \tag{3.30}$$

$$\frac{\partial W^*(t)}{\partial M_L(t)} = \frac{\partial W(t)}{\partial M_L(t)} = -F_{LL} M_L(t) - F_{HL} M_H(t) \tag{3.31}$$

$\frac{\partial W^*(t)}{\partial M_H(t)}$ is larger than zero, if $M_H(t) > -\frac{F_{HL}}{F_{HH}} M_L(t)$ holds; $\frac{\partial W^*(t)}{\partial M_L(t)}$ is larger than zero, if $M_L(t) > -\frac{F_{HL}}{F_{LL}} M_H(t)$ holds. □

The traditional "immigration surplus" is only an inframarginal concept. It compares native welfare without immigrants with native welfare with a certain number of immigrants of one educational type. In inframarginal analyses, a positive effect is generally found, whereas at the margin no effect occurs. Setting $M_H(t) = M_L(t) = 0$, this zero effect is also present in (3.30) and (3.31). As shown in Appendix B, $-F_{HH}(M_H(t))^2$ is a reasonable, strictly overvaluing, approximation for the immigration surplus $\Delta W^*(t)$. To relate this to proposition 2, consider that $\Delta M_H(t) = M_H(t)$. Thus, with the results from proposition 2 (and the further propositions) an upper bound for the inframarginal effects can be derived.

The effects of educational adjustment can also be derived from lemma 1. As summarized in proposition 3, educational adjustment primarily leads to a redistribution of native welfare between cohort t, who is active on the labor market when the immigrants arrive, and cohort $t-1$, who is active in the preceding period and who provides the teachers for cohort t. Cohort $t-1$

gains from the expectation of high skilled immigration in t, whereas cohort t suffers a welfare loss. The expectation of low skilled immigration has the oppositive effect: Cohort t profits and of $t-1$ looses.

Proposition 3. *An adjustment of the native education structure to (expected) high skilled immigration in t increases native welfare in $t-1$, as long as $M_L(t-1) < \kappa(M_H(t-1))$ holds. It decreases native welfare in t, if $M_L(t) < \nu(M_H(t))$. An adjustment of the native education structure to (expected) low skilled immigration in t decreases native welfare in $t-1$, as long as $M_H(t-1) < \kappa'(M_L(t-1))$. It increases native welfare in t, if $M_H(t) < \nu'(M_L(t))$.*

Proof. An adjustment to expected high (low) skilled immigration leads to a welfare gain (loss) in $t-1$, as long as $M_L(t-1) < \frac{w_H(t-1)-F_{HH}M_H(t-1)}{F_{HL}(t-1)} = \kappa(M_H(t-1)) \Leftrightarrow M_H(t-1) < \frac{w_H(t-1)-F_{HL}M_L(t-1)}{F_{HH}(t-1)} = \kappa'(M_H(t-1))$. Under this condition, the term in brackets in (3.26) and (3.27) is larger than zero and the signs of the welfare effects are given by $-\frac{\partial s^*(t)}{\partial M_H^e(t)}$ and $-\frac{\partial s^*(t)}{\partial M_L^e(t)}$.

Expected immigration leads to a direct welfare effect in t through the increase in production and to an indirect welfare effect through educational adjustment. In (3.28) and (3.29), the direct welfare effects are given by the terms which include ε_H and ε_L. The effects of educational adjustment are given by $\frac{\partial s^*(t)}{\partial M_H^e(t)}, \frac{\partial s^*(t)}{\partial M_L^e(t)}$ and the factors in front. For expected high skilled immigration, the effect of educational adjustment is negative, as long as

$$M_L(t) < \frac{w_H(t) - w_L(t)}{(F_{HL} - F_{LL})\, N(t)} + \frac{F_{HL} - F_{HH}}{F_{HL} - F_{LL}} M_H(t) = \nu\left(M_H(t)\right)$$

holds. Analogously, as long as

$$M_H(t) < \frac{w_H(t) - w_L(t)}{(F_{HL} - F_{HH})\, N(t)} + \frac{F_{HL} - F_{LL}}{F_{HL} - F_{HH}} M_L(t) = \nu'\left(M_L(t)\right),$$

the effect of educational adjustment to low skilled immigration is positive. □

Proposition 3 shows that educational adjustment to high skilled immigration leads only to a real redistribution between the cohorts $t-1$ and t, if the stocks of low skilled immigrants in the two cohort are not too large.

Analogously, low skilled immigration leads only to a real redistribution, if the stocks of high skilled immigrants are not too large. The rationale behind this is simple. Assume that, in $t-1$ and t, large stocks of low skilled immigrants are in the country. Cohort $t-1$ should profit from educational adjustment due to an increase in goods production. However, the welfare increase is not equally shared between high and low skilled people. Due to the adjustment of the wage structure, only low skilled people actually gain, but high skilled people lose. If the share of low skilled immigrants is too large, the whole welfare increase flows off into the wages of low skilled immigrants. Analogously, if the stock of low skilled immigrants in t is too high, the decrease in welfare in t is to a great extent borne by them. Native welfare even increases due to the increase in high skilled wages. In the real world, this redistribution between natives and incumbent immigrants may play a role. However, the number of incumbent immigrants is normally not large enough that a reversion of the welfare effects is feasible.

Lemma 1 also allows us to get insights about the overall welfare effects of immigration (or the expectation about it) taking into account the adjustment of the educational structure of natives. However, we need an idea how welfare changes in cohorts $t-1$ and t should be aggregated. This is not trivial, as different individuals are concerned. For the aggregation, I use an interest / time preference rate of δ to transform values from $t-1$ to t. In a situation without immigration, δ corresponds to r (in this case r is one, if cohort sizes do not change over time). However, in contrast to r, δ does not react to immigration. There is no plausible argument why immigration should affect the weight that is given to the welfare of cohort $t-1$ compared to welfare of cohort t.

Aggregating the welfare effects of the two cohorts, the overall effect of an adjustment of the native educational structure to immigration can be analyzed. For this purpose, the case with only one type of immigration in t, no immigration in $t-1$ and perfect anticipation of immigration is considered. In this setting, educational adjustment reduces the positive effect of immigration on native welfare. As this setting is a good approximation for the "traditional" immigration surplus (see above), this implies that the

"traditional" immigration surplus is also reduced.

Proposition 4. *For $M_H(t-1) = M_L(t-1) = 0$, $M_L(t) = 0$ ($M_H(t) = 0$) and $\delta = r(t)$, an adjustment of the educational structure of natives to correctly anticipated future high (low) skilled immigration decreases the positive welfare effect of this immigration.*

Proof. Under the conditions in the proposition, the effect of high skilled immigration on overall native welfare $W^*(t)$ can be written as:

$$\begin{aligned}\frac{\partial W^*(t)}{\partial M_H(t)} &= -F_{HH}M_H(t) - [F_{HH}M_H(t) - F_{HL}M_H(t)]\, N(t)\frac{\partial s^*(t)}{\partial M_H(t)} \\ &\quad + \left[w_H(t) - \delta w_H(t-1)\frac{s^*(t)}{S} - w_L(t)\right] N(t)\frac{\partial s^*(t)}{\partial M_H(t)} \quad (3.32)\end{aligned}$$

By (3.13), the term in the second row is zero for $\delta = r(t)$. The first term in the first row equals the welfare effect without adjustment of the education structure, see proposition 2. The second term gives the additional effect of the adjustment. As $F_{HH} < 0$,$-F_{HL} < 0$ and $\frac{\partial s^*(t)}{\partial M_H(t)} < 0$, it is negative.

Analogously, the effect of low skilled immigration is given by

$$\begin{aligned}\frac{\partial W^*(t)}{\partial M_L(t)} &= -F_{LL}M_L(t) + [F_{LL}M_L(t) - F_{HL}M_L(t)]\, N(t)\frac{\partial s^*(t)}{\partial M_L(t)} \\ &\quad + \left[w_H(t) - \delta w_H(t-1)\frac{s^*(t)}{S} - w_L(t)\right] N(t)\frac{\partial s^*(t)}{\partial M_L(t)}. \quad (3.33)\end{aligned}$$

The second bracket is again zero and the term in the first bracket is negative. Thus, educational adjustment lowers the welfare effect. □

From (3.32), the overall welfare effect of high skilled immigration is given by:

$$-F_{HH} - [F_{HH} - F_{HL}]\, N(t)\frac{\partial s^*(t)}{\partial M_H(t)} \quad (3.34)$$

The sign of (3.34) is ambiguous. It depends on the reaction of low skilled wages to changes in high skilled labor F_{HL}; for $F_{HL} \to 0$, the welfare effect is positive. Inserting (3.24) into (3.34), setting $F_{HL} = 0$ and $S = 1$ and

simplifying it leads to:

$$\begin{aligned} -\frac{(1-s^*(t))(F_{HH})^2}{\frac{w_H(t)}{N(t)}-(1-s^*(t))^2F_{HH}-F_{LL}}-F_{HH} &> 0 \\ \frac{\frac{w_H(t)}{N(t)}-(1-s^*(t))F_{HH}-F_{LL}}{-(1-s^*(t))F_{HH}} &> 0 \end{aligned} \tag{3.35}$$

The overall welfare effect of low skilled immigration is given by:

$$-F_{LL}+\left[F_{LL}-F_{HL}\right]N(t)\frac{\partial s^*(t)}{\partial M_L(t)} \tag{3.36}$$

As the effect of high skilled immigration, it depends on F_{HL}, which is also the reaction of high skilled wages to changes in low skilled labor. For $F_{HL} \to 0$, the welfare effect is again positive; inserting (3.25) into (3.36) and setting $F_{HL} = 0$ and $S = 1$ leads to:

$$\begin{aligned} -\frac{(F_{LL})^2}{\frac{w_H(t)}{N(t)}-(1-s^*(t))^2F_{HH}-F_{LL}}-F_{LL} &> 0 \\ \frac{\frac{w_H(t)}{N(t)}-(1-s^*(t))^2F_{HH}}{-F_{LL}} &> 0 \end{aligned} \tag{3.37}$$

The inequality holds, as $F_{HH} < 0$ and $F_{LL} < 0$.

The expectations of young people about future immigration need not equal the immigration that is ultimately realized. If the expected inflow of high or low skilled people is smaller than the realized inflow, the positive welfare effect of immigration increases;[10] otherwise, educational adjustment would not lower the gains from immigration. If it exceeds realized immigration, the welfare effect of immigration decreases and ultimately becomes negative. Proposition 5 shows that an increase in expected immigration that is not accompanied by an increase in realized immigration has a negative welfare effect. This implies that, for a given level of realized immigration,

[10] As above, it is assumed that no immigrants of the respective other type are in the country. Otherwise, changes in the wage sum of incumbent immigrants can affect the result.

the higher the expected immigration, the lower the welfare gain.

Proposition 5. *If realized high skilled immigration does not change ($\varepsilon_H = 0$) and $M_H(t-1) = M_L(t-1) = M_L(t) = 0$ and $\delta = r(t)$ hold, an increase in expected high skilled immigration reduces native welfare. If $\varepsilon_L = 0$, $M_H(t-1) = M_L(t-1) = M_H(t) = 0$ and $\delta = r(t)$, an increase in expected low skilled immigration reduces native welfare.*

Proof. For high skilled immigration, the welfare effect of an increase in expected immigration that is not realized is given by:

$$\begin{aligned}\frac{\partial W^*(t)}{\partial M_H^e(t)} &= -\left[F_{HH}M_H(t) - F_{HL}M_H(t)\right]N(t)\frac{\partial s^*(t)}{\partial M_H^e(t)} \\ &\quad + \left[w_H(t) - \delta w_H(t-1)s^*(t) - w_L(t)\right]N(t)\frac{\partial s^*(t)}{\partial M_H^e(t)}. \quad (3.38)\end{aligned}$$

Both terms on the right hand side are smaller than zero. As to the first term, this is obvious, as $\frac{\partial s^*(t)}{\partial M_H^e(t)} < 0$. As to the second term, it results as the term in brackets is positive. Replacing the realized wages by the expected wages, the bracket would be zero, as in proposition 4. As $\frac{\partial w_H^e(t)}{\partial M_H^e(t)} < \frac{\partial w_H(t)}{\partial M_H^e(t)}$ and $\frac{\partial w_L^e(t)}{\partial M_H^e(t)} > \frac{\partial w_L(t)}{\partial M_H^e(t)}$ the term in brackets is larger than zero.[11] The expected high skilled immigration decreases the number of low skilled natives so much that some young natives who decide for a low skill level could improve their lifetime welfare acquiring high skills. Analogously, the effect of expected low skilled immigration that is not realized is given by

$$\begin{aligned}\frac{\partial W^*(t)}{\partial M_L^e(t)} &= \left[F_{LL}M_L(t) - F_{HL}M_L(t)\right]N(t)\frac{\partial s^*(t)}{\partial M_L^e(t)} \\ &\quad + \left[w_H(t) - \delta w_H(t-1)s^*(t) - w_L(t)\right]N(t)\frac{\partial s^*(t)}{\partial M_L^e(t)}. \quad (3.39)\end{aligned}$$

As $\frac{\partial w_H^e(t)}{\partial M_L^e(t)} > \frac{\partial w_H(t)}{\partial M_L^e(t)}$ and $\frac{\partial w_L^e(t)}{\partial M_L^e(t)} < \frac{\partial w_L(t)}{\partial M_L^e(t)}$, both terms in brackets on the right hand side are smaller than zero. □

[11] $\frac{\partial w_H^e(t)}{\partial M_H^e(t)} = \left(F_{HH}^e - F_{HL}^e\right)N(t)\frac{\partial s^*(t)}{\partial M_H^e(t)} + F_{HH}^e(t) < \frac{\partial w_H(t)}{\partial M_H^e(t)} = \left(F_{HH} - F_{HL}\right)N(t)\frac{\partial s^*(t)}{\partial M_H^e(t)}$,
$\frac{\partial w_L^e(t)}{\partial M_H^e(t)} = \left(F_{HL}^e - F_{LL}^e\right)N(t)\frac{\partial s^*(t)}{\partial M_H^e(t)} + F_{HL}^e < \frac{\partial w_L(t)}{\partial M_H^e(t)} = \left(F_{HL} - F_{LL}\right)N(t)\frac{\partial s^*(t)}{\partial M_H^e(t)}$

Altogether, educational adjustment reduces the immigration surplus in perfect labor markets. However, the effect of immigration on native welfare is still positive in most cases. If young natives do not perfectly foresee future immigration, their expectations have a substantial effect on future native welfare. Independently of the realized immigration, an increase in expected high or low skilled immigration lowers native welfare. If no immigration is ultimately realized, the expectation of immigration unambiguously reduces native welfare. Nevertheless, all these results rely on the assumption that the stock of the respective other group of immigrants is small. If this stock is large, changes in the wage sum of incumbent immigrants can reverse the effects of (additional) immigration on native welfare.

3.4 Welfare effects with a minimum wage

In the real world, labor markets are not frictionless. In particular, developed countries generally have institutions that ensure a certain minimum income. These institutions are always justified by humanity, but the organization and the minimum income level vary vastly between countries. Labor market frictions can fundamentally change the welfare effects of immigration; for instance, if there is a minimum wage that is binding for low skilled workers, low skilled immigration leads to a welfare loss (see Brecher and Choudhri, 1987). To get an idea in how far the results in the preceding sections depend on the assumption of frictionless labor markets, I introduce a minimum wage in my model. Other labor market frictions, as efficiency wages and search externalities, can also influence the welfare effects of immigration. However, as a minimum wage is one of the strongest labor market frictions in the real world, I concentrate on this issue

Introducing a minimum wage $\overline{w}(t)$ in my model makes some additional assumptions necessary. The minimum wage is exogenously given and does not react to changes in the labor market. It is never binding for high skilled

and always binding for low skilled labor.[12] Thus,

$$\begin{aligned}\overline{w}(t) &= \frac{\partial F\left(H_P^e(t), L_P^e(t), X_1(t), \ldots, X_j(t)\right)}{\partial L_P^e(t)} \\ &= \frac{\partial F\left(H_P(t), L_P(t), X_1(t), \ldots, X_j(t)\right)}{\partial L_P(t)}\end{aligned} \tag{3.40}$$

with $L_P(t)$ denoting the number of employed low skilled workers.

When the number of high skilled workers increases, low skilled employment increases. Nevertheless, high skilled wages still adjust downward. This can be shown using the Euler equation. It is given by:

$$\begin{aligned}Y(t) &= F\left(H_P(t), L_p(t), X_1(t), \ldots, X_j(t)\right) \\ &= w_H(t)H_P(t) + \overline{w}_t L_P(t) + \sum_j w_{xj}(t)X_j(t);\end{aligned} \tag{3.41}$$

The last two terms from (3.8) are not considered, as (3.9) still has to hold. As the Euler equation holds for all combinations of input factors, the derivatives with respect to $H_P(t)$ of the left and right hand side have also to be equal. These derivatives are given by:

$$\begin{aligned}w_H(t) + \overline{w}(t)\frac{H_P(t)}{L_P(t)} &= \left(\frac{\partial w_H(t)}{\partial H_P(t)} + \frac{\partial w_H(t)}{\partial L_P(t)}\frac{\partial L_P(t)}{\partial H_P(t)}\right) H_P(t) + w_H(t) \\ &\quad + \overline{w}(t)\frac{H_P(t)}{L_P(t)} + \sum_j \frac{\partial w_{xj}(t)}{\partial H_P(t)} X_j(t)\end{aligned} \tag{3.42}$$

As long as there are other production factors than labor whose prices react to changes in high skilled labor ($\frac{\partial w_{xj}(t)}{\partial H_P(t)} > 0$), an increase in high skilled labor leads to a decrease in high skilled wages, $w'_H(t) = \left(\frac{\partial w_H(t)}{\partial H_P(t)} + \frac{\partial w_H(t)}{\partial L_P(t)}\frac{\partial L_P(t)}{\partial H_P(t)}\right) < 0$, although low skilled labor increases ($\frac{\partial L_P(t)}{\partial H_P(t)} > 0$).[13]

Moreover, I assume that unemployment benefits equal the minimum wage.

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[12] Without this assumption, a confusing multitude of cases would have to be analyzed.

[13] If high and low skilled labor are the only production factors, high skilled wages do not change, $\left(\frac{\partial w_H(t)}{\partial H_P(t)} + \frac{\partial w_H(t)}{\partial L_P(t)}\frac{\partial L_P(t)}{\partial H_P(t)}\right) = 0$.

To keep the state budget balanced, I additionally have to introduce a (rudimentary) tax system in the model. As I am not interested in distortions via the tax system, I use a lump-sum tax which is only paid by natives. Thus, high skilled immigration should not lead to a fiscal externality. From the state budget constraint, the tax in t, $\tau(t)$, is given by:

$$\tau(t) = \frac{\overline{w}(t)\,(L(t) - L_P(t))}{N(t)} \tag{3.43}$$

$\tau(t)$ adjusts to changes in unemployment and the number of tax payers, whereas $\overline{w}(t)$ is fixed. Modeling a tax system would not be necessary if zero income for unemployed individuals was assumed. However, in developed countries that apply minimum wages, unemployed people generally have some form of income (*e.g.* social assistance). In addition, many countries do not apply direct minimum wages but have social assistance programs that work as indirect minimum wages.[14] Therefore, to draw conclusions for the real world, unemployed individuals should also have an income in the model. As it affects the expected income of low skilled individuals, the choice of the income of unemployed is not trivial for the model.

The modeling of the choice of an individual between acquiring high and low skills in section 3.2 still holds; nevertheless, $w_L^e(t)$ now equals $\overline{w}(t)$.[15] As shown in proposition 6, expected high skilled immigration still leads to a decrease in the number of high skilled natives. Expected low skilled immigration does not affect the education decision of natives. Due to the minimum wage, additional low skilled workers do not lead to more low skilled labor in production, but only to more benefit recipients. Thus, low skilled immigration does not affect high skilled wages.[16]

Proposition 6. *In the presence of a minimum wage, high skilled immigration*

[14]Profit-maximizing individuals are not willing to work for wages below the social assistance.

[15]Assuming no income for unemployed, $w_L^e(t) = \frac{L_P(t)}{L(t)}\overline{w}(t)$ would hold.

[16]With zero income for low skilled people, low skilled immigration would increase the share of high skilled, as low skilled immigration leads to a decrease in $\frac{L_P(t)}{L(t)}$.

still decreases the share of high skilled natives.

Proof. The educational cutoff-equation with a minimum wage is:

$$S\left(w_H^e(t) - \overline{w}(t)\right) - s^*(t)w_H^e(t) = 0 \tag{3.44}$$

Implicit differentiation of (3.44) leads to:

$$\frac{\partial s^*(t)}{\partial M_H^e(t)} = -\frac{w'_H(t-1)\left(S - s^*(t)\right)}{w'_H(t-1)N(t)\left(S - s^*(t)\right) - Sw_H^e(t)} < 0 \tag{3.45}$$

□

The effect of low skilled immigration on native welfare is trivial. As it does not increase production, each additional low skilled individual leads to a loss of $\overline{w}(t)$.[17] Therefore in the following, only the welfare effects of high skilled immigration are analyzed. The effect of high skilled immigration on native welfare of cohorts t and $t-1$ is derived and summarized in lemma 2.

Lemma 2. *The effect of high skilled immigration in t on native welfare in $t-1$ and t is given by:*

$$\begin{aligned}
\frac{\partial W(t-1)}{\partial M_H^e(t)} &= -\left[w_H(t-1) + \overline{w}(t-1)\frac{\partial L_P(t-1)}{\partial H_P(t-1)} - w'_H(t-1)M_H(t-1)\right] \\
&\quad \times \frac{s^*(t)}{S} N(t) \frac{\partial s^*(t)}{\partial M_H^e(t)} \qquad (3.46) \\
\frac{\partial W(t)}{\partial M_H^e(t)} &= \left[w_H(t) + \overline{w}(t)\frac{\partial L_P(t)}{\partial H_P(t)} - w'_H(t)M_H(t)\right] N(t)\frac{\partial s^*(t)}{\partial M_H^e(t)} \\
&\quad + \left[\overline{w}(t)\frac{\partial L_P(t)}{\partial H_P(t)} - w'_H(t)M_H(t)\right] \varepsilon_H \qquad (3.47)
\end{aligned}$$

Proof. The proof is given in appendix A. □

If native education does not adjust to immigration, high skilled immigration leads to an increase in native welfare. Both terms in the second bracket

[17] As native education does not adjust to low skilled immigration, it has no welfare effect in $t-1$.

in (3.47) are positive. Thus, proposition 2 still holds with respect to high skilled immigration. However, the effect is no more conditional on a small stock of low skilled immigrants. The same holds for proposition 3. From (3.46) and (3.47), it can easily be seen that educational adjustment leads to a decrease in native welfare in cohort t and an increase in $t-1$. The terms in brackets are positive and $\frac{\partial s^*(t)}{\partial M_H^e(t)}$ is negative.

Proposition 4 also holds for high skilled immigration with a minimum wage. From (3.46) and (3.47) the overall welfare effect of high skilled immigration is:

$$\begin{aligned}\frac{\partial W^*(t)}{\partial M_H(t)} &= N(t)\Bigg(\left[w_H(t)+\overline{w}(t)\frac{\partial L_P(t)}{\partial H_P(t)}-w'_H(t)M_H(t)\right]\\ &\quad -\delta\left[w_H(t-1)+\overline{w}(t-1)\frac{\partial L_P(t-1)}{\partial H_P(t-1)}\right]\frac{s^*(t)}{S}\Bigg)\frac{\partial s^*(t)}{\partial M_H(t)}\\ &\quad +\left[\overline{w}(t)\frac{\partial L_P(t)}{\partial H_P(t)}-w'_H(t)M_H(t)\right] \qquad (3.48)\end{aligned}$$

With $M_H(t-1)=0$. For $\overline{w}(t-1)=\overline{w}(t)$, $\delta=1$, and $\frac{\partial L_P(t-1)}{\partial H_P(t-1)}=\frac{\partial L_P(t)}{\partial H_P(t)}$,[18] this can be rewritten as:

$$\begin{aligned}\frac{\partial W^*(t)}{\partial M_H(t)} &= \left[w_H(t)-w_H(t-1)\frac{s^*(t)}{S}-w'_H(t)M_H(t)\right]N(t)\frac{\partial s^*(t)}{\partial M_H(t)}\\ &\quad +\left[\overline{w}(t)\frac{\partial L_P(t)}{\partial H_P(t)}-w'_H(t)M_H(t)\right] \qquad (3.49)\end{aligned}$$

As $\frac{s^*(t)}{S}<1$, the term in the first bracket is positive. The second bracket equals the welfare effect of immigration without educational adjustment. Thus, educational adjustment still leads to a reduction in native welfare. The sign of the overall welfare effect cannot be unambiguously determined. For certain parameter set-ups, the overall welfare effect can become negative. For high skilled immigration, proposition 5 still holds: If realized high skilled

[18] $\frac{\partial L_P(t-1)}{\partial H_P(t-1)}$ and $\frac{\partial L_P(t)}{\partial H_P(t)}$ can potentially differ due to different endowments with high skilled labor. However, this differences should generally be very small.

immigration does not change, an increase in expected immigration leads to a welfare loss. To see this, replace $\frac{\partial s^*(t)}{\partial M_H(t)}$ by $\frac{\partial s^*(t)}{\partial M_H^e(t)}$ in (3.49) and set the last bracket equal to zero. As the term in front of $\frac{\partial s^*(t)}{\partial M_H(t)}$ is positive, the effect is negative.

Altogether, in spite of a minimum wage, the propositions on the effects of educational adjustment to immigration still hold for high skilled immigration. This indicates that they are not only valid for frictionless labor markets but also for labor markets that exhibit frictions. Nevertheless, the propositions do not hold anymore with respect to low skilled immigration. Low skilled immigration does not lead to changes in the native educational structure anymore. Thus, for groups of workers that are directly affected by strong labor market frictions the propositions do not hold. In the real world strong labor market frictions often affect only small parts of the labor force. Thus, the welfare effect of educational adjustment to immigration should also be an issue in the real world.

3.5 Policy implications

The findings in this paper have strong implications for the optimal design of immigration policy. First, if immigration is foreseeable, natives adjust their educational level to it. Less natives acquire the qualifications that immigrants typically have. To keep the model manageable, only two qualification levels are analyzed in the paper. Nevertheless, adjusting proposition 1 for more qualification levels is straightforward. For instance, assume that the supply of low skilled labor is fixed. High skilled individuals can choose between technical and administrative skills and technical skills lead to higher education costs. In proposition 1, high skilled workers can then simply be replaced by technically skilled workers and low skilled workers by administratively skilled workers.

An expected inflow of workers with certain qualifications has the effect that less natives acquire these qualifications. This means that immigration policy programs that are targeted at attracting specialized workers, as the

German Greencard for IT specialists, can after all be counterproductive. In the short run, such programs may be successful. Immigrants may remove the shortage of workers with certain qualifications. However, less natives will decide to acquire the respective qualifications in the long run. As soon as the inflow of foreign workers with the respective qualifications stops, the shortage will again appear and possibly be even stronger. In this context, physicians in the UK are an interesting example. For years, the number of foreign physicians has been high and the number of native physicians has been low. It is obvious that the UK has hired foreign physicians, because the supply of natives has not been sufficient. Nevertheless, it is also most likely that, without the foreign physicians, the UK would have had to motivate more young natives to study medical science. For doing this, it would have had to improve the working conditions for physicians.

As young natives cannot perfectly foresee future immigration, their expectations about immigration are decisive for their educational choice. As shown in proposition 5, the higher expected immigration relative to realized immigration, the lower native welfare. Immigration policy, and even more the public discussion about it, can strongly affect the expectations about future immigration. If an immigration program is extensively discussed in the media, (young) natives will generally expect that this program leads to a large inflow of immigrants. Similarly, if forecasts of future immigration flows are discussed in the media, young natives will generally revise their expectations about future immigration according to these numbers. My results clearly indicate that policy makers and experts should be extremely cautious in discussing migration policy in public. An understatement of future immigration is always better than an overstatement.

Nevertheless, my findings indicate that immigration is welfare-enhancing for natives in the immigration country – at least if the immigrants really enter the labor market. Hence, countries should be open for immigrants who can provide for their living themselves. They just should be cautious how the native educational structure changes.

3.6 Conclusions

Unexpected immigration leads to an increase in native welfare. If natives adjust their education decision to immigration, the welfare effect of immigration is substantially smaller and not unambiguously positive anymore. If low (high) skilled wages do not react too much to high (low) skilled labor supply, it is still positive. This holds not only in a frictionless labor market. In a labor market with a minimum wage, the same pattern results with respect to high skilled immigration, as long as the minimum wage is not binding for high skilled labor. Thus, an adjustment of the educational structure of the native population substantially alters the welfare effects of immigration. Deciding about their education, young natives cannot perfectly foresee future immigration and have to build expectations. As shown in the paper, the higher the expected number of future immigrants compared to realized immigration, the lower native welfare after immigration. When making immigration policy, possible changes in the educational structure of natives should be taken into account. As these changes depend on the expectations of young natives about future immigration, policy makers should carefully observe the formation of expectations about future immigration in the society.

A further interesting result from my model is that an adjustment of the native education structure to immigration leads to a strong redistribution of native welfare between different cohorts. Policy makers do not necessarily attach the same importance to the welfare of different cohorts. This is evident, if certain cohorts have the right to vote and others not. Thus, an immigration policy that does not maximize overall welfare but the welfare of certain groups or cohorts may be optimal for politicians. For example, low skilled immigration may lead to an increase in overall welfare but reduce welfare of cohort $t-1$. Then, a policy maker that only considers the welfare of cohort $t-1$ will not allow for low skilled immigration, although it enhances overall welfare.

3.7 Appendix A: Proofs to lemmas 1 and 2

Lemma 1

Proof. The effect of immigration in t on native welfare W of cohort $t-1$ in period $t-1$ equals the effect on output less the wage sums paid to the incumbent immigrants:

$$\begin{aligned}
\frac{\partial W(t-1)}{\partial M_H^e(t)} &= \frac{\partial}{\partial M_H^e(t)}\Big[F\left(H_P(t-1), L(t-1), X_1(t-1), \ldots, X_j(t-1)\right) \\
&\quad -w_H(t-1)M_H(t-1) - w_L(t-1)M_L(t-1)\Big] \\
&= \left[\frac{\partial F\left(\ldots\right)}{\partial H_P(t-1)} - \frac{\partial w_H(t-1)}{\partial H_P(t-1)}M_H(t-1) - \frac{\partial w_L(t-1)}{\partial H_P(t-1)}M_L(t-1)\right] \\
&\quad \times \frac{\partial H_P(t-1)}{\partial H_E[t-1)}\frac{\partial H_S(t-1)}{\partial s^*(t)}\frac{\partial s^*(t)}{\partial M_H^e(t)} \\
&= -\left[w_H(t-1) - \frac{\partial w_H(t-1)}{\partial H_P(t-1)}M_H(t-1) - \frac{\partial w_L(t-1)}{\partial H_P(t-1)}M_L(t-1)\right] \\
&\quad \times \frac{s^*(t)}{S}N(t)\frac{\partial s^*(t)}{\partial M_H^e(t)}, \qquad (3.50)
\end{aligned}$$

$$\begin{aligned}
\frac{\partial W(t-1)}{\partial M_L^e(t)} &= \frac{\partial}{\partial M_L^e(t)}\Big[F\left(H_P(t-1), L(t-1), X_1(t-1), \ldots, X_j(t-1)\right) \\
&\quad -w_H(t-1)M_H(t-1) - w_L(t-1)M_L(t-1)\Big] \\
&= -\left[w_H(t-1) - \frac{\partial w_H(t-1)}{\partial H_P(t-1)}M_H(t-1) - \frac{\partial w_L(t-1)}{\partial H_P(t-1)}M_L(t-1)\right] \\
&\quad \times \frac{s^*(t)}{S}N(t)\frac{\partial s^*(t)}{\partial M_L^{exp}(t)}. \qquad (3.51)
\end{aligned}$$

The effect in cohort t is given by

$$\begin{aligned}
\frac{\partial W(t)}{\partial M_H^e(t)} &= \frac{\partial}{\partial M_H^e(t)}[F\left(H_P(t), L(t), X_1(t), \ldots, X_j(t)\right) \\
&\quad -w_H(t)M_H(t) - w_L(t)M_L(t)] \\
&= \frac{\partial F\left(\ldots\right)}{\partial H_P(t)}\frac{\partial H_P(t)}{\partial s^*(t)}\frac{\partial s^*(t)}{\partial M_H^e(t)} + \frac{\partial F\left(\ldots\right)}{\partial L(t)}\frac{\partial L(t)}{\partial s^*(t)}\frac{\partial s^*(t)}{\partial M_H^e(t)} \\
&\quad +\frac{\partial F\left(\ldots\right)}{\partial H_P(t)}\frac{\partial H_P(t)}{\partial M_H(t)}\frac{\partial M_H(t)}{\partial M_H^e(t)} - w_H(t)\frac{\partial M_H(t)}{\partial M_H^e(t)} \\
&\quad -\left[\frac{\partial w_H(t)}{\partial H_P(t)}M_H(t) + \frac{\partial w_L(t)}{\partial H_P(t)}M_L(t)\right]\frac{\partial H_P(t)}{\partial s^*(t)}\frac{\partial s^*(t)}{\partial M_H^e(t)} \\
&\quad -\left[\frac{\partial w_H(t)}{\partial L(t)}M_H(t) + \frac{\partial w_L(t)}{\partial L(t)}M_L(t)\right]\frac{\partial L(t)}{\partial s^*(t)}\frac{\partial s^*(t)}{\partial M_H^e(t)} \\
&\quad -\left[\frac{\partial w_H(t)}{\partial H_P(t)}M_H(t) + \frac{\partial w_L(t)}{\partial H_P(t)}M_L(t)\right]\frac{\partial H_P(t)}{\partial M_H(t)}\frac{\partial M_H(t)}{\partial M_H^e(t)} \\
&= -\Big[\frac{\partial w_H(t)}{\partial H_P(t)}M_H(t) + \frac{\partial w_L(t)}{\partial H_P(t)}M_L(t) \\
&\quad -\frac{\partial w_H(t)}{\partial L(t)}M_H(t) - \frac{\partial w_L(t)}{\partial L(t)}M_L(t)\Big] \\
&\quad \times N(t)\frac{\partial s^*(t)}{\partial M_H^e(t)} + \left[w_H(t) - w_L(t)\right]N(t)\frac{\partial s^*(t)}{\partial M_H^e(t)} \\
&\quad -\left[\frac{\partial w_H(t)}{\partial H_P(t)}M_H(t) + \frac{\partial w_L(t)}{\partial H_P(t)}M_L(t)\right]\frac{\partial M_H(t)}{\partial M_H^e(t)}, \qquad (3.52) \\
\frac{\partial W(t)}{\partial M_L^e(t)} &= \frac{\partial}{\partial M_L^e(t)}[F\left(H_P(t), L(t), X_1(t), \ldots, X_j(t)\right) \\
&\quad -w_H(t)M_H(t) - w_L(t)M_L(t)] \\
&= -\Big[\frac{\partial w_H(t)}{\partial H_P(t)}M_H(t) + \frac{\partial w_L(t)}{\partial H_P(t)}M_L(t) \\
&\quad -\frac{\partial w_H(t)}{\partial L(t)}M_H(t) - \frac{\partial w_L(t)}{\partial L(t)}M_L(t)\Big] \\
&\quad \times N(t)\frac{\partial s^*(t)}{\partial M_L^e(t)} + \left[w_H(t) - w_L(t)\right]N(t)\frac{\partial s^*(t)}{\partial M_L^e(t)} \\
&\quad -\left[\frac{\partial w_H(t)}{\partial L(t)}M_H(t) + \frac{\partial w_L(t)}{\partial L(t)}M_L(t)\right]\frac{\partial M_L(t)}{\partial M_L^e(t)}. \qquad (3.53)
\end{aligned}$$

□

Lemma 2

Proof. The effect of high skilled immigration on native welfare W of cohort $t-1$ equals the effect on output less the wage sums paid to immigrants:

$$\begin{aligned}\frac{\partial W(t-1)}{\partial M_H^e(t)} &= \frac{\partial}{\partial M_H^e(t)}\Big[F\left(H_P(t-1), L_P(t-1), X_1(t-1), \ldots, X_j(t-1)\right) \\ &\quad -w_H(t-1)M_H(t-1) - \overline{w}(t-1)M_L(t-1)\Big] \\ &= \left[\frac{\partial F\left(\ldots\right)}{\partial H_P(t-1)} + \frac{\partial F\left(\ldots\right)}{\partial L_P(t-1)}\frac{\partial L_P(t-1)}{\partial H_P(t-1)} - w'_H(t-1)M_H(t-1)\right] \\ &\quad \times \frac{\partial H_P(t-1)}{\partial H_E(t-1)}\frac{\partial H_E(t-1)}{\partial s^*(t)}\frac{\partial s^*(t)}{\partial M_H^e(t)}. \end{aligned} \tag{3.54}$$

The effect in t is given by:

$$\begin{aligned}\frac{\partial W(t)}{\partial M_H^e(t)} &= \frac{\partial}{\partial M_H^e(t)}[F\left(H_P(t), L_P(t), X_1(t), \ldots, X_j(t)\right) - w_H(t)M_H(t) \\ &\quad -\overline{w}(t)M_L(t)] \\ &= \left[\frac{\partial F\left(\ldots\right)}{\partial H_P(t)} + \frac{\partial F\left(\ldots\right)}{\partial L_P(t)}\frac{\partial L_P(t)}{\partial H_P(t)} - w'_H(t)M_H(t) - w_H(t)\right]\frac{\partial M_H(t)}{\partial M_H^e(t)} \\ &\quad + \left[\frac{\partial F\left(\ldots\right)}{\partial H_P(t)} + \frac{\partial F\left(\ldots\right)}{\partial L_P(t)}\frac{\partial L_P(t)}{\partial H_P(t)} - w'_H(t)M_H(t)\right]\frac{\partial H_P(t)}{\partial s^*(t)}\frac{\partial s^*(t)}{\partial M_H^e(t)}. \end{aligned} \tag{3.55}$$

□

3.8 Appendix B: The immigration surplus in the inframarginal case

The immigration surplus $IS(t)$ is defined as the increase in total domestic production $Y(t) = F(H_P(t), L(t), \ldots)$ due to immigration less the wage sum

paid to immigrants. For high skilled immigration it can be written as:

$$IS(t) = F(H_P^1(t), \ldots) - F(H_P^0(t), \ldots) - \frac{\partial F(H_P^1(t), \ldots)}{\partial H_P^1(t)} M_H(t) \qquad (3.56)$$

with $H_P^1(t) = c(t)N(t) - H_S(t)$[19] and $H_P^1(t) = H_P^0(t) + M_H(t) - H_S(t)$. As $F(H_P(t), \ldots)$ is strictly monotonically increasing in $H_P(t)$, (3.56) can be rewritten as:

$$IS = \frac{\partial F(H_P^y(t), \ldots)}{\partial H_P^y(t)} M_H(t) - \frac{\partial F(H_P^1(t), \ldots)}{\partial H_P^1(t)} M_H(t) \qquad (3.57)$$

with $H_P^y(t) = H_P^0(t) + y(H_P^1(t) - H_P^0(t))$, $0 \leq y \leq 1$. As by the Inada conditions $\frac{\partial F(H_P(t), \ldots)}{\partial H_P(t)}$ is strictly monotonic increasing in $H_P(t)$, (3.57) can be rewritten as:

$$\begin{aligned} IS &= -\frac{\partial^2 F(H_P^z(t), \ldots)}{\partial \left(H_P^z(t)\right)^2} M_H(t) \left(H_P^1(t) - H_P^y(t)\right) \\ &= -\frac{\partial^2 F(H_P^z(t), \ldots)}{\partial \left(H_P^z(t)\right)^2} M_H^2(t) \left(1 - y\right) \end{aligned} \qquad (3.58)$$

with $H_P^z(t) = H_P^y(t) + z(H_P^1(t) - H_P^y(t))$. For constant second derivatives of the production function, the immigration surplus is overestimated by a factor of $\frac{1}{(1-y)}$, if (3.34) is used as approximation for it. As $\frac{\partial^2 F(H_P(t), \ldots)}{\partial (H_P(t))^2} < 0$, by the Inada conditions, y is closer to zero than to one.

[19] The demand for teachers does not change, as immigration does not affect the education structure of the succeeding cohort.

4 High Unemployment in Germany: Why do Foreigners Suffer Most?

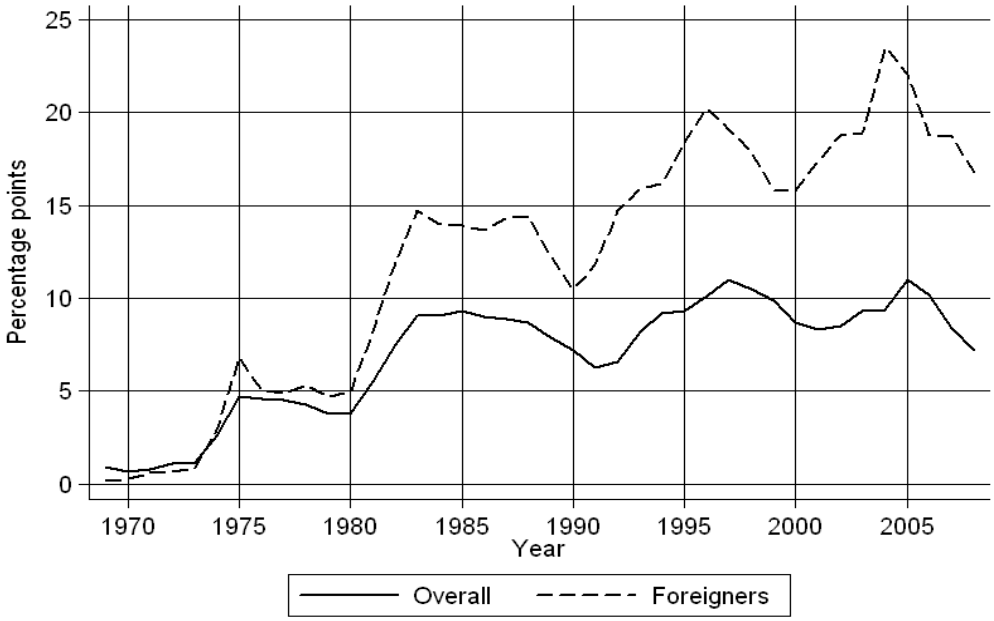
4.1 Introduction

A substantial part of today's German labor force consists of immigrants. In 2008, the share of foreigners amounted to 8.8%(see Statistisches Bundesamt, 2009). The share of foreign born people is still considerably larger(17.1% in 2005, see Geis et al., 2010). Thus, the performance of immigrants in the labor market has a sizeable effect on overall welfare in Germany. The labor market situation of immigrants is bad: In 2008, the unemployment rate of foreigners was 18.1%, whereas the overall unemployment rate was only 8.0% (Bundesanstalt für Arbeit, 2009). Comparing the developments of total and foreign unemployment over time, leads to an additional finding. The gap between foreign and native unemployment is particularly high in years with high overall unemployment rates. Figure 4.1 depicts foreign and overall unemployment rates in West Germany between 1969 and 2008.[1]

This paper analyzes empirically the reasons for the gap between native

[1]Focussing on West Germany has two advantages. First, it allows to trace unemployment back to the years before 1990. Second, as over 95% of the foreigners in Germany today live in West Germany, it also makes foreigners and natives better comparable. Therefore, in the following the paper focuses on West Germany.

Figure 4.1: Development of foreign unemployment in West Germany



Source: *Bundesanstalt für Arbeit (2009). Since 2002 data include former Eastern Berlin.*

and immigrant unemployment as well as the stronger fluctuation in immigrant unemployment. I find that the lower endowment with human capital of immigrants is the main reason. Besides lower formal degrees, lacking language skills are also a reason for the worse situation of foreigners. At least for the gap between native and immigrant unemployment, differences in social networks also play a role.

Up to now, empirical papers on the differences between immigrant and native unemployment in Germany are scarce. In contrast to this, a substantial literature deals with differences in wages between immigrants and natives in Germany (see Thomsen et al., 2007; Lang, 2005, and the refernces in these papers). This is astonishing, as employment and unemployment rates immensely differ between natives and immigrants in Germany, whereas wage levels are nearly identical (see Geis et al., 2010). In contrast, in the US, the difference in unemployment rates between immigrants and natives is negligible, whereas the difference in wages is much larger than in Germany (see Geis et al., 2010). Explanations for differences in un-/employment and

wages between natives and immigrants may be the same (differences in human capital, discrimination, etc.), but the (quantitative) relevance of these explanations can be very different (see Nordin and Rooth, 2009). Thus, to understand why immigrants are so badly integrated into the German labor market, differences in un-/employment rates have to be analyzed.

Dustmann et al. (2010) is the only paper documenting that immigrant employment in Germany (and the UK) reacts considerably more to cyclical variations than native employment.[2] They also analyze the effects of cyclical fluctuations on wages and find no difference between immigrants and natives. Moreover, they include controls for (crude) education groups and age in their empirical analysis and still find a stronger cyclicality of immigrant unemployment. My estimations also indicate that formal degrees cannot fully explain the stronger reaction of immigrant unemployment to changes on the labor market. The fact that immigrant unemployment is not only higher but also more cyclical than native unemployment has implications for an empirical analysis of the native-immigrant un-/employment gap. The gap can be decomposed into a baseline component and a labor market situation component[3] (in the following called situation component): The baseline component measures the difference between immigrant and native unemployment assuming some fixed level of native unemployment. The situation component measures the extent to which immigrant and native unemployment react differently to changes in the labor market (or to changes in the overall unemployment rate respectively). The decomposition allows us to assess how large immigrant unemployment would be for different situations on the labor market. This is a precondition for evaluating labor market measures for immigrants, when the labor market changes due to cyclical fluctuations.

Using data from the German Socio-Economic Panel (GSOEP), I analyze

[2]Nevertheless, there are also some papers on the cyclical development of the unemployment rates of the Black in the U.S.: Abbring et al. (2001), Bradbury (2000), Couch and Fairlie (2008), Fairlie and Sundstrom (1997) and Fairlie and Sundstrom (1999).

[3]This component measures primarily the effect of cyclical fluctuations. However, as the baseline is calculated for a fixed unemployment rate and not the trend unemployment rate, it is not a business cycle component in the proper meaning of the word.

the two components of the native-immigrant unemployment gap. Fixing native unemployment at zero and defining immigrants as foreigners, I find a baseline component of 5.6. This means that, for a native unemployment rate of zero, the unemployment rate of immigrants would be 5.6 percent. The situation component is 0.7. This means that a one percentage point increase in the total unemployment rate increases immigrant unemployment by 0.7 percentage points more than native unemployment. In a further step, I analyze potential explanations for these differences between native and immigrant unemployment. I include controls for various factors that can affect the probability of an individual to be employed in my empirical analysis. I first include the "classical" determinants of the labor market situation of an individual: Personal characteristics, such as age and sex, educational degrees and employment experience. Both, the baseline and the situation component of the unemployment gap are still significant. However, the baseline component decreases by 3/4 and the situation component by 4/5.

The "classical" determinants of the labor market situation are primarily measures for general human capital. However, country-specific human capital, as language skills, can also affect the labor market success of immigrants. Additionally controlling for lacking skills in the German language decreases both components of the unemployment gap by 1/2. The situation component is no more statistically significant indicating that this component is potentially fully explained by the "classical" determinants and lacking country-specific human capital. Not only human capital but also the position of an individual in the society can affect her employment success. Immigrants can have a lower position than natives due to discrimination. This can be taste based discrimination or some sort of statistical discrimination. However, lacking social networks can also impair the position of immigrants in the society. Including self-assessed discrimination and / or measure for social networks (number of friends, contact to Germans) in my estimations, the baseline component as well as the situation component of the unemployment gap become statistically and economically insignificant.

The paper is organized in the following way. In section 4.2, the empirical approach and the data are described. Section 4.3 discusses estimates for the

components of the native-immigrant unemployment gap without controls. In section 4.4, the effect of the "classical" determinants of labor market success, educational degrees and employment experience, on the unemployment gap are analyzed. Section 4.5 deals with the effects of language fluency and assimilation. In section 4.6, the relevance of discrimination and lacking social networks for the difference between native and immigrant unemployment are discussed. Section 4.7 concludes and discusses policy implications.

4.2 Data and empirical approach

Employment rates of immigrants can be strongly affected by immigration and emigration flows. Assume, for instance, that at a certain point in time a large number of highly qualified people arrive and immediately get a job. The employment rate of immigrants will rise, although no unemployed incumbent immigrant comes into employment. The unemployment rate of immigrants will correspondingly decrease. At a later point in time, the aforementioned highly qualified people may again emigrate. Then, the immigrant unemployment rate will increase, although no immigrant is actually fired. The labor market situation in an immigration country can have a strong effect on migration flows, as it affects migration incentives (*e.g.* expected wages) and immigration policy (*e.g.* recruitment programs for specialized workers). Thus, in- and outflows of immigrants can affect the situation component of the unemployment gap between immigrants and natives.

Dustmann et al. (2010) find that cyclical immigration flows are not the driving force behind the stronger cyclicality of immigrant unemployment in Germany. Analyzing the native-immigrant unemployment gap, one should nevertheless control for changes in the composition of the immigrant labor force.[4] A convenient way to do this, is to use panel data and follow the employment history of the same individuals over time. To properly measure

[4]The effects of (cyclical) changes in the immigrant labor force are potentially also an interesting object of investigation. However, they have nothing to do with the integration of immigrants that is actually analyzed with the native-immigrant unemployment gap.

the situation component[5], the data has to contain observations for different labor market situations. The German Socio-Economic Panel (GSOEP)[6] is well suited to analyze the native-immigrant unemployment gap. It contains a sufficient number of immigrants and allows to follow the employment histories of individuals over more than two business cycles (encompassing a large range of labor-market situations). In addition, the GSOEP contains information on a large variety of individual characteristics. In particular, it contains information on language usage of immigrants and social networks – information that is found in few data sets. Descriptive statistics for the variables that are used in the empirical analysis can be found in table 4.1.

In 1984, the GSOEP was launched with two partial samples, one for natives (sample A) consisting of 4,500 households and one for foreigners (sample B) consisting of 1,400 households. This "foreigner sample" mainly covers the families of former "guest worker".[7] In later years, various additional samples have been included in the GSOEP. Thereof, the "immigrant sample" (sample D) that was launched with 522 households in 1994/95 is also interesting for my analysis, as it covers more or less all immigrant groups.[8] Some of the sampled immigrant households have migrated back in the meantime, so that the composition of immigrants has also changed in the GSOEP. The GSOEP allows to distinguish return migration from panel mortality. Persons who have migrated back are not considered in my estimations.[9] One could argue that the sampling of the GSOEP yields to some kind of cohort bias. However, comparing samples A and B, this bias should have the same extent for immigrants and natives.

I define individuals who state in the survey to be working as employed

[5]If the situation component is not properly measured, the unemployment gap cannot be decomposed.

[6]See Wagner et al. (2007) for further information on the GSOEP.

[7]Only households with an Italian, Spanish, Greek, Yugoslavian or Turkish head were sampled.

[8]The sampling restriction for sample D was that at least one household member has immigrated after 1984.

[9]Completely balancing the panel would lead to a large loss of observations.

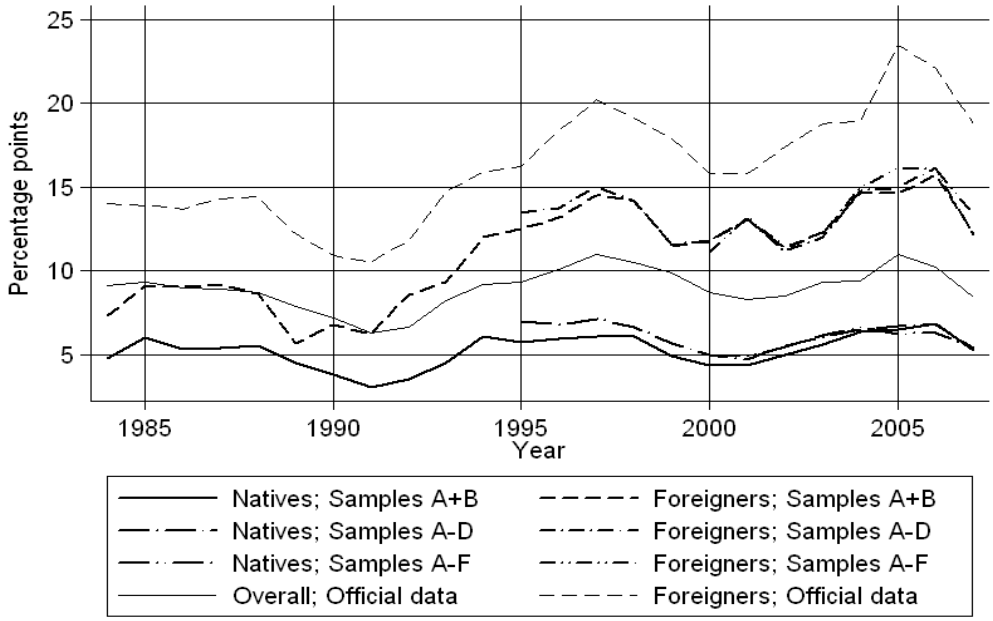
Table 4.1: Descriptive statistics

	Total Population	Natives	Foreigners	Born in Turkey	In former Yugoslavia	Elsewhere
Number of observations	196,014	155,173	40,841	13,940	7,179	18,122
Female	51.32%	52.54%	46.70%	46.38%	50.72%	48.10%
Age	44	46	38	38	43	44
	(17.2)	(17.6)	(14.1)	(13.4)	(12.5)	(14.7)
Birth year	1950	1949	1955	1956	1950	1949
	(17.7)	(18.3)	(14.4)	(13.1)	(12.0)	(14.4)
Empl. Experience	16.2	16.7	13.8	11.9	18.5	18.7
	(13.2)	(13.3)	(12.5)	(11.8)	(11.9)	(12.9)
Unempl. Experience	0.5	0.5	0.8	1.0	0.9	0.6
	(1.6)	(1.5)	(1.8)	(2.1)	(1.8)	(1.6)
CASMIN 1a	6.58%	2.51%	23.02%	25.91%	22.32%	18.12%
CASMIN 1b	20.30%	17.48%	31.68%	35.71%	27.35%	28.82%
CASMIN 1c	33.87%	36.06%	25.03%	21.09%	35.23%	29.32%
CASMIN 2a	4.89%	4.63%	5.92%	6.34%	2.10%	3.35%
CASMIN 2c-gen.	3.48%	3.76%	2.36%	1.24%	0.89%	2.16%
CASMIN 2c-voc.	4.88%	5.70%	1.57%	0.84%	0.45%	3.10%
CASMIN 3a	3.16%	3.74%	0.80%	0.68%	0.45%	1.74%
CASMIN 3b	6.03%	6.91%	2.52%	1.69%	2.16%	4.49%
Degree abroad	14.65%	0.87%	67.00%	74.57%	82.35%	54.39%
Years abroad	3.9	0.7	15.9	19.1	21.3	18.8
	(9.3)	(4.6)	(12.4)	(10.9)	(10.1)	(12.6)
Partly for. lang. at home	7.32%	0.22%	35.96%	36.40%	37.21%	27.52%
Mostly for. lang. at home	5.14%	0.08%	25.59%	41.94%	16.17%	17.18%
Newspaper language	4.57	4.99	3.12	2.43	3.48	3.62
(1 only for. - 5 only Ger.)	(1.01)	(0.16)	(1.32)	(1.18)	(1.12)	(1.35)
Sometimes discriminated	7.35%	0.33%	35.72%	43.24%	31.93%	24.80%
Often discriminated	1.67%	0.06%	8.16%	12.02%	5.61%	5.06%
No contact with Germany	2.91%	0.00%	13.99%	21.57%	10.11%	9.55%
Number of friends	4.4	4.3	4.8	5.7	4.3	3.9
	(4.3)	(4.0)	(5.3)	(6.6)	(3.3)	(3.9)

Standard deviations are given in parentheses.

and individuals who state to be unemployed as unemployed. Moreover, I define individuals as being non-working but in the labor force, if they state to be unemployed or non-working for reasons other than old age (over 65), education or training, maternity leave and military / community service. Unemployment rates that are based on these definitions are lower than the official unemployment rates. This is mainly due to the fact that in the official statistics self-employed people, civil servants and employees with income below the reporting threshold for social security are not counted as employed. For an analysis of the native-immigrant unemployment gap, these workers should be considered. Otherwise switching from dependent employment to self-employment and the like, which may be affected by the labor market situation, can bias the results. As shown in figure 4.2, official unemployment rates and unemployment rates calculated using the aforementioned

Figure 4.2: Foreign unemployment in the GSOEP



Source: *Own calculations; only persons in West Germany are considered.*

definitions show the same temporal variations.[10] As in the official data, the foreign unemployment rate shows a stronger variation than native unemployment rate. Thus, the effect of in- and outflow of immigrants on the situation component of the immigrant-native unemployment gap is obviously not substantial for the considered years.

For the empirical analysis of the native-immigrant unemployment gap, I use Pooled Probit[11] as estimation model. The dependent variable in the baseline specification is a binary variable indicating if an individual is un-

[10]Curves for samples A-F were included. Samples E+F (launched in 1998 and 2000) cover the whole population and are large (7,000 households). Thus, they make the numbers for the later years more reliable.

[11]A random or fixed effects model is not suitable for my analysis, as the variation of interest comes mainly from the cross-sectional dimension. The baseline component of the unemployment gap is solely determined by cross-sectional differences between immigrants and natives. In addition, the main determinants of the unemployment gap (*e.g.* education levels) do hardly vary over time.

employed or employed (see above). The gap between native and immigrant employment rates may differ from the gap between unemployment rates. Therefore, I use a binary variable for being employed or non-working (see the definitions above) as dependent variable in some extensions. I decided for the unemployment gap as baseline specification, as non-working is in most cases voluntary.

To measure the baseline component of the unemployment gap, I use a dummy variable indicating if an individual is an immigrant or a native person. Immigrants can either be defined by nationality or by country of birth. As the definition of immigrants can affect the results, I work with both definitions alternately. To measure the situation component, I use an interaction between the immigrant dummy and state-specific unemployment rate at the respective time. In addition, I also control for the current labor market situation using state-specific unemployment rates in all estimations. These state-specific unemployment rates are annual values[12] from the official statistic.[13] In home-country specific regressions, I use dummies for being born in Turkey, former Yugoslavia, Southern Europe, Eastern Europe and elsewhere instead of the immigrant dummy. Each of these dummies is then interacted with the state-specific unemployment rates to measure the situation components of the unemployment gaps for the various groups.

To get qualitatively and quantitatively interpretable results, I calculate marginal effects at the mean. The beta-coefficient for the interacted terms and the interaction term would not even be qualitatively interpretable (see Ai and Norton, 2003). At the mean denotes that the marginal effects are calculated for an individual with mean characteristics (mean values for the explaining variables). In Probit regressions, marginal effects differ over obser-

[12]In the GSOEP individual employment is inquired by the month. However, seasonal unemployment patterns are beyond the scope of this paper. Moreover, most other variables of interest are only available on a yearly base.

[13]The unemployment rates could also be calculated from the GSOEP. However, this has two disadvantages. First, this could lead to endogeneity bias, which is minimized using a different source and definition of the unemployment rates. Second, the GSOEP is too small to calculate reliable state specific unemployment rates and the economic situation in Germany differs over states.

vations, as they depend on the ex-ante probability of the dependent variable (the probability to be unemployed in this case). Therefore, the results presented in the following hold for average immigrants, but not necessarily for immigrants with characteristics far away from the average.

4.3 Decomposition of the native-immigrant unemployment gap

In this section, I present estimates for the baseline and situation component of the native-immigrant unemployment gap without further controls. These results tell us in how far the unemployment gap is driven by the labor market situation and allow us to assess how large the unemployment gap would be under different labor market situations (different aggregate unemployment rates). With this information, predictions of immigrant unemployment can be derived from predictions of the overall unemployment rate. This is necessary for evaluating immigration policy measures. It allows us to calculate immigrant unemployment in the counterfactual case, although the labor market situation changes due to cyclical variation.[14]

Estimation results for the two components of the unemployment gap are given in tables 4.2 and 4.3. In table 4.2, immigrants are defined by nationality, whereas in table 4.3 they are defined by country of birth. Estimated marginal effects for the baseline specification (samples A and B) and defining immigrants as foreigners are displayed in the first column of table 4.2. The value for the baseline component is given by the estimate for the foreigner dummy of 0.056. This value indicates that the immigrant unemployment rate would be 5.6 percent, if there was no native unemployment. The estimate for the interaction term of 0.0070 measures the situation component. It indicates that, if the overall unemployment rate increases by 1 percentage point, immigrant unemployment increases by 0.70 percentage points more than na-

[14]As such immigration policy measures generally work in the long run, (cyclical) labor market changes are an important issue for their evaluation.

Table 4.2: Estimates for the unemployment gap between foreigners and natives without controls

	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment rate	0.0070***	0.0072***	0.0064***	0.0068***	0.0073***	0.0084***
	(0.0005)	(0.0004)	(0.0004)	(0.0006)	(0.0008)	(0.0011)
Foreigner	0.0564***	0.0552***	0.0576***	0.0554***	0.0599***	0.0461***
	(0.0039)	(0.0039)	(0.0038)	(0.00050)	(0.0063)	(0.0078)
Foreigner*unempl.	0.0069***	0.0070***	0.0074***	0.0076***	0.0061***	0.0131***
	(0.0014)	(0.0014)	(0.0013)	(0.0018)	(0.0024)	(0.0027)
R^2	0.0281	0.0257	0.0234	0.0314	0.0250	0.0037
Observations	122956	133536	169861	71772	51184	158451
Samples	A+B	A-D	A-F	A+B	A+B	A+B

The dependent variable is a dummy variable for unemployment/employment, in (6) for non-employment/employment. The estimation method is pooled Probit and the displayed coefficients are marginal effects at the mean. Standard errors are given in parenthesis; * significant at the 10%-level, ** significant at the 5%-level and *** significant at the 1%-level. In (4) only males and in (5) only females are considered.

tive unemployment. For an overall unemployment rate of 7.2 percent, the West German unemployment rate in 2008, my estimation predicts a difference between native an immigrant unemployment of $5.6 + 0.7 \times 7.2 = 10.6$ percentage points. This almost exactly equals the actual difference of 10.5 percentage points.[15] To test the robustness of these results, I have repeated the regression using more samples from the GSOEP (columns 2 and 3 in table 4.2) and differentiating between men (column 4) and women (column 5). The estimation results are hardly affected by these changes.

Changing the definition of immigrants to people who are born abroad has a stronger effect on the results. The estimated baseline component of the unemployment gap is reduced to 5.5 percentage points and the situation component to 0.57 percentage points. Nevertheless, the difference to the baseline estimates is not statistically significant. Differentiating between home country groups shows that the unemployment gap varies strongly over immigrant groups. I find the highest baseline component for people from Turkey with 10.1 percentage points. The estimate for people from former Yugoslavia is 5.4 percentage points and thus only about half as large. The estimates for people from Eastern and Southern European countries, 4.0[16]

[15]The official foreign unemployment rate in West Germany was 16.8 percentage points and the official native unemployment rate 6.3 percentage points.

[16]Including additional samples from the GSOEP, the estimate for people from Eastern

Table 4.3: Estimates for the unemployment gap between foreign born and natives without controls

	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment rate	0.0070***	0.0069***	0.0068***	0.0068***	0.0085***	0.0078***
	(0.0005)	(0.0004)	(0.0005)	(0.0004)	(0.0011)	(0.0011)
Foreign born	0.0551***	0.0576***			0.0620***	
	(0.0041)	(0.0038)			(0.0080)	
Foreign born*unempl.	0.0057***	0.0060***			0.0113***	
	(0.0014)	(0.0013)			(0.0027)	
Born in Turkey			0.1009***	0.1042***		0.1527***
			(0.0082)	(0.0083)		(0.0134)
Turkey*unemployment			0.0108***	0.0115***		0.0134***
			(0.0028)	(0.0029)		(0.0045)
Former Yugoslavia			0.0539***	0.0539***		0.0083
			(0.0090)	(0.0091)		(0.0156)
Yugoslavia*unempl.			0.0140***	0.0142***		0.0231***
			(0.0029)	(0.0030)		(0.0047)
Southern Europe			0.0350***	0.0357***		-0.0147
			(0.0068)	(0.0069)		(0.0013)
S. Europe*unempl.			0.0006	0.0017		0.0016
			(0.0025)	(0.0025)		(0.0045)
Eastern Europe			0.0398**	0.0660***		0.1192***
			(0.0173)	(0.0098)		(0.0286)
E. Europe*unempl.			0.0023	0.0055*		-0.0018
			(0.0041)	(0.0029)		(0.0082)
Born elsewhere			0.0084	0.0273**		0.0023
			(0.0105)	(0.0113)		(0.0228)
Elsewhere*unempl.			-0.0010	-0.0008		-0.0038
			(0.0026)	(0.0025)		(0.0067)
R^2	0.0271	0.0290	0.0319	0.0329	0.0048	0.0100
Observations	122956	133536	122956	133536	158451	158451
Samples	A+B	A-D	A+B	A-D	A+B	A+B

The dependent variable is a dummy variable for unemployment/employment, in (5) and (6) for non-employment/employment. The estimation method is pooled Probit and the displayed coefficients are marginal effects at the mean. Standard errors are given in parenthesis; * significant at the 10%-level, ** significant at the 5%-level and *** significant at the 1%-level.

and 3.5 percentage points, are still smaller and the estimate for people born elsewhere is even insignificant. The estimates for the situation component of the unemployment gap are only significant for people from Turkey and former Yugoslavia. They are 1.08 and and 1.40 percentage points, respectively. Thus, immigrants from Turkey and former Yugoslavia exhibit not only the largest unemployment compared to natives. They also suffer most from deteriorations of the labor market situation in Germany. This indicates that

Europe becomes much larger. This is not surprising as after 1989 many people from Eastern Europe have immigrated to Germany and fundamentally changed this population group.

integration policy should focus on these two groups, which are also among the largest.

Analyzing the employment gap instead of the unemployment gap leads to an interesting result. If immigrants are defined as foreigners, the estimate for the baseline component of 4.6 percentage points is noticeably smaller than the estimate for the unemployment gap of 5.6 percentage points (see table 4.2). The situation component of 1.31 percentage is almost twice as high. Defining immigrants as foreign born people or differentiating between home country groups does not change this pattern (see table 4.3). Thus, compared to natives, the employment of immigrants obviously reacts more to changes in the labor market than their unemployment. The fact that immigrants in most cases have/had[17] shorter claims for unemployment insurance may be an explanation for this, although unemployment is self-assessed. Nevertheless, the extent of the difference remains puzzling.

4.4 Educational degrees and experience

Since the ground-breaking work of Mincer (1974) empirical economists generally use years of schooling or educational degrees and employment experience to explain the labor market success of individuals. In virtually all studies, statistically and economically highly significant effects of education and experience are found. This finding is independent of whether labor market success is measured by employment probabilities, wages or something else. Immigrants and natives in Germany strongly differ with respect to their educational degrees. In 2005, 14% of the foreign born people between 25 and 65 had no educational degree, whereas the overall share was only 4% (Statistisches Bundesamt, 2007).[18] Thus, the difference in the educational structure

[17]Before the Hartz IV reforms 2005 unemployment benefit claims strongly depended on the time that a person has worked in Germany.

[18]Nevertheless, as shown in Geis et al. (2010), differentiating between education groups, immigrant unemployment rates are still considerably higher than native unemployment rates.

between immigrants and natives may explain the unemployment gap.

From a theoretical point of view, the effects of low education and low experience levels of immigrants on the baseline component of the unemployment gap are obvious. The German labor market exhibits frictions that affect primarily low skilled labor. In particular, the generous social benefits in Germany lead to such frictions. These frictions prevent wages from declining to the equilibrium level and thus lead to unemployment. By the same reasoning, an effect of education and experience on the situation component of the unemployment gap can be explained. A worsening of the labor market situation is generally connected to a reduction of productivity. This reduction should lead to declining wages. However, labor market frictions prevent wage reductions, so that unemployment increases. As the frictions are stronger for low skilled people, their unemployment increases more. Thus, low education levels of immigrants can also explain the situation component of the unemployment gap.

As to cyclical changes which are the driving force behind changes in the labor market, there is yet another explanation for the different reactions of immigrant and native unemployment. For most jobs, firm or job specific human capital is necessary. Firm specific human capital has, at least partly, to be financed by the employer. Hence, hiring a new worker is more costly than retaining an incumbent worker. If a worker is not needed for a certain time but his job has to be filled again later on, depending on the time span, it can pay off for the employer to hold the worker. The higher the job specific human capital of a worker, the more likely he is retained for a certain time span, for instance during a recession, although he is not needed. High skilled workers generally need more firm specific human capital than low skilled workers, think for instance of assembly-line workers and developing engineers. Thus, they are more likely retained. Unfortunately, thorough theoretical and empirical research in how far the effects of business cycles on low and high skilled labor differ does not yet exists.[19] Nevertheless, additional estimation

[19]Hoynes (2009) and Dustmann et al. (2010) indicate that low skilled workers are stronger affected by business cycles.

results, discussed in Appendix A, show that low skilled unemployment in Germany indeed reacts more to changes in the labor-market situation than high skilled unemployment.

To control for education in my estimations, I use the Comparative Analysis of Social Mobility in Industrial Nations (CASMIN) classification for educational degrees. The CASMIN classification divides educational degrees into eight[20] groups (see Brauns et al., 2003). It is similar to the International Standard Classification of Education (ISCED), but considers explicitly vocational degrees. These vocational degrees play an important role on the German labor market. Thus, they should be considered analyzing unemployment. Employment experience is directly observed in the GSOEP.[21] Following the literature, I also include its square in the regressions to control for potential non-linearities. Not only employment experience but also unemployment experience can affect human capital and labor market success of an individual. Motivation often decreases and skills that have to be trained continuously, such as fluency in a foreign language, decline. Analogous to employment experience, I also add unemployment experience and its square in my estimations. In addition to education and experience, I also control in all regression for sex, age and birth cohort (measured by year of birth).

Estimation results with controls for education, experience and personal characteristics are given in table 4.4.[22] All estimates, including the ones for unemployment experience, have the expected signs and are highly significant (except for one CASMIN dummy). Defining immigrants as foreigners, the estimate for the baseline component of the unemployment gap is 1.5 percentage points and the estimate for the situation component is 0.15 percentage points. Both are statistically significant. A comparison with the results without controls shows that educational degrees and experience re-

[20]In the GSOEP and in my estimations level 2c is further divided into vocational and general maturity.

[21]The GSOEP even distinguishes between experience in full and part time employment. I use the sum of the two as employment experience.

[22]The square terms do not appear in the tables, as for them no own marginal effect exists. Their estimates are highly significant.

Table 4.4: Estimates with controls for education and experience

	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment rate	0.0036***	0.0036***	0.0063***	0.0036***	0.0036***	0.0036***
	(0.0003)	(0.0003)	(0.0009)	(0.0003)	(0.0003)	(0.0003)
Foreigner	0.0149***	0.0146***	0.0082		0.0127***	0.0116***
	(0.0024)	(0.0024)	(0.0070)		(0.0029)	(0.0029)
Foreigner*unempl.	0.0015**	0.0019***	0.0064***		0.0014*	0.0012***
	(0.0007)	(0.0007)	(0.0023)		(0.0007)	(0.0007)
Foreign born				0.0135***		
				(0.0024)		
Foreign born*un.				0.0008		
				(0.0007)		
Female	0.0061***	0.0072***	0.1487***	0.0056***	0.0061***	0.0061***
	(0.0017)	(0.0017)	(0.0057)	(0.0017)	(0.0017)	(0.0017)
Age	0.0004***	0.0004***	0.0141***	0.0004***	0.0004***	0.0004***
	(0.0001)	(0.0001)	(0.0005)	(0.0001)	(0.0001)	(0.0001)
Birth year	-0.0003***	-0.0003***	-0.0024***	-0.0003***	-0.0003***	-0.0003***
	(0.0001)	(0.0001)	(0.0003)	(0.0001)	(0.0001)	(0.0001)
Employment experience	-0.0011***	-0.0012***	-0.0192***	-0.0011***	-0.0011***	-0.0011***
	(0.0001)	(0.0001)	(0.0005)	(0.0001)	(0.0001)	(0.0001)
Unemployment experience	0.0171***	0.0183***	0.0593***	0.0170***	0.0171***	0.0170***
	(0.0006)	(0.0006)	(0.0036)	(0.0006)	(0.0006)	(0.0006)
CASMIN 1a (inad. completed)	0.0329***	0.0346***	0.1352***	0.0350***	0.0328***	0.0317***
	(0.0062)	(0.0062)	(0.0154)	(0.0063)	(0.0062)	(0.0062)
CASMIN 1b (gen. el. school)	0.0189***	0.0187***	0.0739***	0.0198***	0.0188***	0.0189***
	(0.0033)	(0.0032)	(0.0098)	(0.0033)	(0.0033)	(0.0033)
CASMIN 1c (basic voc. qual.)	0.0110***	0.0113***	0.0527***	0.0112***	0.0110***	0.0114***
	(0.0024)	(0.0024)	(0.0081)	(0.0024)	(0.0024)	(0.0024)
CASMIN 2b (inter. gen. qual.)	0.0012	0.0037	0.0261**	0.0019	0.0011	0.0010
	(0.0037)	(0.0037)	(0.0119)	(0.0037)	(0.0037)	(0.0037)
CASMIN 2c-gen. (gen. mat. cert.)	-0.0164***	-0.0171***	0.0754***	-0.0166***	-0.0164***	-0.0165***
	(0.0028)	(0.0030)	(0.0149)	(0.0028)	(0.0028)	(0.0028)
CASMIN 2c-voc. (voc. mat. cert.)	-0.0131***	-0.0135***	-0.0659***	-0.0134***	-0-0130***	-0-0131***
	(0.0029)	(0.0029)	(0.0101)	(0.0029)	(0.0029)	(0.0029)
CASMIN 3a (lower tert. ed.)	-0.0136***	-0.0154***	-0.1088***	-0.0139***	-0.0135***	-0.0135***
	(0.0035)	(0.0033)	(0.0123)	(0.0035)	(0.0035)	(0.0036)
CASMIN 3b (higher tert. ed.)	-0.0167***	-0.0154***	-0.1282***	-0.0169***	-0.0167***	-0.0167***
	(0.0027)	(0.0027)	(0.0086)	(0.0027)	(0.0027)	(0.0027)
Degree abroad					0.0031	
					(0.0031)	
Years abroad						0.0002
						(0.0001)
R^2	0.2388	0.2350	0.2395	0.2384	0.2388	0.2389
Observations	122956	133536	158451	122956	122956	122956
Sample	A+B	A-D	A+B	A+B	A+B	A+B

The dependent variable is a dummy variable for unemployment/employment, in (3) it is non-employment/employment. The estimation method is pooled Probit and the displayed coefficients are marginal effects at the mean. Standard errors are given in parenthesis; * significant at the 10%-level, ** significant at the 3%level and *** significant at the 1%-level. The reference category for the education levels is CASMIN 2a (intermediate vocational qualification).

duce the estimate for the baseline component by about 3/4 and the estimate for the situation component by about 4/5. Defining immigrants as foreign born leads to a similar estimate for the baseline component of 1.4 percentage points. However, the situation component of 0.8 percentage points is con-

Table 4.5: Home country specific estimates with controls

	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment rate	0.0035***	0.0035***	0.0035***	0.0032***	0.0031***	0.0052***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0012)
Born in Turkey	0.0251***	0.0125**	0.0062	0.0068	0.0055	0.0303
	(0.0042)	(0.0049)	(0.0049)	(0.0058)	(0.0057)	(0.0192)
Turkey*unemployment	0.0033**	0.0028**	0.0022*	0.0031**	0.0035**	0.0107**
	(0.0014)	(0.0013)	(0.0013)	(0.0015)	(0.0015)	(0.0050)
Former Yugoslavia	0.0073	-0.0030	-0.0082*	-0.0082	-0.0105**	-0.0567***
	(0.0050)	(0.0051)	(0.0047)	(0.0053)	(0.0052)	(0.0196)
Yugoslavia*unempl.	0.0036**	0.0021	0.0018	0.0013	0.0015	0.0096*
	(0.0014)	(0.0013)	(0.0011)	(0.0012)	(0.0013)	(0.0056)
Southern Europe	0.0069*	0.0006	-0.0052	-0.0070	-0.0095**	-0.0610***
	(0.0038)	(0.0042)	(0.0043)	(0.0047)	(0.0045)	(0.0180)
S. Europe*unempl.	-0.0021	-0.0019	-0.0022*	-0.0017	-0.0016	0.0004
	(0.0014)	(0.0014)	(0.0012)	(0.0013)	(0.0012)	(0.0050)
Eastern Europe	0.0081	0.0076	0.0069	0.0093	0.0197***	0.0338
	(0.0082	(0.0091)	(0.0089)	(0.0108)	(0.0058)	(0.0268)
E. Europe*unempl.	0.0008	0.0016	0.0016	0.0017	-0.0005	0.0025
	(0.0020)	(0.0021)	(0.0021)	(0.0022)	(0.0017)	(0.0076)
Born elsewhere	0.0102	0.0085	0.0045	-0.0039	0.0047	0.0095
	(0.0065)	(0.0078)	(0.0075)	(0.0070)	(0.0072)	(0.0299)
Elsewere*unempl.	-0.0012	-0.0018	-0.0018	-0.0033	-0.0033	-0.0019*
	(0.0022)	(0.0027)	(0.0025)	(0.0025)	(0.0020)	(0.0103)
Mostly foreign		0.0087***	0.0075***	0.0069***	0.0082***	0.0687***
language at home		(0.0021)	(0.0022)	(0.0024)	(0.0024)	(0.0144)
Partly foreign		0.0046***	0.0032**	0.0036**	0.0038**	0.0237**
language at home		(0.0015)	(0.0016)	(0.0018)	(0.0016)	(0.0107)
Foreigner			0.0091**	0.0055	0.0071	-0.0076
			(0.0039)	(0.0045)	(0.0044)	(0.00141)
No contact				0.0173**	0.0188***	0.0519***
to Germans				(0.0068)	(0.0068)	(0.0187)
Number of friends				-0.0004***	-0.0004***	-0.0013**
				(0.0001)	(0.0001)	(0.0006)
R^2	0.2395	0.2489	0.2489	0.2579	0.2541	0.3124
Observations	122956	104165	104165	82093	90637	105238
Sample	A+B	A+B	A+B	A+B	A-D	A+B

The dependent variable is a dummy variable for unemployment/employment, in (6) it is non-employment/employment. The estimation method is pooled Probit and the displayed coefficients are marginal effects at the mean. Standard errors are given in parenthesis; * significant at the 10%-level, ** significant at the 3%level and *** significant at the 1%-level. Not shown in the table in all regression CASMIN-Dummies, (squared) employment and unemployment experience, age birth year and sex were used as additional explaining variables.

siderably smaller and insignificant. Differentiating between home country groups leads to similar findings, see table 4.5. Only the baseline component for people from Turkey and the situation components for people from Turkey and former Yugoslavia are still significant at the 5 percent level.[23] Compared to the regression without controls, all estimates for the components of the

[23]At the 10 percent level, the baseline component for people from Southern Europe is also significant.

unemployment gap decreased by more than 2/3.

Although foreign educational degrees are officially equivalent to native degrees, their contents can strongly differ. Thus, people who have acquired a degree abroad may not be perfect substitutes for people who have acquired the degree in the immigration country. This could be one explanation why the unemployment gap is still significant. The GSOEP contains the information whether the highest degree has been acquired in Germany or abroad.[24] Including an indicator for the place of the highest degree in my regression, I find no significant effect for it. Besides degrees, working experience may also be imperfectly comparable over countries. Therefore, I also use the years a person has lived abroad as additional control. The estimated effect is also insignificant. In both cases, the estimates for the situation component of the unemployment gap virtually did not change. The changes in the estimates for the baseline component are not significant. Thus, the place where educational degrees and employment experience are acquired does obviously not play an important role for the success of immigrants in the German labor market.

4.5 Assimilation and language usage

Beginning with Chiswick (1978), numerous economic papers deal with the effects of assimilation on the labor market success of immigrants. Most of them measure labor market success by income. Nevertheless, some papers as Clark and Lindley (2009) and Venturini and Villosio (2008) also consider the employment probability as an additional indicator.[25] Empirical analyses have shown that, (directly) after arriving in the immigration country, immigrants earn much lower wages and have a lower probability to be employed than comparable natives. With the time that immigrants have spent

[24] I use a dummy variable indicating, if a person has acquired her highest educational or her highest vocational degree or both abroad.

[25] Amuedo-Dorantes and de la Rica (2007) analyze occupational assimilation instead of income assimilation.

in the immigration country, their wages converge to the level of comparable natives.[26] With respect to employment, such an assimilation process is less obvious (see Clark and Lindley, 2009; Venturini and Villosio, 2008). The need for immigrant assimilation can be explained by lacking immigration country specific skills, especially language fluency, at the time of arrival.[27]

The number of years an immigrant has lived in the immigration country is an obvious and often used measure for assimilation. As long as only immigrants are considered, the usage of years since migration as an explaining variable in a regression analysis does not pose a problem. However, as the aim of my estimations is to explain differences in the unemployment rates between natives and foreigners, I necessarily also have to consider observations for natives. Years since migration cannot even be set missing for them. What is now the "right" value for the years since migration of natives? At first sight, one could think of setting years since migration to zero for natives. However, this is nonsense, as it would mean that natives have the same degree of assimilation as foreigners who have just arrived. Another possibility would be to set years since migration equal to some large value (*e.g.* 100 or the life expectancy). Nevertheless, the (exact) value for years of migration would neither be justified.

There is a possibility to control for years since migration in the regressions in spite of this problem. If the number of years that an individual has lived in Germany is used as an additional control variable, years since migration can be interpreted as an interaction between years in Germany and being foreign born.[28] Including the two variables in my baseline estimation, the estimate for years since migration is statistically insignificant and positive, see table

[26]See Borjas (1994) and Borjas (1999a).

[27]Immigrant assimilation can also be explained independent of an increase in human capital. Assume that there is on the job search of the Burdett and Mortensen (1998)-type. Immigrants have to anew start their career path when they enter the immigration country (searching a first job, improving their wages by job changes and wage bargaining etc.). Thus, their wages successively assimilate to the native wage level.

[28]This means that natives get a value of zero. However, in the calculation of the marginal effects, it is considered that years since migration only have explaining power for foreigners.

Table 4.6: Estimates with controls for assimilation and language fluency

	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment rate	0.0036***	0.0036***	0.0036***	0.0036***	0.0036***	0.0064***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0011)
Foreigner	0.0106***	0.0128***	0.0074**	0.0062***		-0.0294***
	(0.0033)	(0.0030)	(0.0032)	(0.0029)		(0.0093)
Foreigner*unempl.	0.0012	0.0014*	0.0008	0.0007		0.0070***
	(0.0007)	(0.0007)	(0.0008)	(0.0007)		(0.0025)
Foreign born	0.0044				0.0053*	
	(0.0042)				(0.0030)	
Foreign born*unempl.					0.0004	
					(0.0008)	
Years in Germany	-0.0002					
	(0.0002)					
Years since migration	0.0003					
	(0.0002)					
Years in Germany/age		-0.0052				
		(0.0059)				
Mostly foreign			0.0088***		0.0096***	0.0862***
language at home			(0.0021)		(0.0020)	(0.0116)
Partly foreign			0.0035**		0.0045***	0.0253***
language at home			(0.0015)		(0.0014)	(0.0089)
Language of				-0.0020***		
newspaper reading				(0.0005)		
R^2	0.2391	0.2388	0.2481	0.2448	0.2480	0.3026
Observations	122956	122956	104165	108082	104165	133846
Sample	A+B	A+B	A+B	A+B	A+B	A+B

The dependent variable is a dummy variable for unemployment/employment, in (6) it is non-employment/employment. The estimation method is pooled Probit and the displayed coefficients are marginal effects at the mean. Standard errors are given in parenthesis; * significant at the 10%-level, ** significant at the 3%level and *** significant at the 1%-level. Not shown in the table in all regression CASMIN-Dummies, (squared) employment and unemployment experience, age birth year and sex were used as additional explaining variables. The reference category for (4) is only German spoken at home. Missing values are imputed by person using the next following (next preceding) year for which an observation exists. Persons without any observation are not considered.

4.6. [29] Assimilation would imply a negative effect.[30] As being foreigner is the definition of immigrants in the baseline case and years since migration is an interaction of being foreign born, I control for both in the estimation. Only being foreigner is significant. This indicates that nationality is more important for the unemployment gap than country of birth. Not shown in the paper, this finding is confirmed by further robustness checks. One could argue that the ability of an immigrant to assimilate depends on the age at

[29]Summing up, the estimates for years since migration and years in Germany also leads to a positive value.

[30]If an employment in the immigration country is required for immigration, this can explain a positive effect. However, this is not the relevant case in Germany where in the last years most immigrants came via family reunification programs or were "Spätaussiedler".

which she has immigrated. Then, an obvious measure for assimilation would be years in Germany relative to age. Compared to years since migration, this measure has the additional advantage that no control for years in Germany is needed. Such a control can be problematic in combination with age. The estimated effect for this relative assimilation measure is negative, as expected (see table 4.6). However, it is insignificant. Thus, my estimation results indicate that the time immigrants have spent in Germany does not explain their employment situation. It is neither an (important) determinant of the native-immigrant unemployment gap.

Language skills are generally the most important part of country specific human capital. Thus, they are probably a better measure for the labor market relevant aspects of immigrant assimilation than years since migration. The GSOEP does not directly measure the fluency of immigrants in the German language. However, it contains a question on the language spoken at home. Three response options are given: *mostly German, mostly my native language* and *both*. Using this information, I built dummy variables for speaking mostly a foreign language at home and speaking partly a foreign language at home (the answer *both*).[31] Including these two dummies in my baseline specification, I get highly significant and positive estimates for them. In addition, as expected, the estimate for mostly speaking a foreign language at home is larger than the estimate for partly speaking a foreign language. The inclusion of language skills into my estimation has also a strong effect on the estimates for both components of native-immigrant unemployment gap. The baseline component is with 0.74 percentage points only about half as large as in the case without these controls (1.49 percentage points). Nevertheless, it is still significant at the 5 percent level. The estimate for the situation component is statistically insignificant and, with 0.08 percentage points, negligibly small.[32]

[31]This information is not available for all years. For immigrants, for whom at least one observation exists, missing years have been imputed. In a loop, missing values have in a first step been replaced by the value for the following year and in a second step by the value of the preceding year.

[32]The estimate indicates that an increase in overall unemployment by 10 percentage

Robustness checks confirm these results. Defining immigrants as foreign born people leads to a similar picture, although the estimate for the baseline component is only 0.53 percentage points and significant at the 10 percent level, see table 4.6. Differentiating between home country groups, only baseline and situation component for people from Turkey remain significant, see table 4.5. Considering countries of birth, naturalization and thus nationality can also be a measure of assimilation. Including a foreigner dummy, the baseline effect for people from Turkey also becomes insignificant. Analyzing the native-immigrant employment gap instead of the unemployment gap leads to peculiar results: The estimate for the baseline component is highly significant and negative. The estimate for the situation component is highly significant and positive. This would indicate that, in good economic situations, foreigners are less likely to be non-working than comparable natives but react more to economic changes by leaving the labor market. As a further robustness check, I use a different measure of language skills. The GSOEP contains also the following question: *What nationality newspaper do you read?* with response options ranging from *Only newspaper of my home country* (1) to *only German newspapers* (5).[33] Using this variable instead of the language spoken at home leads to similar estimates for the two components of the unemployment gap, see table 4.6.[34] Nevertheless, as many people do not read newspapers regularly, this measure may be doubtful. Therefore, language spoken at home is used as control for language skills in the following.

Altogether, my estimates show that the language skills of immigrants, or more broadly their country specific human capital, are an important explanation for the native-immigrant unemployment gap. Controlling for usage of the German language, the situation component of the gap becomes in-

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points leads only to a 0.8 percentage points higher increase in the unemployment rate of immigrants compared to the increase in the unemployment rate of natives with the same human capital endowment. An effect that is obviously economically insignificant.

[33]Natives are assumed to read only German newspapers. For immigrants who state to read no newspaper at all, the variable is set to missing. Missing years are imputed as described above.

[34]Not shown in the paper including both measures in the same regression leads to peculiar results.

significant. Thus, the stronger reaction of immigrant unemployment to labor market changes can potentially be fully explained by their lower human capital endowment. Lacking language skills are also an explanation for the baseline component of the gap. Nevertheless, the baseline component is not fully explained by differences in human capital endowment. In addition, the results in this section indicate that years since migration are not closely related to language skills and cannot explain immigrant unemployment. This is in line with Schmidt (1997) who shows that earnings of immigrants in Germany neither strictly increase with years since migration. Obviously, the labor market situation of immigrants does not automatically improve with the time spent in Germany.

4.6 Discrimination and social networks

In the preceding sections, I have analyzed the impact of differences in human capital endowment on the native-immigrant unemployment gap and found that these differences cannot fully explain the gap. Although human capital is surely the most important determinant of the labor market success of an individual, it is not the only one. Her social position also affects her labor-market situation. Various factors determine the social position of an individual. Such factors are the influence that she has on others, the extent to which others owe her favors and the number and social positions of other individuals with whom she is acquainted. Human capital is certainly an important determinant of the social position of an individual. However, it cannot fully explain it.[35] Other factors, such as the possessions of an individual and the social position of her parents, also play an important role.

There are various modes of action how an individual's position in the society, or more concretely her social network, affects her labor market success. First, social contacts determine which information she has about the

[35]In how far the position is explained by human capital depends on in how far soft skills, such as capacity for teamwork, are regarded as human capital.

labor market.[36] This information is particularly important for job search. Even though job offers are publicized, social contacts can help individuals to find out about it, as collecting information on job offers is not costless. The second mode of action is also related to the information flow. Potential employers have more information about people with whom they have direct or indirect social contacts. Everything else equal, a risk averse employer will prefer a candidate about whom she has more information.

A further argument why employers should prefer applicants with a high social position is gift exchange. Potential employers may already owe the candidate or some of his relatives a favor, or they may want the candidate or his relatives to owe them a favor. In Germany, gift exchange is probably not important for regular jobs, but it may play a role for internships and the like. In addition, the position in the society determines the self-image of an individual. A strong position generally leads to a better self-assessment. This, in turn, helps the individual to sell well in job interviews and the like. Many more channels through which the position of an individual in the society affect her labor-market success are imaginable. Unfortunately, there is not yet much research on the effects of the social position on the labor market success of individuals (see Granovetter, 2005; Montgomery, 1991, for theoretical approaches).

The most obvious argument why the position of immigrants in the society should on average be lower than the position of natives is discrimination. Other members of the society may simply not be willing to have social contacts to them, because they are immigrants, or because of their ethnicity (discrimination in the sense of Becker, 1971). Thus, employers may not be willing to hire immigrants. Beckerian discrimination is not the only potential explanation for disadvantages of immigrants in recruitment processes. Information asymmetries and statistical discrimination may also play a role. In particular with respect to application documents, there can be very pronounced information asymmetries. A potential employer can often quite

[36]It can also affect the time, when she has the information. Having earlier the information of a job offer, an individual can for instance better prepare application documents.

exactly assess the content of native degrees and the quality of native educational institutions, whereas she has hardly an idea of foreign degrees and institutions. If such an employer is risk averse, she always prefers a native worker to a comparable immigrant worker. Similarly, immigrants, or certain groups of them, may on average have bad labor market relevant characteristics compared to natives, *e.g.* worse skills in the German language. In this case, an employer who cannot completely observe these characteristics may also prefer native applicants (statistical discrimination).[37]

The effect of discrimination on the labor market success of immigrants is often measured by the following approach. In an estimation, controls for all observed labor market relevant characteristics are used. The remaining difference between immigrants and natives is ascribed to discrimination, see for instance Nielsen et al. (2004). This approach is not convincing as it requires that all labor market relevant characteristics are observed.[38] Otherwise the estimated discrimination effect is biased and no statement on discrimination can be made. In general, there is hardly an alternative to this approach, as an objective measure for discrimination does not exists. The GSOEP offers a question on experienced discrimination. Of course, self-assessed discrimination is no clean measure for real discrimination. Immigrants will often not be aware that they have worse labor market relevant characteristics than natives and ascribe disadvantages to discrimination. Nevertheless, estimation results should give us at least an idea about the effects of discrimination. They should more or less be an upper bound. The exact wording of the question about discrimination is: *Over the last two years how often were you discriminated against in Germany based on your origin?* with response options *never*, *seldom* and *often*.[39] Including dummies for being often and seldom discriminated against affects the estimates for the unemployment gap. Not only the estimate for the situation component, that has already been in-

[37]See e.g. Altonji and Pierret (2001), Chaudhuri and Sethi (2008).

[38]Moreover, it has to be controlled for all non-linearities in the effects of these characteristics.

[39]Missing values are imputed as for language spoken at home.

Table 4.7: Estimates with controls for discrimination and social networks

	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment rate	0.0036***	0.0033***	0.0033***	0.0032***	0.0033***	0.0057***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0012)
Foreigner	0.0051	0.0027	0.0006	0.0005		-0.0303***
	(0.0033)	(0.0033)	(0.0035)	(0.0032)		(0.0112)
Foreigner*unempl.	0.0007	0.0008	0.0007	0.0013*		0.0067**
	(0.0008)	(0.0009)	(0.0008)	(0.0008)		(0.0029)
Foreign born					0.0023	
					(0.0033)	
Foreign born*unempl.					0.0005	
					(0.0008)	
Mostly foreign	0.0076***	0.0083***	0.0075***	0.0104***	0.0085***	0.0811***
language at home	(0.0021)	(0.0024)	(0.0024)	(0.0024)	(0.0024)	(0.0141)
Partly foreign	0.0028*	0.0041*	0.0036**	0.0055***	0.0043***	0.0269**
language at home	(0.0016)	(0.0018)	(0.0018)	(0.0016)	(0.0017)	(0.0105)
Often	0.0071***		0.0073**			
discriminated	(0.0026)		(0.0029)			
Sometimes	0.0022		0.0020			
discriminated	(0.0015)		(0.0017)			
No contact		0.0190***	0.0181***	0.0204***	0.0189***	0.0550***
to Germans		(0.0070)	(0.0069)	(0.0071)	(0.0070)	(0.0190)
Number of friends		-0.0003***	-0.0004***	-0.0004***	-0.0003***	-0.0011*
		(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0006)
R^2	0.2486	0.2565	0.2569	0.2519	0.2565	0.3109
Observations	104165	82093	82093	90637	82093	105238
Sample	A+B	A+B	A+B	A-D	A+B	A+B

The dependent variable is a dummy variable for unemployment/employment, in (6) it is non-employment/employment. The estimation method is pooled Probit and the displayed coefficients are marginal effects at the mean. Standard errors are given in parenthesis; * significant at the 10%-level, ** significant at the 3%level and *** significant at the 1%-level. Not shown in the table, in all regression CASMIN-Dummies, (squared) employment and unemployment experience, age birth year and sex were used as additional explaining variables. Missing values are imputed by person using the next following (next preceding) year for which an observation exists. Persons without any observation are not considered .

significant before, but also the estimate for the baseline component is now insignificant and small, see table 4.7. The estimates for discrimination are positive and highly significant.

Discrimination is not the only potential reason for a lower position of immigrants in the society compared to natives. Differences in social networks can also play a role. Empirical papers have shown that, in most cases, people migrate in the context migrant networks (see Munshi, 2003). Thus, they have a social network in the immigration country immediately after their arrival. Nevertheless, compared to the networks of natives, the networks of immigrants may on average still be small. In addition, they may be disconnected to the networks of natives who are influential on the labor market.

A rough measure for the size of the social network of an individual is the number of her (good) friends. The GSOEP contains a question on this. A rough measure for the connection of immigrant and native networks are private contacts between immigrants and natives. Based on questions about having been on a visit to Germans or having be visited by Germans within the the last 12 months, I built a dummy variable indicating if an immigrant has private contacts to Germans or not. Including these two variables in my estimations has the same effect as including discrimination. The estimate for the situation component and the estimate for the baseline component are both insignificant and small, see table 4.7. Having no contacts to Germans is highly significant and has the expected positive sign. The number of friends is highly significant and has the expected negative sign. Various robustness checks lead to the same results, see tables 4.5 and 4.7.

Including both self-assessed discrimination and number of friends and no contact to Germans in a regression, both have significant effects (see table 4.7). Thus, the effect of discrimination on employment is not fully explained by my measures for differences in social networks. Nevertheless, this does not necessarily mean that discrimination plays an important role in the German labor market. On the one hand, self-assessed discrimination is at least to a certain degree endogenous, so that the estimate may be upward biased. On the other hand, my measures for social networks are very rough. My estimates show that social networks have an effect on the individual employment probability. However, they probably do not capture the complete effect of social networks on un-/employment. Therefore, one should also be cautious interpreting these estimates quantitatively.

My results indicate that the worse social position of immigrants and in particular smaller social networks can be an explanation for their high unemployment. However, one has to be a bit cautious in interpreting this as a causal relation. The employment situation of a person can have an effect on her social position. As co-workers often become part of the social network, employment may enlarge the network. In addition, as staffs in most cases consist of immigrants and natives, employment may increase the probability that immigrants have social contacts to Germans. With respect

to discrimination, the same holds. Immigrants may not be discriminated against because they are immigrants, but because they are immigrants and unemployed; think of the "welfare magnet" debate. Nevertheless, my results show that the high unemployment of immigrants is related to their social position and in particular to their social networks. Thus, social networks are probably an important issue for future research on the labor market situation of immigrants.

4.7 Conclusions

The unemployment rate of immigrants in Germany is not only higher than the rate of natives. It also reacts more to changes in the labor market situation. Decomposing the native-immigrant unemployment gap into a baseline and a situation component, I find a baseline component of 5.6 percentage points and a situation component of 0.7 percentage points. The large part of the difference, about 3/4 of the baseline and 4/5 of the situation component, can be explained by differences in the endowment with "classical" human capital (educational degrees and experience). Also controlling for language skills, the situation component becomes insignificant and the baseline component again decreases by 1/2. Adding (self-assessed) discrimination and/or controls for social networks the baseline component also becomes insignificant.

What do these results imply for immigration and integration policy? If Germany wants to decrease its immigrant unemployment, it has to improve the education of immigrants. In the long run, a higher educational level will quite likely also improve the position of immigrants in the German society. Improving fluency in the German language is probably easier for an immigrant than reaching a higher educational degree. Good language skills are actually a precondition to acquire an additional degree in Germany. Thus, the starting point for integration policy are (better) language classes for immigrants. Possibly, immigrants have to be obligated to join this programs. The native-immigrant unemployment gap in Germany is immense and the costs of unemployment for the German state are large due to the generous welfare state. Thus, if a measure to improve the human capital of immigrants

is effective, even rather high investments in it will pay off. Hence, research and political effort should be put in the search for effective measures.

My results also have some implication for further research on integration of immigrants. First, besides human capital, social networks and the like are also an explanation for differences in the labor-market success between immigrants and natives. To fully understand how social networks affect the labor market success of immigrants, more theoretical and empirical research is necessary. Disentangling the effects of discrimination and social networks would not only be an enrichment for the (economic) research on integration and minorities. Social networks can also be a starting point for integration policy. Second, immigrant employment in Germany reacts much stronger to changes on the labor market, especially business cycles, than native unemployment. Thus, the labor-market situation has to be considered when analyzing differences between immigrant and native un-/employment. This is particularly important for evaluations of immigration policy measures under changing labor market situations.

4.8 Appendix: Cyclicality of skill-specific unemployment

As discussed in section 3, there is not yet much evidence on the connection between skill levels and cyclicality of unemployment. Using the data from the GSOEP, I test if low skilled unemployment reacts more to changes of the labor-market situation than high skilled unemployment. Analogous to the analysis of the situation component of the native-immigrant unemployment gap, I regress individual un-/employment on the overall unemployment rate, the individual education level and an interaction between the two. The results are given in table A1. They clearly show that low skilled unemployment reacts more to changes on the labor market than high skilled unemployment. As I do not want to control for some sort of selection here, the regressions are weighted by standard population weights.

Table 4.8: Estimates for the effect of labor market changes on skill-specific unemployment

	(1)	(2)	(3)	(4)	(5)	(6)
Unempl. rate	0.0102***	0.0074***	0.0069***	0.0035***	0.0034***	0.0036***
	(0.0003)	(0.0006)	(0.0006)	(0.0003)	(0.0003)	(0.0003)
CASMIN	-0.0172***	-0.0139***		-0.0070***	-0.0057***	
	(0.0009)	(0.0010)		(0.0006)	(0.0004)	
CASMIN*unempl.	-0.0023***	-0.0017***		-0.0009***	-0.0009***	
	(0.0002)	(0.0003)		(0.0002)	(0.0001)	
ISCED			-0.0187***			
			(0.0015)			
ISCED*unemployment			-0.0024***			
			(0.0004)			
CASMIN 1a						0.0466***
(inad. comp.)						(0.0105)
CASMIN1a*un.						0.0015
						(0.0031)
CASMIN 1b						0.0296***
(gen. el. school)						(0.0053)
CASMIN1b*un.						0.0043**
						(0.0017)
CASMIN 1c						0.0164***
(basic voc. qual.)						(0.0034)
CASMIN1c**un..						0.0009
						(0.0010)
CASMIN 2b						0.0013
(inter. gen. qual.)						(0.0047)
CASMIN2b*un.						0.0047***
						(0.0012)
CASMIN 2c-gen.						-0.0219***
(gen. mat. cert.)						(0.0030)
CASMIN2cg*un.						-0.0016
						(0.0010)
CASMIN2c-voc.						-0.0182***
(voc. mat. cert.)						(0.0045)
CASMIN2cv*un.						0.0027**
						(0.0012)
CASMIN 3a						-0.0136***
(lower tert. ed.)						(0.0048)
CASMIN3a*un.						-0.0030**
						(0.0013)
CASMIN 3b						-0.0138***
(higher tert. ed.)						(0.0034)
CASMIN3a*un.						-0.0035***
						(0.0010)
R^2	0.0650	0.0414	0.0316	0.2498	0.2387	0.2512
Controls	no	no	no	yes	yes	yes
Sample	Overall	West	West	West	A+B	West

The estimation method is pooled Probit and the displayed coefficients are marginal effects at the mean; the dependent variable is individual unemployment. Except for (5), which is unweighed, all estimations are weighted by population weights. Standard errors are given in parenthesis;* significant at the 10%-level, ** significant at the 3%level and *** significant at the 1%-level. Controls include (squared) employment and unemployment experience, age birth year sex and an foreigner/native. The reference category for the education levels in (6) is CASMIN 2a (intermediate vocational qualification).

5 Why Applying Educational Requirements for Naturalization?

5.1 Introduction

In most developed countries, passing a language test is a necessary condition for naturalization. In addition, some immigration countries, such as Germany and the US, require tests on their history, their political and social systems and the like. Such skill requirements for naturalization are the subject of controversial public discussion. However scientific research has not yet focused on them. The aim of this paper is to reveal the rationales behind skill requirements for naturalization. In addition, this paper analyzes by means of a theoretical model based on a human-capital approach how an immigration country should optimally shape the requirements for naturalization.

Basically, one can distinguish two different motives for imposing skill requirements for naturalization. First, the government of an immigration country may want to select its "new" citizens. Second, the government may want to affect the educational structure of (naturalized) immigrants by means of these requirements. The government of an immigration country, which represents the native population, can have an interest in the selection of additional citizens. With citizenship, immigrants generally obtain the right to vote in the country. Thus, a large number of naturalizations can substantially affect election outcomes and hence the balance of powers in the country. The

preferences of immigrants with respect to public goods and services may differ from the preferences of natives. Thus, as political leaders will in many cases consider the needs of the naturalized immigrants when making decisions about public expenditure and taxes, naturalization can have negative economic effects on the natives. Mariani (2004) analyzes the effect of naturalizations on political decisions. Discussing skill requirements for naturalization as a measure to select naturalized immigrants raises a fundamental question: There are many possible selection criteria (*e.g.* durations of stay). Why should the government of an immigration country base the selection of "new" citizens on the educational level of the immigrants? The educational level is an appropriate selection criterion, if the naturalization of high skilled is less problematic (or more attractive) for natives than the naturalization of low skilled. This can be the case, if the native population is relatively well educated and individual preferences with respect to public goods depend on the educational level.

Skill requirements for naturalization can also be used as a measure to improve the skill structure of (naturalized) immigrants. Basic prerequisite for doing this is that immigrants adjust their educational level to the requirements. In general, immigrants will only adjust their educational level, if naturalization leads to some welfare gain for them. There are hardly any obvious economic gains from naturalization. Permanent residence and working permits are normally preconditions for naturalization. Thus, naturalization does not directly improve the situation of immigrants in the labor market. Moreover, in most countries permanent immigrants also have the same claims for welfare benefits as natives (the US is a remarkable exception), so that naturalization does neither directly change the financial situation of immigrants. Nevertheless, naturalization has positive effects for immigrants. They can participate in political decisions and thus in the shaping of public expenditure and taxes. They get access to restricted jobs, such as policeman and attorney-at-law. And, the passport of the immigration country in many cases simplifies traveling abroad. These positive effects can be such valuable for the immigrants that they are willing to make additional investments in education to meet the naturalization requirements.

Why should an immigration country exploit the willingness of immigrants to incur expenses for an improvement of their educational structure and not simply "sell" the citizenship? Aside from the fact that, from an ethical perspective, selling the citizenship would be highly problematic, some arguments militate in favor of using naturalization requirements to improve the educational structure of immigrants. Generally, the fiscal balance of a person – that is roughly her tax payments less her receipt of public benefit – increases in her educational level. Moreover, high skilled workers may be more important for the economic development of a country than low skilled workers, as high skilled work is for instance necessary for research and development activities. Moreover, the educational levels of parents have an influence on the educational levels of their children (see Tsukahara, 2007), so that an improvement of the educational structure of immigrants can have a positive welfare effect in the long run.

As stated above, economic research has not yet dealt with skill requirements for naturalization. Altogether, social science research and, in particular, economic research on naturalization policy is still extremely scarce. There is a series of econometric studies on the determinants of the individual naturalization decision (*e.g.* Yang, 1995; Constant et al., 2007; Chiswick and Miller, 2008). Bratsberg et al. (2002) analyze the effects of naturalization on the income of immigrants in the US and find a causal effect of naturalization on the wages of naturalized immigrants. Fougère and Safi (2008), DeVoretz and Pivnenko (2006) and Bevelander and Veenmann (2008) show that naturalization also has a positive effect on the employability of immigrants. Setting a different focus, Bertocchi and Strozzi (2004) show that citizenship legislation has an effect on migration flows. Naturalization policy may not only have economic effects on (naturalized) immigrants but also on the native population. The only paper, I am aware of, that deals with such effects is Mariani (2004), who analyzes naturalization policy in a political economy framework. He models an economy with a public good that is consumed only by part of the native population and shows that the form of the right to vote in the country should have an effect on its naturalization policy.

My paper shall be a first step on the way towards a scientific foundation

for the discussion about skill requirements for naturalization. In a first step, section 5.2 analyzes how skill requirements for naturalization affect the skill structure of the immigrant population. In a second step, in section 5.3, I discuss how the government of an immigration country should set these requirements. In my theoretical model, I assume that the government only considers the fiscal balance of the immigrants and maximizes native welfare. An immigration country has to consider further effects of naturalization, such as the right to vote for the naturalized immigrants, when deciding about skill requirements for naturalization. How these further effects influence the optimal requirement level is analyzed in section 5.4. If skill requirements for naturalization have a positive welfare effect, this implies that they should also be imposed on the children of non-naturalized immigrants. In section 5.5, potential gains and risks from imposing skill requirements for these children are discussed. Section 5.6 concludes.

5.2 Naturalization and education

Most immigration countries use some form of skill requirements, such as passing a language test or successfully taking language classes, for granting naturalization to immigrants. For immigrants who already possess all skills that are required or would eventually acquire these skills anyway, the requirements will generally not affect behavior. For immigrants who lack at least some of the required skills, the decision becomes more difficult. If they want to be naturalized, they have to invest in additional skills. The more skills are missing, the more they have to invest. Such an investment is costly and will often appear as an too high, if judged from the direct expected returns from enhanced income and employment perspectives alone.

In most cases, naturalization increases the overall lifetime welfare of immigrants. With naturalization, they acquire the right to vote and can participate in decisions about taxes and public goods. They get access to certain restricted occupations that require citizenship, such as police officers. Additionally, the passport of the immigration country in many cases facilitates traveling and enables immigrants to make longer stays in their home coun-

tries without losing the right to return. In some countries, such as the USA, citizens also have better access to family reunification programs. Thus, taking into account these benefits from naturalization, the investment needed to meet the skill requirements may be worthwhile. Whether this is the case or not depends on the individual migrant's abilities. More specifically, her innate abilities will likely determine the cost of meeting the naturalization requirement, and her preferences will determine the benefits from obtaining naturalization status. In the following, I shall assume heterogeneity in migrants' innate abilities, but uniform benefits from naturalization.

With respect to the naturalization decision, four immigrant groups can be distinguished. The first group consists of all immigrants who would not gain from naturalization in any case, whereas immigrants in all other groups gain from naturalization. This group consists, for instance, of people whose home country passport allows freer traveling than the immigration country passport. These people will never apply for naturalization, so that naturalization rules do not affect them. This first group, as well as immigrants who are, for whatever reason, permanently ineligible for naturalization,[1] are not considered in the following analysis. The second group are immigrants whose ex-ante optimal skill level already lies above the requirements for naturalization. "Ex-ante" optimal refers to the skill level that an individual obtains in a first stage, based on her innate abilities without considering naturalization requirements. Immigrants in this group need not invest in additional skills to apply for naturalization. As they gain from naturalization, they apply for naturalization and are naturalized. The third group are immigrants whose ex-ante optimal skill level does not meet the naturalization requirements, but for whom the gains from naturalization outweigh the costs for additional investments in education. These people invest in additional skills until they meet the requirement and then apply for naturalization. The last group are

[1]This does not include immigrants who have not yet reached minimum lengths of stay required for naturalization. The educational decision of these immigrants is clearly affected by naturalization requirements. They additionally have to decide about the timing of their potential additional investments in education (either immediately or when the minimum length of stay is met).

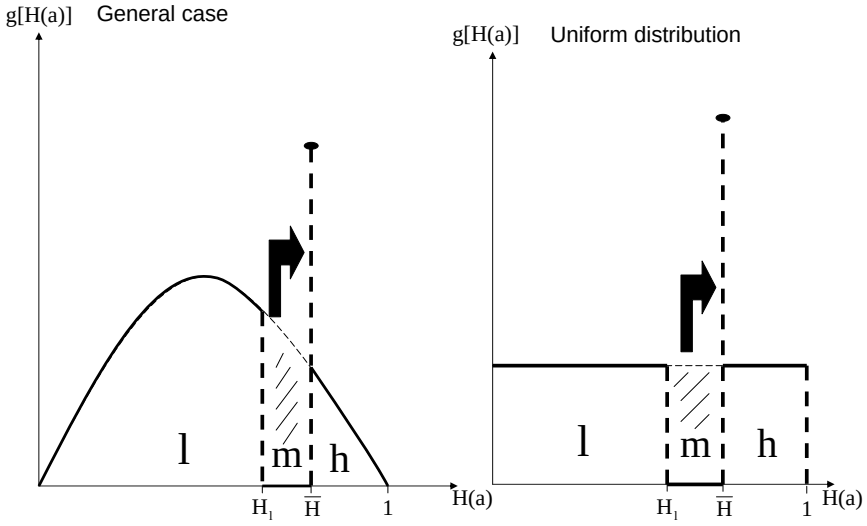
immigrants for whom the investment in education to meet the naturalization requirements is not profitable. These immigrants keep their ex-ante optimal skill level and do not apply for naturalization.

Generally, the probability of holding the skills that are required for naturalization is positively correlated with the educational level of an immigrant. The costs of the investments in additional skills that are necessary for naturalization are negatively correlated with the educational level. This is obvious, as less well educated people in most cases lack more of these skills. Thus, the group that meets the requirements ex-ante, in the following indexed by h, primarily includes immigrants with a high educational level. The group for whom increasing the skill level to reach naturalization is not profitable, indexed by l, mainly includes low skilled people. The skill levels of immigrants for whom it pays to increase their skill level, indexed by m, lie somewhere in the medium range.

Figure 5.1 shows how educational requirements for naturalization change the skill structure of immigrants, for two different continuous distributions of ex-ante optimal human capital or skill levels. The human capital (or skill level) that is required for naturalization is given by $\bar{H}$. For immigrants whose skill levels are beneath the requirement level and above a certain threshold value H_l (the group m), it pays to increase the skill levels to meet the naturalization requirements. H_l is discussed in more detail in the analysis below. Immigrants with abilities below and above this interval do not change their skill-levels, either because it does not pay off or because it is unnecessary, given their low (high) skill-levels obtained in the first stage. The naturalization requirement thus leads to a discontinuity of the skill-distribution among immigrants, which substantially complicates the analysis, as will be seen below. The two graphs show that sizes and average skill levels of the three groups, l, m and h, depend on the level of skill requirements for naturalization and the distribution of ex-ante optimal human capital levels. In the following, I will largely focus on the uniform distribution.

A simple theoretical model may illustrate the effect of a skill requirement for naturalization on the three groups: There is a continuum of immigrants $i \in [0, 1]$ with mass I. Individuals are sorted according to their innate abilities

Figure 5.1: Effects of naturalization requirements on the skill structure of immigrants



$a(i)$. The human capital of an immigrant $H(i)$ increases in her innate ability $a(i)$ and her learning effort $e(i)$ according to the following skill-formation function:

$$H(i) = \sqrt{a(i)e(i)} \tag{5.1}$$

$a(i)$ is uniformly distributed in the interval $[0, 1]$ and $0 < e(i) < 1$ has to hold. Analogously, there is a continuum of natives $n \in [0, 1]$ with mass N.

With respect to production and wages, the simplest possible assumptions are made. The economy produces one single good and is a closed economy. Human capital is the only production factor. A linear production function $Y = \alpha H^o$ is assumed, with H^o being the overall stock of human capital. Wages w equal the marginal productivity of human capital, $\partial F/\partial H^o = \alpha = w$. Thus, w is independent of H^o. The government collects a proportional income tax t that is used to finance public services and benefits. Public services and benefits are distributed to all people in the country in a lump-sum way. The amount that each individual in the country receives is sb. By assumption, the state adjusts sb to keep the budget balanced, whereas t is fixed.

Acquiring skills leads to costs for the individuals which depend on learning effort $e(i)$. The following functional form is assumed:

$$c(e(i)) = \frac{1}{2}\beta e(i) \tag{5.2}$$

These costs can be interpreted as opportunity costs, *e.g.* from leisure foregone. They do neither affect overall production nor the state budget. The decision making of immigrants about their education consists of two stages. In the first stage, immigrants choose the educational level that maximizes their income less the education costs, leaving the naturalization requirement out of consideration. In the second stage, they revise their educational decision considering the naturalization requirement. Either they increase their educational level to meet the requirement or they keep the ex-ante optimal educational level from the first stage. After having taken their final education decision, individuals enter the labor market and work. The wage income of an individual $wH(i)$ is interpreted as lifetime wage income and it is assumed that at each point in time only one cohort is present in the labor market. The educational decision of a migrant in the first stage is given by the following maximization problem:

$$\begin{aligned} &\max_{e(i)} \left[(1-t)wH(i) + sb - c(e(i))\right] \\ = &\max_{e(i)} \left((1-t)w\sqrt{a(i)e(i)} + sb - \frac{1}{2}\beta e(i)\right) \\ &\Longrightarrow [(1-t)w]^2 e(i) = \beta^2 a(i) \end{aligned} \tag{5.3}$$

To simplify the further analysis, I assume that $(1-t)w = \beta$ holds. This should not lead to much loss of generality, as β w and t are fixed in the model. The ex-ante optimal level of human capital is then:

$$\tilde{H}(a) = a(i) \tag{5.4}$$

Following the distribution of $a(i)$, $\tilde{H}(a)$ is also uniformly distributed in the

interval $[0, 1]$.[2]

When analyzing the second stage of the educational decision of immigrants, gains from naturalization have to be considered. I assume that these gains are decreasing in the level of human capital. This can be motivated by the fact that low skilled immigrants are more likely to lose access to the immigration country. First, if they return to their home countries, it is more difficult for them to re-enter the immigration country, as immigration policies generally favor high skilled people. Second, low skilled people are often more in danger of becoming delinquent and being deported. In most cases, delinquency is the only condition under which immigrants with a permanent residence permit can be deported. In the model, the gains from naturalization of an immigrant are supposed to be $B(1 - \tilde{H}(a))$.

Immigrants whose ex-ante optimal human capital is higher than the required human capital level, $\tilde{H}(a) = a(i) > \bar{H}$, are naturalized without changing their human capital level. Immigrants for whom the individual gain from naturalization $B(1 - \tilde{H}(a))$ does not outweigh the loss from the additional (over-)investment in education do neither apply for naturalization and nor change their educational level. This loss equals the costs for the additional investment in education less the higher pre-tax wage due to the increase in human capital. Thus, for immigrants for whom the following inequality holds, it does not pay to invest in additional skills to meet the naturalization requirements.

$$B(1 - \tilde{H}(a)) < c(e(\bar{H}) - e(\tilde{H}(a))) - (w(1 - t)\bar{H} - w(1 - t)\tilde{H}(a)) \quad (5.5)$$

with $e(H(a)) = H(a)^2/a$ (see (5.1)). Actually, there is still a second order effect: The higher tax payments of better educated immigrants also lead to higher public benefits. However, for a single individual this effect is negligible. Hence, I assume that immigrants do not consider the state budget when making their second stage educational decision.

[2]For $(1 - t)w \neq \beta$, $\tilde{H}(a)$ and $a(i)$ would still both be uniformly distributed but on different intervals.

From (5.5), the highest ability level for which it does not pay for an immigrant to invest in additional education to meet the naturalization requirement is given by:

$$\begin{aligned} & B(1-\tilde{H}(a)) - \frac{1}{2}w(1-t)\left(\frac{\bar{H}'^2}{a} - \frac{\tilde{H}(a)^2}{a}\right) + w(1-t)\bar{H} - w\tilde{H}(a) = 0 \\ \Rightarrow \quad & w(1-t)(\bar{H}-a) - w(1-t)\frac{1}{2a}(\bar{H}^2-a^2) + B(1-a) = 0 \\ \Rightarrow \quad & H_l(\bar{H},B) = a = \frac{\left(\bar{H}+\eta\right) - \sqrt{-2\frac{B}{w(1-t)}\bar{H}^2 + 2\eta\bar{H} + (\eta)^2}}{1+2\eta} \end{aligned} \tag{5.6}$$

with $\eta = B/((1-t)w)$. For immigrants whose ability levels lie between $H_l(\bar{H},B)$ and $\bar{H}$, acquiring additional skills in the second stage pays off. These people put exactly as much additional effort into education as they need to meet the naturalization requirements. Thus, the ultimate educational level of this medium group is $\bar{H}$.

Altogether, the model leads to the three immigrant groups discussed above: High skilled immigrants h, for whom $a(i) > \bar{H}$ holds, are naturalized without improving their educational level. Medium skilled immigrants m, for whom $a(i) \in \left[H_l(\bar{H},B);\bar{H}\right]$ holds, increase their learning effort until they reach the required educational level $\bar{H}$. Then, they are naturalized. Low skilled immigrants l, for whom $a(i) < H_l(\bar{H},B)$ holds, do not increase their learning effort and are not naturalized. The necessary educational investments to reach the requirements would not pay for them. The effect of changes in $\bar{H}$ on the sizes of groups h and l are obvious. The higher the requirements for naturalization, the smaller the group which does not have to invest into additional skills h and the larger the group for whom it does not pay to invest into additional skills l. The effect on the middle group m is by far less clear. It depends inter alia on the distribution of the ex-ante optimal educational levels, see figure 5.1.[3] In the real world, skill requirements for

[3]Up to now, the assumption of a uniform distribution has not been used in the calcu-

naturalization (and skills per-se) are not one-dimensional. Thus, the bounds between the three groups are less clear than in the model.

5.3 Optimal skill requirements for naturalization

The optimal skill requirements for naturalization depend on the aims of naturalization policy. One possible aim of an immigration country is to integrate immigrants as well as possible into its society. As naturalization generally improves integration, a government with this aim should impose only very low skill requirements, if at all. Another aim may be to keep immigrants out of the political decision process. This can be rational, as the preferences of immigrants with respect to public goods may differ from the preferences of natives. In this case, the government may be tempted to impose very tough naturalization requirements. Skill requirements for naturalization are an appropriate policy measure when the educational structure of (naturalized) immigrants shall be influenced. For other aims of naturalization policy, other types of policy measure are more suitable. For instance, to keep immigrants away from political decisions, the state can also impose long durations of stay as a requirement for naturalization.

Why should a state take measures to influence the educational structure of its immigrants? In many developed countries, immigrants are on average far less skilled than natives. Lacking qualifications of immigrants, especially lacking language skills, often lead to problems on the labor market and prevent their integration into society. There are several rationales why natives could have an interest in improving the skill structure of immigrants. First, improving the skill structure of immigrants can help strengthen the coherence of the society. Idealism of natives is not essential for this argument, as it may seem at first sight. A strong coherence of the society can also have concrete advantages for natives; for instance, it may lead to less delinquency.

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lations.

Second, an improvement of the skill level of an immigrant generally improves her fiscal balance. With an increase in the skill level of an individual, her wage normally increases and she is less at risk to become unemployed. This leads to higher state revenues in the form of income taxes and lower state expenditure in the form of unemployment benefits. In the following, I focus my analysis on these changes in the fiscal balance.

Obviously, boiling down naturalization requirements to a single dimension H and only considering the fiscal balance of immigrants is a strong simplification vis-à-vis the real world. But it seems useful for our purpose of theoretical analysis. First, almost all dimensions of naturalization requirements have educational implications. If immigrants do not meet the requirements, then aiming to do so in a very general sense implies some learning effort. And secondly, what emerges from the present analysis is that an immigration country may have an incentive to frame naturalization requirements in terms of human capital or skill-levels directly. This may be a first step to understand how the fine-tuning of naturalization requirements works (or should work, respectively) in practice.

Building on the modeling in section 5.2, the skill requirements for naturalization that maximize native welfare shall be derived. In a first step, I assume that naturalization does not lead to costs or benefits for the immigration country. Native welfare W_n is given by the after-tax incomes of all natives plus the benefits that they receive:

$$W_n = (1-t)wN \int_n H(n)\mathrm{d}n + \frac{N}{N+I}SB \tag{5.7}$$

with $H(n)$ being the human capital of a single native and SB the overall sum of public services and benefits. To keep the state budget balanced, $SB = H^o wt$ has to hold. As $H^o = N\int_n H(n)dn + I\int_i H(i)di$, (5.7) can be rewritten as

$$W_n = (1-t)wN \int_n H(n)\mathrm{d}n + tw\frac{N^2}{N+I}\int_n H(n)\mathrm{d}n + tw\frac{NI}{N+I}\int_i H(i)\mathrm{d}i. \tag{5.8}$$

Educational requirements for naturalization only affect the last summand on

the right hand side. Without requirements, it is

$$tw\frac{NI}{N+I}\int_0^1 \tilde{H}(i)\mathrm{d}i = tw\frac{NI}{N+I}\int_0^1 \tilde{H}(a)\mathrm{d}G(a). \tag{5.9}$$

With requirements it becomes

$$tw\frac{NI}{N+I}\left[\int_0^{H_l(\bar{H},B)} \tilde{H}(a)\mathrm{d}G(a) + \int_{H_l(\bar{H},B)}^{\bar{H}} \bar{H}\mathrm{d}G(a) + \int_{\bar{H}}^1 \tilde{H}(a)\mathrm{d}G(a)\right]. \tag{5.10}$$

The increase in native welfare due to naturalization requirements is thus given by

$$\Delta W_n = tw\frac{NI}{N+I}\left[\int_{H_l(\bar{H},B)}^{\bar{H}} \bar{H}\mathrm{d}G(a) - \int_{H_l(\bar{H},B)}^{\bar{H}} \tilde{H}(a)\mathrm{d}G(a)\right]. \tag{5.11}$$

Imposing the uniform distribution for a, we have $G(a) = a$ and $\mathrm{d}G(a) = \mathrm{d}a$ and

$$\Delta W_n = tw\frac{NI}{N+I}\left[\int_{H_l(\bar{H},B)}^{\bar{H}} \bar{H}\mathrm{d}a - \int_{H_l(\bar{H},B)}^{\bar{H}} \tilde{H}(a)\mathrm{d}a\right]. \tag{5.12}$$

Taking into account $\tilde{H}(a) = a$, we have

$$\begin{aligned}
\Delta W_n &= tw\frac{NI}{N+I}\left[\bar{H}^2 - \bar{H}H_l(\bar{H},B) - \int_{H_l(\bar{H},B)}^{\bar{H}} a\mathrm{d}a\right] \\
&= tw\frac{NI}{N+I}\left[\bar{H}^2 - \bar{H}H_l(\bar{H},B) - \frac{1}{2}\left(\bar{H}^2 - \left[H_l(\bar{H},B)\right]^2\right)\right] \\
&= \frac{1}{2}tw\frac{NI}{N+I}\left[\bar{H} - H_l(\bar{H},B)\right]^2.
\end{aligned} \tag{5.13}$$

The state chooses the naturalization requirement $\bar{H}$ that maximizes native welfare or the increase in native welfare because of the naturalization requirement ΔW_n, respectively. As native welfare is not affected by $\bar{H}$, as long as there is no naturalization requirement, the two optimization prob-

lems are obviously equivalent. In the following, the calculation steps for the second problem are presented, as they are much more intuitive than the steps for the first problem. Inserting

$$H_l(\bar{H}, B) = \frac{\left(\bar{H} + \eta\right) - \sqrt{-2\frac{B}{w(1-t)}\bar{H}^2 + 2\eta\bar{H} + (\eta)^2}}{1 + 2\eta}$$

into (5.13), the optimal naturalization requirement can be found from

$$max_{\bar{H}}\left\{\frac{1}{2}tw\frac{NI}{N+I}\left(\frac{2\eta\bar{H} - \eta + \sqrt{-2\frac{B}{w}\bar{H}^2 + 2\eta\bar{H} + \left(\frac{B}{w}\right)^2}}{1+2\eta}\right)^2\right\}. \quad (5.14)$$

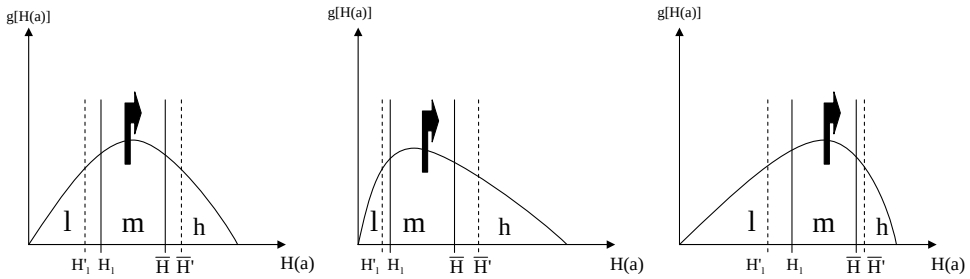
$$\begin{aligned} \Longrightarrow \quad & \frac{NI}{N+I}tw\frac{1}{(1+2\eta)^2}\left(2\eta\bar{H} - \eta + \sqrt{-2\eta\bar{H}^2 + 2\eta\bar{H} + (\eta)^2}\right) \\ & \times\left(2\eta + \frac{1}{2}\frac{-4\eta\bar{H} + 2\frac{B}{w}}{\sqrt{-2\eta\bar{H}^2 + 2\eta\bar{H} + (\eta)^2}}\right) = 0 \end{aligned}$$

$$\Longrightarrow \quad \bar{H}_1^* = \frac{1}{2} + \frac{\sqrt{8\left(\frac{B}{w(1-t)}\right)^3 + 8(\eta)^2 + 2\eta}}{2(1+2\eta)} \quad (5.15)$$

The calculation steps are given in the appendix. Table 5.1 on page 123 displays some calibrated skill requirements $\bar{H}_1^*$ and native welfare gains ΔW_{n1} for different parameter set-ups.

As shown in the appendix, the optimal educational requirement $\bar{H}_1^*$ increases in the benefits from naturalization B. Due to the higher benefits, immigrants are willing to increase their educational levels more to reach the naturalization requirement. Thus, the government can increase its educational requirements to a certain degree and the immigrants who applied for naturalization beforehand will still apply for naturalization. The range of ability levels for which it is optimal to acquire an educational level of $\bar{H}$ instead of $\tilde{H}(a)$ increases. Thus, total welfare also increases in B (also shown

Figure 5.2: Optimal naturalization requirements for different ability distributions



in the appendix).[4]

The optimal educational requirement for naturalization depends on the assumed distributions of abilities. This is obvious from figure 5.2 in which some distribution are depicted. Thus the requirement found in (5.15) is obviously influenced by the assumed uniform distribution. Due to its high variance, the uniform distribution is actually not perfectly appropriate for my analysis. In contrast to most other distributions, no unambiguous optimal naturalization requirement is found for the uniform distribution, if the distance between $\bar{H}$ and $H_l(\bar{H}, B)$ is fixed. However, to my knowledge, the uniform distribution is the only distribution that remains mathematically tractable, when the discontinuity due to the naturalization requirement is considered.[5] Figure 5.2 depicts optimal human capital requirements for naturalization for different ability distributions and a fixed distance between $\bar{H}$ and $H_l(\bar{H}, B)$. The graphs also show that an increase in this distance (to the distance between $\bar{H}'$ and H_l'), which would be the consequence of a higher B, leads to a higher increase in immigrant human capital and thus, under the assumptions discussed above, also in native welfare.

This indicates that it is in the interest of natives that the individual

[4]Analogously, an increase in wages reduces the importance of the gains from naturalization relative to income (see appendix).

[5]Not even the Pareto distribution remains mathematically tractable.

gains from naturalization for the immigrants B are rather high. There are two possibilities for a government to increase these gains, namely by improving the situation of naturalized immigrants and by downgrading the situation of non-naturalized immigrants. In the real world, improving the situation of naturalized immigrants without affecting non-naturalized immigrants is almost impossible. Nationality leads to the same rights and duties for naturalized immigrants and natives. Downgrading the situation of non-naturalized immigrants is also difficult. In developed countries, anti-discrimination legislation generally leaves little scope for doing so. Nevertheless, as discussed in Mazzolari (2009), the US have exacerbated the access to welfare benefits for immigrants in 1996. In addition, in most countries, immigration legislation with respect to family members (family re-unification programs) can be used to affect the situation of non-naturalized immigrants.

5.4 Further benefits and costs from naturalization

In the preceding section, I have assumed that naturalization does not lead to costs for the immigration country. The costs of an immigration country for the administration of naturalization are generally negligibly small. However, if preparatory classes and naturalization tests are at least partly financed by the state, naturalization costs can be substantial. Besides these direct costs, naturalization has other consequences for the immigration country and its population that can be interpreted as indirect costs or benefits. The most important of these consequences is probably that immigrants obtain the right to vote.[6] For the native population as a whole, the right to vote for immigrants is conceivably disadvantageous (see Benhabib, 1996; Dolmas and Huffman, 2004). Beforehand, natives had been able to chose extent,

[6]Of course, this holds only true for democratic societies. Moreover, immigrants can achieve the right to vote in some cases without naturalization (*e.g.* in Germany, EU-citizens have the right to vote in communal elections).

composition and allocation of public goods, as well as the tax burden, that were optimal for them. Now, the wishes of the naturalized immigrants have to be taken into account and composition and allocation of public goods will generally change. Although these changes are not costs in the literal sense, in a theoretical analysis of the effects of naturalization policy, they can be interpreted as such.

A further consequence of naturalization policy that can be interpreted as indirect costs or benefits[7] are changes in the incentives for immigration. For people who think about migrating to a certain country, the naturalization policy of this country can be quite an important factor. First, it can be decisive for the occupational success in the immigration country. For some occupations, a native citizenship is required and, for others which are connected with traveling, the passport of the immigrant country may facilitate the work. Second, naturalization policy can be an indicator how difficult it is to get integrated into the society of the immigration country. Bertocchi and Strozzi (2004) show that citizenship legislation has a significant effect on migrant flows. Various other effects of naturalization policy on native welfare can also be interpreted as indirect costs or benefits. In particular, naturalization can have an effect on the identity and the behavior of an immigrant. For instance, naturalized immigrants may invest more of their savings in the immigration country and less in their home countries.

What is the effect of these indirect costs and benefits on the optimal educational requirement for naturalization? To answer this question, we need an idea how they affect native welfare. For simplicity, I assume that the naturalization of each immigrant leads to the same costs and benefits for the immigration country. The sum of all costs and benefits can be positive or negative, but I refer to it as naturalization costs c in the following. As all immigrants with an educational level above $H_l(\bar{H}, B)$ obtain the citizenship,

[7]It is beyond the scope of this paper to judge if these incentives lead to costs of benefits for the native population in the immigration country. Nevertheless, they can affect native welfare and are thus an example for indirect costs and benefits from naturalization policy.

the overall sum of naturalization costs is

$$C = I \int\limits_{H_l(\bar{H},B)}^{1} c \, \mathrm{d}G(a). \tag{5.16}$$

These costs have to be borne by the immigration country, when immigrants are naturalized, so that the state budget becomes $SB = H^o wt - C$. In the case without naturalization, native welfare is still given by (5.8) and (5.9). In the case with naturalization, (5.10) has to be replaced by

$$tw\frac{NI}{N+I}\left[\int\limits_{0}^{H_l(\bar{H},B)} \tilde{H}(a)\mathrm{d}G(a) + \int\limits_{H_l(\bar{H},B)}^{\bar{H}} \bar{H}\mathrm{d}G(a) + \int\limits_{\bar{H}}^{1} \tilde{H}(a)\mathrm{d}G(a)\right]$$
$$-\frac{NI}{N+I}\int\limits_{H_l(\bar{H},B)}^{1} c \, \mathrm{d}G(a). \tag{5.17}$$

The increase in native welfare due to naturalization is now

$$\begin{aligned}\Delta W_n &= tw\frac{NI}{N+I}\left[\int\limits_{H_l(\bar{H},B)}^{\bar{H}} \bar{H}\mathrm{d}G(a) - \int\limits_{H_l(\bar{H},B)}^{\bar{H}} \tilde{H}(a)\mathrm{d}G(a)\right] \\ &\quad -\frac{NI}{N+I}\int\limits_{H_l(\bar{H},B)}^{1} c \, \mathrm{d}G(a).\end{aligned} \tag{5.18}$$

Alternatively to the modeling in (5.18), one could also assume that naturalization costs are solely borne by natives. In this case, the factor $\frac{N}{N+I}$ in front of the last term on the right hand side would vanish. If we think of the costs discussed above, for instance the right to vote, it is difficult to judge which alternative comes closer to reality. Nevertheless, as N, I and c are exogenous, it is only a question of the scaling of c.

Taking the uniform distribution of a and $\tilde{H}(a) = a$ into account, (5.18)

can be reshaped to

$$\Delta W_n = \frac{1}{2} tw \frac{NI}{N+I} \left[\bar{H} - H_l(\bar{H}, B)\right]^2 - \frac{NI}{N+I} c \left[1 - H_l(\bar{H}, B)\right]. \quad (5.19)$$

Inserting $H_l(\bar{H}, B)$, the optimal $\bar{H}$ is found by

$$\begin{aligned}
&\max_{\bar{H}} \frac{NI}{N+I} \Bigg\{ \frac{tw}{2} \left(\frac{2\eta\bar{H} - \eta + \sqrt{-2\frac{B}{w(1-t)}\bar{H}^2 + 2\eta\bar{H} + (\eta)^2}}{1+2\eta} \right)^2 \\
&-c\left(1 - \frac{\left(\bar{H}+\eta\right) - \sqrt{-2\eta\bar{H}^2 + 2\eta\bar{H} + (\eta)^2}}{1+2\eta}\right) \Bigg\}. \\
\Longrightarrow \quad &\Bigg\{ \frac{tw}{(1+2\eta)^2} \left(2\eta\bar{H} - \eta + \sqrt{-2\eta\bar{H}^2 + 2\eta\bar{H} + (\eta)^2} \right) \\
&\times \left(2\eta + \frac{1}{2} \frac{-4\eta\bar{H} + 2\frac{B}{w(1-t)}}{\sqrt{-2\eta\bar{H}^2 + 2\eta\bar{H} + (\eta)^2}} \right) \\
&-\frac{c}{1+2\eta} \left(-1 + \frac{1}{2} \frac{-4\eta\bar{H} + 2\eta}{\sqrt{-2\eta\bar{H}^2 + 2\eta\bar{H} + \left(\frac{B}{w}\right)^2}} \right) \Bigg\} = 0 \qquad (5.20)
\end{aligned}$$

Unfortunately, there is no closed form analytical solution for (5.20); hence we must resort to numerical methods. Table 5.1 gives an overview over optimal naturalization requirements $\bar{H}_2^*$ and welfare increases ΔW_{n2} for various parameter set-ups. In the model, an immigration country should only offer naturalization, if it leads to an increase in native welfare $\Delta W_{n2} > 0$. If naturalization costs c are too high, no (optimal) naturalization requirement $\bar{H}_2^*$ exists for which the increase in native welfare is positive (indicated by – in table 5.1).

The simulations show that, as in the case without naturalization costs, the optimal naturalization requirement $\bar{H}_2^*$ increases in the individual benefits from naturalization B. A higher B leads also to a higher increase in native welfare and thus to more native welfare. An increase in the naturalization cost c leads also to a higher optimal naturalization requirement $\bar{H}_2^*$, but to less native welfare. The higher c relative to B, the more likely no $\bar{H}_2^*$ exists

Table 5.1: Calibrated naturalization requirements

I	w	t	B	$\bar{H}_1^*$	ΔW_{n1}	c	$\bar{H}_2^*$	ΔW_{n2}	$\Delta W_{n2}^{\#}$
100	100	0.1	0.1	0.524	0.275	0.01	0.960	0.003	0.993
100	100	0.1	0.1	0.524	0.275	0.001	0.568	0.228	0.327
100	100	0.1	0.1	0.524	0.275	0	0.524	0.275	0.275
100	100	0.1	0.1	0.524	0.275	-0.001	0.478	0.327	0.228
100	100	0.1	0.01	0.507	0.028	0.01	1.050	$-*$	$-*$
100	100	0.1	0.01	0.507	0.028	0.001	0.953	0.000	0.099
100	100	0.1	0.01	0.507	0.028	0	0.507	0.028	0.028
100	100	0.1	0.01	0.507	0.028	-0.001	0.053	0.099	0.000
100	100	0.1	1	0.575	2.750	0.01	0.619	2.278	3.268
100	100	0.1	1	0.575	2.750	0.001	0.579	2.701	2.800
100	100	0.1	1	0.575	2.750	0	0.575	2.750	2.750
100	100	0.1	1	0.575	2.750	-0.001	0.570	2.800	2.701
100	100	0.5	0.1	0.532	2.475	0.001	0.537	2.426	2.525
100	100	0.05	0.1	0.523	0.130	0.001	0.618	0.085	0.184
100	10	0.1	0.1	0.575	0.275	0.001	0.619	0.228	0.327
100	1000	0.1	0.1	0.507	0.275	0.001	0.552	0.228	0.327
10	100	0.1	0.1	0.524	0.028	0.001	0.568	0.023	0.033
1000	100	0.1	0.1	0.524	2.525	0.001	0.568	2.091	3.000

N=10000

$*$ Immigration country does not offer of naturalization.

for which a positive effect on native welfare results. In addition, for positive naturalization costs, the naturalization requirement $\bar{H}_2^*$ decreases in the tax rate t, whereas, in the case without or with negative naturalization costs, it increases in the tax rate. In all cases, $\bar{H}_2^*$ increases in the wage level.

ΔW_{n2} compares native welfare with naturalization requirements to native welfare without naturalization, but we are actually interested in a comparison to native welfare with naturalization without requirements. Assuming that, in this case, naturalization costs occur for all immigrants, $\Delta W_{n2}^{\#}$ has been calculated. Considering that $\Delta W_{n2}^{\#}$ is the overall increase in native welfare, the simulated effects of naturalization requirements on natives are very small. Nevertheless, this finding is, at least partly, driven by the model assumption.

For instance, assuming a broader range for innate ability than the interval $[0, 1]$ leads to a higher increase in native welfare.

The simulation results show that indirect costs and benefits from naturalization have a strong effect on the optimal educational requirement for naturalization. In the real world, naturalization can have a large number of effects that can be interpreted as indirect costs and benefits. In relation to the fiscal balance of an immigrant, the extent of these costs and benefits can be much higher than in the model. Thus, the human capital requirement which maximizes the fiscal balance of immigrants can strongly differ from the human capital requirements that maximizes native welfare in fact. Nevertheless, the results above show clearly that an immigration country can use skill requirements for naturalization not only to select "new citizens" but also to improve the qualification structure of the immigrant population. This improvement in the qualification structure can lead to an increase in native welfare, even if naturalization leads to costs for the immigration country. Thus, governments that care about native welfare may be tempted to impose skill requirements for naturalization.

5.5 Naturalization policy with regard to children of non-naturalized immigrants

In the preceding sections, I have discussed optimal naturalization requirements for persons who have immigrated. I have shown that the immigration country has an incentive to set requirements in a way that it is not optimal, or even possible, for all immigrants to naturalize. This poses the question how the state should deal with the children of immigrants who are not naturalized. The state can either claim the same naturalization requirements as from persons that have migrated (a *ius sanguinis* legislation) or it can give the citizenship to these children without requirements (a *ius soli* legislation).

The practice of dealing with children of non-naturalized immigrants substantially depends on how the nation of the immigration country defines itself. If it defines itself as people who have been born on the same land (a

ius soli definition), children of non-naturalized immigrants are part of the nation and therefore natives. In this case, it is ethically impossible to exclude them from nationality. In addition, a pure redistribution of welfare between children of (non-naturalized) immigrants and children of natives, for instance in the form of higher tax payments, would not affect native welfare. A nation can also define itself as people with common ancestors (a *ius sanguinis* definition). In this case, there is no normative compulsion to naturalize the children of immigrants. Moreover, a redistribution of welfare between children of immigrants and children of natives leads to an increase in native welfare. Assuming a strict *ius sanguinis* definition, this is still the case, when the children of immigrants are naturalized, at least as long as both of their parents (or all of their ancestors, respectively) are immigrants. In the real world, nations generally use a mixture of *ius sanguinis* and *ius soli* to define themselves.

Educational degrees of parents influence the success of their children in the education system (see Tsukahara, 2007). Thus, the increase in the educational level of immigrants due to naturalization requirements may last over multiple generations. This implies that educational requirements for naturalization also improve the fiscal balance of the children of immigrants. If the increase in the educational levels of these children does not leads to costs for them, educational requirements for naturalization lead to a welfare gain in the following generations. In my model, the condition for this is that higher educational levels of parents affect the innate abilities of their children and not their learning efforts. Naturalization requirements for children of non-naturalized immigrants could lead to an increase in native welfare in the long run, even if the nation of the immigration country defines itself by the land of birth.

Despite of these potential gains, an analysis of naturalization requirements for the children of non-naturalized immigrants only makes sense, if the nation of the immigration country defines itself by common ancestors. Naturalization requirements for these children are an option for policy makers in the case of a *ius sanguinis* definition but not in the case *ius soli* definition. Therefore, I assume a *ius sanguinis* definition in the following. Only taking

into account the fiscal balance of immigrants, educational requirements for the naturalization of the children of non-naturalized immigrants should lead to a large welfare gain in the long run. Using a strict *ius sanguinis* definition, higher (private) education costs, which may be necessary for a higher educational level of the children of immigrants, do not affect native welfare. In terms of my model, this means that it does not matter if the higher educational level of the parents affects the ability or the learning effort of their children.

Nevertheless, a strong transmission of educational levels from parents to children can also lead to problems with naturalization requirements for children of non-naturalized immigrants. If it does not pay for parents to increase their skill level to meet the naturalization requirements, in many cases, it will neither pay for their children. Thus, in the long run, a minority without the citizenship of the immigration country can evolve. The existence of such a minority can possibly lead to costs for the immigration country (*e.g.* in the form of social tensions and riots). These costs can be larger than the gains from naturalization requirements, so that naturalization requirements harm the immigration country in the long run.

In the following, the gains (or losses) from imposing naturalization requirements for the children of non-naturalized immigrants are analyzed more formally. For this, I assume that a mass of I immigrants comes to the immigration country at a certain point in time, $t = 0$ (at this time the stock of immigrants is 0). Later on, no further immigrants arrive. Moreover, I use a strict *ius sanguinis* definition for the nation of immigration country. Concretely, I assume that, independent of their citizenship, neither immigrants nor their descendants are part of the native population. The government of the immigration country has the choice between imposing naturalization requirements for the children of non naturalized immigrants (a *ius sanguinis* legislation) and naturalizing these children without requirements (a *ius soli* legislation). In principle, the immigration country could impose different skill requirements for people who have migrated and children of non-naturalized immigrants. However, this is not the case in the real world due to equality considerations. Therefore, I assume one single naturalization requirement for

all immigrants.

In the real world, the transmission of skills from parents to children is a complex and largely unexplored process. To keep the model tractable, I assume a relatively simple intergenerational transmission: There is a one-to-one relation between parents and children; each parent has one child and each child one parent.[8] With probability y, the innate ability of a child equals the educational level of her parent. With probability $1-y$, the innate ability of a child is independent of the educational level of the parent. In this case, the ability levels of immigrant children have the same distribution as the ability levels of first generation immigrants. Thus, for any subset of the mass of $I(t)$ descendants of immigrants in generation t, we find that, for a fraction y, $a(t) = H(t-1)$ holds and, for a fraction $1-y$, $a(t)$ is uniformly distributed on the interval $[0,1]$.

Moreover, I assume that wages w, benefits from naturalization B and the tax rate t do not change over time. Thus, those children of non-naturalized immigrants who have the same educational level as their parents do not naturalize, as naturalization does not pay for them. As the other children have the same ability distribution as first generation immigrants, the children of non-naturalized immigrants who are naturalized have the same ability distribution as naturalized first generation immigrants. This means that the naturalization of people who have migrated and of people who have been born in the immigration country leads to the same increase in native welfare per naturalized immigrant in the respective generation: $\Delta W_n(0)/I^*(o) = \Delta W_n(t)/I^*(t)$ with $I^*(t)$ being the mass of naturalized immigrants.[9] Because of the intergenerational transmission of educational levels, an increase in the

[8]Thus, potential marriages between (descendants of) immigrants and natives are also omitted in the analysis

[9]Analogously to (5.19), the increase in native welfare in t from naturalization of immigrant children in t is

$$\Delta W_n = \frac{1}{2}tw\frac{NI^{**}(t)}{N+I}\left[\bar{H} - H_l(\bar{H},B)\right]^2 - \frac{NI^{**}(t)}{N+I}c\left[1 - H_l(\bar{H},B)\right] \qquad (5.21)$$

with $I^{**}(t)$ being $1-y$ times the stock of non-naturalized immigrants.

educational level of immigrants in generation t also leads to a gain in native welfare in the following generation. Not taking into account naturalization in later generations, the net present value of the overall gain in all generation from naturalization in period 0 is ΔW_n^*. Assuming an infinite time horizon and an (intergenerational) discount rate of r, this is related to the gain in period 0 in the following way:

$$\Delta W_n^* = \frac{\Delta W_n}{1 - ry}. \tag{5.22}$$

If the educational level of children is independent of the education of their parents $y = 0$, $\Delta W_n^* = \Delta W_n$ holds.

To analyze the long run effects of naturalization policies with regard to the children of non-naturalized immigrants, one has to know how many descendants of an immigrant cohort remain non-naturalized in the following generations. In the first generation, the mass of non-naturalized immigrants is given by

$$N^0 = G(a)I = \Pr\left(a(i) < \frac{\left(\bar{H} + \frac{B}{w}\right) - \sqrt{-2\frac{B}{w}\bar{H}^2 + 2\frac{B}{w}\bar{H} + \left(\frac{B}{w}\right)^2}}{1 + 2\frac{B}{w}}\right) I. \tag{5.23}$$

If children of immigrants are naturalized without requirements, the number of non-naturalized immigrants is zero in all following generations. If children of non-naturalized immigrants have to fulfill the same requirements as actual immigrants, their number in the second generation is

$$N(1) = \left[yG + (1-y)G^2\right] I. \tag{5.24}$$

In the third and fourth generation, it is

$$N(2) = \left[y^2G + 2y(1-y)G^2 + (1-y)^2n^3\right] I \tag{5.25}$$

$$N(3) = \left[y^3G + 3y^2(1-y)G^2 + 3y(1-y)^2G^3 + (1-y)^3G^4\right] I. \tag{5.26}$$

and, in the $T+1$-th generation, it is

$$N(T) = \sum_{t=0}^{T} \left[\binom{T}{t} y^{T-t} (1-y)^t n G^{t+1} \right] I. \tag{5.27}$$

If the educational level of a child is independent from the educational level of her parent ($y = 0$), the number of non-naturalized immigrants in period T is $n^T I$. If there is perfect transmission of educational levels (the educational level of the child equals the level of the parent, $y = 1$), it is nI.

In the same way, long run gains in native welfare from skill requirements for naturalization with a *ius soli* and *ius sanguinis* legislation can be derived. In the first generation, the gain is:

$$\Delta W_n^t(0) = (1-n)\,\overline{\Delta W_n} I \tag{5.28}$$

with $\overline{\Delta W_n}$ being the increase in native welfare per naturalized immigrant ($\overline{\Delta W_n}(0) = \Delta W_n(0)/(1-G)I$ in generation 0). If the immigration country applies a *ius sanguinis* legislation, the gain in the second period is given by

$$\begin{aligned} \Delta W_n^t(1) &= y(1-G)\overline{\Delta W_n} + (1-y)(1-G)G\overline{\Delta W_n} \\ &= \left[y\,(1-G) + (1-y)(1-G)G\right] \overline{\Delta W_n} I. \end{aligned} \tag{5.29}$$

The first term on the right hand side is the gain from naturalizations in generation 0.[10] The second term is the gain from naturalizations in generation

[10]Naturalization in generation 0 leads to a gain in generation 1 because of the transmission of educational levels.

1. In the third, and fourth generation respectively, it is

$$\begin{aligned}\Delta W_n^t(2) &= \left\{y^2(1-G) + y(1-y)(1-G)G \right. \\ &\quad \left. +(1-y)(1-G)\left[yG + (1-y)G^2\right]\right\}\overline{\Delta W_n}I \qquad (5.30)\\ \Delta W_n^t(3) &= \left\{y^3(1-n) + y^2(1-y)(1-G)G + \right. \\ &\quad y(1-y)(1-G)\left[yG + (1-y)G^2\right] \\ &\quad \left. +(1-y)(1-G)\left[y^2G + 2y(1-y)G^2 + (1-y)^2G^3\right]\right\}\overline{\Delta W_n}I. \\ &\qquad (5.31)\end{aligned}$$

The gain in the $T+1$-th period is

$$\begin{aligned}\Delta W_n^t(T) &= \left[\sum_{t=1}^{T}\left(y^{T-t}(1-y)(1-G)\sum_{i=1}^{t}\left[\binom{t-1}{i-1}y^{t-i}(1-y)^{i-1}G^i\right]\right)\right. \\ &\quad \left. +y^T(1-G)\right]\overline{\Delta W_n}I. \qquad (5.32)\end{aligned}$$

The net present value of all gains from naturalization up to generation T follows as

$$\begin{aligned}\Delta W_n^* &= \sum_{k=0}^{T} r^k\left[\sum_{t=1}^{k}\left(y^{k-t}(1-y)(1-G)\sum_{i=1}^{t}\left[\binom{t-1}{i-1}y^{t-i}(1-y)^{i-1}G^i\right]\right)\right. \\ &\quad \left. +y^k(1-G)\right]\overline{\Delta W_n}I. \qquad (5.33)\end{aligned}$$

With an infinite time horizon, this can be rewritten as

$$\begin{aligned}\Delta W_n^* &= \sum_{k=0}^{\infty} r^k\left[\sum_{t=1}^{k}\left(y^{k-t}(1-y)(1-G)\sum_{i=1}^{t}\left[\binom{t-1}{i-1}y^{t-i}(1-y)^{i-1}G^i\right]\right)\right] \\ &\quad \times\overline{\Delta W_n}I + \frac{(1-G)\overline{\Delta W_n}I}{(1-ry)}. \qquad (5.34)\end{aligned}$$

If a *ius soli* legislation is applied, children of immigrants are unconditionally

naturalized and the net present value of gain in native welfare is

$$\Delta W_{nu}^{*} = \frac{(1-G)\overline{\Delta W_n} I}{(1-ry)}. \tag{5.35}$$

Thus, imposing naturalization requirements also on the children of non-naturalized immigrants has the following, positive effect on native welfare:

$$\begin{aligned} \Delta(\Delta W_n^{*}) \;=\; & \sum_{k=0}^{\infty} r^k \left[\sum_{t=1}^{k} \left(y^{k-t}(1-y)(1-G) \right.\right. \\ & \left.\left. \times \sum_{i=1}^{t} \left[\binom{t-1}{i-1} y^{t-i}(1-y)^{i-1} G^i \right] \right) \right] \overline{\Delta W_n} I \end{aligned} \tag{5.36}$$

If the innate ability levels of all children are equal to the educational levels of their parents ($y = 1$), a *ius sanguinis* legislation does not lead to a welfare gain ($\Delta G = 0$). If the educational level of parent and child are completely independent, a positive welfare gain of

$$\Delta(\Delta W_{nu}^{*}) = \frac{rG(1-G)\overline{\Delta W_n} I}{(1-rG)} \tag{5.37}$$

results.

As stated above, the existence of a large non-naturalized minority in a country may lead to costs. For an immigration country, it is then only optimal to impose naturalization requirements on the children of non-naturalized immigrants, if $\Delta(\Delta W_{nu}^{*})$ is larger than the net present value of these costs. In the real world, it is hardly possible to correctly assess the expected costs of a non-naturalized minority and to compare them with long run gains from naturalization requirements. Nevertheless, my results show that, at the first sight, an immigration country whose nation defines itself by *ius sanguinis* should also impose naturalization restrictions for the children of non-naturalized immigrants. However, the negative consequences of the existence of a large non-naturalized minority may outweigh these positive effects in the long run.

5.6 Conclusions

Skill requirements for naturalization are an appropriate policy measure to improve the human capital endowment of immigrants. An increase in the skill level of immigrants generally leads to an increase in native welfare. Higher skilled immigrants are more productive, earn higher wages and pay higher taxes. The skill requirements for naturalization that maximize native welfare depend on various factors. These factors are the ex-ante distribution of skills within the immigrant population, the exact relationship between skill levels and tax payments, other aspects of naturalization that affect native welfare, such as the right to vote, and the individual gains of immigrants from naturalization. The paper shows that the skill requirements for naturalization which maximize native welfare are, under realistic conditions, not so low that it pays off for all immigrants to increase their skill level to meet them. The requirements are neither so high that all immigrants have to increase their skill level to reach them. Thus, skill requirements for naturalization that are not / cannot be met by all immigrants are much more than a sorting mechanism for "new" citizens.

My results imply that, with regard to the children of non-naturalized immigrants, a *ius sanguinis* legislation is preferable to a *ius soli* legislation, at least if these children are not automatically considered as natives. Nevertheless, if the existence of a non-naturalized minority leads to costs, for instance in the form of riots, a *ius soli* legislation can lead to a higher long-run native welfare, especially if the educational level of children strongly depends on the educational level of their parents.

5.7 Appendix

Derivation of the result in (5.15):
For (5.15) to hold, either the first or the second large parenthesis in the second to last row has to be zero. For the first parenthesis, I do not find a

zero point in the interval $(0;1)$:

$$\begin{gathered}
2\eta\bar{H}-\eta+\sqrt{-2\eta\bar{H}^2+2\eta\bar{H}+(\eta)^2}=0 \\
\sqrt{-2\eta\bar{H}^2+2\eta\bar{H}+\left(\frac{B}{(1-t)w}\right)^2}=-2\eta\bar{H}+\eta \\
-2\eta\bar{H}^2+2\eta\bar{H}+(\eta)^2=4(\eta)^2\bar{H}^2-4(\eta)^2\bar{H}+(\eta)^2 \\
(4\eta+2)\bar{H}^2-(4\eta+2)\bar{H}=0 \\
\bar{H}=0;\left(\bar{H}=1\right)
\end{gathered} \tag{5.38}$$

The only solution $\bar{H}=0$ does not lie within the interval (by insertion it can be seen that $\bar{H}=1$ is no solution). The second parenthesis has for feasible values for B, w and t a zero point within the interval $(0;1)$:

$$\begin{aligned}
& 2\eta+\frac{1}{2}\frac{-4\eta\bar{H}+2\eta}{\sqrt{-2\eta\bar{H}^2+2\eta\bar{H}+(\eta)^2}}=0 \\
\Rightarrow\quad & -2\eta\sqrt{-2\eta\bar{H}^2+2\eta\bar{H}+(\eta)^2}=\frac{1}{2}\left(-4\eta\bar{H}+2\eta\right) \\
\Rightarrow\quad & \sqrt{-2\eta\bar{H}^2+2\eta\bar{H}+(\eta)^2}=\bar{H}-1 \\
\Rightarrow\quad & -2\eta\bar{H}^2+2\eta\bar{H}+(\eta)^2=\bar{H}^2-\bar{H}+\frac{1}{4} \\
\Rightarrow\quad & (1+2\eta)\bar{H}^2-(1+2\eta)\bar{H}-\left(\frac{1}{4}-(\eta)^2\right)=0 \\
\Rightarrow\quad & \bar{H}=\frac{1+2\eta\pm\sqrt{(1+2\eta)^2-4(1+2\eta)\left(\frac{1}{4}-\left(\frac{B}{(1-t)w}\right)^2\right)}}{2(1+2\eta)} \\
\Rightarrow\quad & \bar{H}^*=\frac{1}{2}+\frac{\sqrt{8(\eta)^3+8(\eta)^2+2\eta}}{2(1+2\eta)}
\end{aligned} \tag{5.39}$$

With numerical methods, it can be shown that (for feasible values for B and $(1-t)w$) the term in (5.39) is the only solution and a maximum and lies within the interval $(0;1)$.

Effects of B and w on $\bar{H}^*$ (no naturalization costs):

$$\begin{aligned}
\frac{\partial \bar{H}^*}{\partial B} &= \frac{\frac{1\left(24(\eta)^2+16\eta+2\right)}{2\sqrt{8(\eta)^3+8(\eta)^2+2\eta}}\frac{1}{(1-t)w}2\left(1+2\eta\right)-\sqrt{8\left(\eta\right)^3+8\left(\eta\right)^2+2\eta}4\frac{1}{(1-t)w}}{4\left(1+2\eta\right)^2} \\
&= \frac{1}{(1-t)w}\frac{\left(24\left(\eta\right)^2+16\eta+2\right)\left(1+2\eta\right)-4\left(8\left(\eta\right)^3+8\left(\eta\right)^2+2\eta\right)}{4\left(1+2\frac{B}{(1-t)w}\right)^2\sqrt{8\left(\eta\right)^3+8\left(\eta\right)^2+2\eta}} \\
&= \frac{1}{(1-t)w}\frac{48\left(\eta\right)^3+56\left(\eta\right)^2+20\eta+2-32\left(\eta\right)^3-32\left(\frac{B}{(1-t)w}\right)^2-8\eta}{4\left(1+2\eta\right)^2\sqrt{8\left(\eta\right)^3+8\left(\eta\right)^2+2\eta}} \\
&= \frac{1}{(1-t)w}\frac{16\left(\eta\right)^3+24\left(\eta\right)^2+12\eta+2}{4\left(1+2\eta\right)^2\sqrt{8\left(\eta\right)^3+8\left(\eta\right)^2+2\eta}} > 0 \qquad (5.40) \\
\frac{\partial \bar{H}}{\partial w} &= -\frac{B}{(1-t)w^2}\frac{16\left(\eta\right)^3+24\left(\eta\right)^2+12\eta+2}{4\left(1+2\eta\right)^2\sqrt{8\left(\eta\right)^3+8\left(\eta\right)^2+2\eta}} < 0 \qquad (5.41)
\end{aligned}$$

Welfare effects of an increase in B (no naturalization costs):
The effect of an increase in benefits from naturalization for immigrants on native welfare is given by:

$$\begin{aligned}
&\frac{\partial}{\partial B}\left((1-t)wN\int_n H(n)\mathrm{d}n+\frac{N}{N+I}SB\right) \\
&= \frac{\partial}{\partial B}tw\frac{NI}{N+I}\max_{\bar{H}}\int_{\check{H}(i)}^{\bar{H}}\left(\bar{H}-\tilde{H}(a)\right)tw\ \mathrm{d}a > 0 \qquad (5.42)
\end{aligned}$$

The equality holds as B only affects the immigrants that opt for naturaliza-

tion. The proof that the effect is larger than zero is as follows:

$$\begin{aligned}
&\frac{\partial}{\partial B}\max_{\bar{H}^*}\int_{\tilde{H}(a)}^{\bar{H}}\left(tw\frac{NI}{N+I}\bar{H}-\tilde{H}(a)\right)\,\mathrm{d}a \\
= \quad &\frac{\partial}{\partial B}\frac{1}{2}tw\frac{NI}{N+I}\left(\frac{2\eta\bar{H}^*-\eta+\sqrt{-2\eta\bar{H}^{*2}+2\eta\bar{H}^*+(\eta)^2}}{1+2\eta}\right)^2 \\
= \quad & tw\tfrac{NI}{N+I}\left(\tfrac{2\eta\bar{H}^*-\eta+\sqrt{-2\frac{B}{w}\bar{H}^{*2}+2\eta\bar{H}^*+(\eta)^2}}{1+2\eta}\right)\left(\tfrac{1}{1+2\eta}\right)^2 \\
&\times\Bigg[(1+2\eta)\left(2\bar{H}^*-1+\tfrac{-2\bar{H}^{*2}+2\bar{H}^*+2\eta}{2\sqrt{-2\frac{B}{(1-t)w}\bar{H}^{*2}+2\eta\bar{H}^*+(\eta)^2}}\right) \\
&-2\left(2\eta\bar{H}^*-\eta+\sqrt{-2\eta\bar{H}^{*2}+2\eta\bar{H}^*+(\eta)^2}\right)\Bigg] \qquad (5.43)
\end{aligned}$$

To derive the marginal effect of an increase in B, I assume the optimal education requirements $\bar{H}^*$ to be fixed. If B has a positive effect on welfare with fixed $\bar{H}^*$, it definitely also increases welfare with an adjustment of $\bar{H}^*$. The change from the fixed (no more optimal) $\bar{H}^*$ to the new optimal $\bar{H}^*$, by the definition of $\bar{H}$, has to increase welfare. The first and the second large bracket in (5.43) are positive (the first bracket equals the probability to be treated). Thus, it has only to be shown that the third large bracket is also positive:

$$\begin{aligned}
&\left(1+2\frac{B}{w}\right)\left(2\bar{H}^*-1+\frac{-2\bar{H}^{*2}+2\bar{H}^*+2\frac{B}{w}}{2\sqrt{-2\frac{B}{w}\bar{H}^{*2}+2\frac{B}{w}\bar{H}^*+\left(\frac{B}{w}\right)^2}}\right) \\
&-2\left(2\frac{B}{w}\bar{H}^*-\frac{B}{w}+\sqrt{-2\frac{B}{w}\bar{H}^{*2}+2\frac{B}{w}\bar{H}^*+\left(\frac{B}{w}\right)^2}\right)
\end{aligned}$$

$$
\begin{aligned}
&= 2\bar{H}^* - 1 + \left(1 + 2\frac{B}{w}\right) \frac{-\bar{H}^{*2} + \bar{H}^* + \frac{B}{w}}{\sqrt{-2\frac{B}{w}\bar{H}^{*2} + 2\frac{B}{w}\bar{H}^* + \left(\frac{B}{w}\right)^2}} \\
&\quad -2\sqrt{-2\frac{B}{w}\bar{H}^{*2} + 2\frac{B}{w}\bar{H}^* + \left(\frac{B}{w}\right)^2} \\
&= 2\bar{H}^* - 1 + \left(-2\eta\bar{H}^{*2} + 2\frac{B}{(1-t)w}\bar{H}^* + (\eta)^2\right)^{-\frac{1}{2}} \\
&\quad \times \Bigg[(1+2\eta)\left(-\bar{H}^{*2} + \bar{H}^* + \eta\right) \\
&\quad -2\left(-2\eta\bar{H}^{*2} + 2\eta\bar{H}^* + (\eta)^2\right) \Bigg] \\
&= 2\bar{H}^* - 1 + \left(-2\eta\bar{H}^{*2} + 2\eta\bar{H}^* + (\eta)^2\right)^{-\frac{1}{2}} \\
&\quad \times \left(-\bar{H}^{*2} + \bar{H}^* + \eta + 2\eta\bar{H}^{*2} - 2\eta\bar{H}^*\right) \\
&= 2\bar{H}^* - 1 + \left(-2\eta\bar{H}^{*2} + 2\eta\bar{H}^* + (\eta)^2\right)^{-\frac{1}{2}} \\
&\quad \times \left((1-2\eta)\,\bar{H} - \left(1 - 2\frac{B}{(1-t)w}\right)\bar{H}^{*2} + \eta\right) \\
&> 0 \qquad (5.44)
\end{aligned}
$$

By (5.15), $0,5 < \bar{H}^* \leq 1$. The inequality holds as long $\eta < \frac{1}{2}$, a condition that should generally be fulfilled.

6 Conclusions

As for all immigration countries, the integration of immigrants is a challenge for Germany. Especially people with Turkish roots, the largest immigrant group in Germany, often exhibit strong integration deficits. These deficits lead to high shares of welfare recipients among the immigrants and to high crime rates. Thus, lacking integration is connected with large public expenditure for the immigration country. Discussing immigration policy, policy makers as well as the public often fear that new immigrants will not be willing or able to properly integrate. Therefore, immigration countries are often extremely reluctant to allow for new inflows of permanent migrants.

Integration deficits are generally reflected in problems of immigrants on the labor market. In Germany, the unemployment rate of immigrants is much higher than the unemployment rate of natives. Moreover, as shown in chapter 4, they are also more affected by cyclical variations on the labor market. My empirical investigations clearly indicate that lacking human capital is the main reason for the worse labor market performance of immigrants. On average, immigrants have much lower formal educational degrees than natives. In addition, many immigrants cannot make full use their qualifications on the labor market because of lacking language skills. Remarkably, the labor market situation of immigrants, ceteris paribus, does not significantly improve with years in Germany. Discrimination and / or lacking labor market relevant social networks also play a certain role for the labor market situation of immigrants, but compared to human capital their influence is small.

This clearly indicates that the starting point to improve the labor market situation of immigrants lies in their education. It is difficult to increase the (formal) qualification level of an immigrant after she has entered the labor market. However, improving her language fluency is less demanding. The main measure to do this are courses in the German language. On the one hand, the state should offer a large variety of language courses to meet the needs of the immigrants. On the other hand, it should set strong incentives for immigrants to participate in these courses. For immigrants who do not already have permanent residence permits, this can happen in the form of requirements for the extension of residence permits. With respect to other immigrants, one could think of cuts of welfare benefits for those who do not participate. Incentives to learn the German language are particularly important for mothers of young children. Immigrant women often do not have much contact to natives and their language skills are very bad. In addition, their fluency in the German language can have an effect on the success of their children in the educational system and the labor market. If their husbands work, social assistance legislation should generally have no effect on their education decision. Thus, other measures to set incentives for them to improve their language skills have to be considered.

Various policy measures can be used to improve the educational level and thus the integration of immigrants. An important step on the way towards complete integration into the society of the immigration country is naturalization. Educational requirements for naturalization can be a strong incentive for immigrants to improve their qualifications, especially their language skills. Chapter 5 analyzes which educational requirements for naturalization maximize native welfare. The optimal requirements depend on the educational structure of the immigrants as well as on other aspects of naturalization legislation that affect native welfare (*e.g.* the right to vote). For feasible parameter set-ups, the optimal requirement level is neither unattainably high, nor so low that all immigrants meet it without investing in their education. Thus, naturalization policy may be an appropriate policy instrument to improve the qualification structure and the integration of immigrants.

A large variety of further policy measures to improve the educational

structure of immigrants or their integration is conceivable. It is an important challenge for integration research to discuss these measures and analyze their effectiveness. For doing this, empirical data are necessary. Accompanying evaluations from various pilot projects in the field of supportive integration measures may deliver new insights in the next years. These findings may help the German government to improve its integration policy. Lacking integration not only is a problem for people who have immigrated themselves but also for their offspring. Hence, in the long run the positive welfare effects of a better integration of immigrants, for instance in the form of lower welfare recipient rates and less delinquency, can be enormous. These positive effects can justify high public spending for integration measures. Intensified integration research may help political decision makers in optimally allocating public expenditure for integration.

Governments generally search for an immigration policy that maximizes native welfare. The short run effect of immigration hardly depends on the integration of immigrants. However, integration plays a central role in the long run. By improving their educational level, especially their language skills, immigrants also improve their position on the labor market: They are less at risk to become unemployed, earn higher wages and pay higher taxes. Therefore the fiscal balance of an immigrant generally improves with integration. In studies on the welfare effects of immigration, integration patterns have hardly been considered up to now.[1] Hence, as integration may improve the effect of immigration on native welfare, the results of these studies are probably to pessimistic.

Integration research strongly indicates that the willingness or ability to integrate varies over immigrant groups. This has implications for immigration policy. Assume that there are two equal groups of immigrants that have the same educational structure, but differ with respect to their ability to integrate. Not considering integration patterns, one would predict the same effect on native welfare for the immigration of both groups. If integration patterns are considered, the predicted effects on native welfare strongly dif-

[1]Generally, the educational level of immigrants is assumed to be fixed.

fer. Discussing group specific immigration programs, policy makers should consider the willingness and ability of these groups to integrate.

Including integration patterns is not the only challenge for the evaluation of immigration policies. Adjustment processes in the native population have similarly gained insufficient interest up to now. In chapter 3, I have shown that a reaction of the native educational structure to immigration can fundamentally change the welfare effects of immigration. The education of an adult person generally does not change any more, so that for single inflows of immigrants this adjustment does not play a role. However, steady inflows of immigrants over a longer period affect the expectation formation of natives, and these expectations, in turn, can have a strong effect on the native educational structure. The same holds true for (the announcement of) policy reforms that can possibly lead to a large inflow of immigrants, such as EU enlargements. Considering such adjustment processes is particularly important, when occupation specific immigration programs are discussed. For instance, the low number of native physicians in the UK surely explains the high number of foreign physicians. However, the high number of foreign physicians is quite likely also an explanation for the low number of native physicians.

A further adjustment of the native population to immigration, discussed more intensely in migration research, is movement of people within the immigration country. It has been argued that natives may leave cities where immigrants live or do not move there. However, Peri (2007) finds no evidence for this in the US, where natives are traditionally more mobile than in Europe. It is impossible to consider all potential adjustment processes to immigration in an evaluation of a certain immigration policy program. Nevertheless, to get satisfying evaluation results, at least the most important processes have to be considered. Here lies a challenge for future immigration research. Potential adjustment processes to immigration have to be identified and their (economic) importance has to be evaluated. Important effects then have to be considered in the evaluation of immigration programs. Combined with the consideration of integration patterns, this should make estimation of the welfare effects of immigration more reliable. Perhaps, it leads to completely

new and surprising insights.

Integration policy does not only affect the welfare effects of immigration, but also the willingness of people to migrate. The expected income in an immigration country is normally one of the most important reasons for people to migrate. As the individual income increases with integration, people will generally consider their expectations about integration when making their migration decision. Thus, an important side effect of a good integration policy is that it makes a country more attractive for potential immigrants. Moreover, as discussed in chapter 5, naturalization legislation can have a strong positive effect on the migration decision. The estimation of potential immigration flows after policy reforms, such as enlargements of the European Union, is a central task of migration research. Future research has to analyze to what extent the consideration of integration policy measures and integration patterns can improve estimations of migration potentials.

There is a large number of further factors that can influence the migration decision, but are not yet used for estimations of migration potentials. In chapter 2 the influence of various labor market institutions as well as the health and education system, on migration are analyzed. The results indicate that good health and education systems and strong employment protection have positive effects on the decision of migrants move to a certain country. Altogether, there is still much research necessary to obtain a comprehensive picture of the factors that influence the migration decision. However, this is a precondition to make reliable ex-ante predictions of migration potentials. Ideally, reliable predictions of future immigration flows and assessments of the welfare effects of immigration should be the basis of decision-making for immigration policy.

Migration has been an important topic od research in social sciences and economics for years. Nevertheless, many questions still remain unsettled and many aspects have not yet been investigated. Integration has attracted less interest, and especially economic research on integration policy is scarce. The four chapters of my thesis have given some new insights in the economics of immigration and integration. The results obtained hopefully contribute towards a more comprehensive picture on the economics of immigration and

integration. The issues addressed certainly need continued attention. I hope that the research presented in my thesis will stimulate further fruitful research.

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