

Essays on Segregation, Gender Economics, and Self-employment

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ECONOMICS, AND SELF-EMPLOYMENT

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Abstract

Neuman, Emma (2015). *Essays on Segregation, Gender Economics, and Self-employment*, Linnaeus University Dissertation No 223/2015, ISBN: 978-91-87925-63-4. Written in English.

This thesis consists of four empirical essays on the topics of ethnic segregation, gender economics, and self-employment.

Essay I investigates how the residential mobility of Sweden's native population contributes to ethnic segregation, by applying regression discontinuity methods. The results show that the growth in the native population in a neighbourhood discontinuously drops as the share of non-European immigrants exceeds the tipping point. Tipping is driven by the departure of natives and their avoidance of tipped neighbourhoods. Tipping behaviour is selective in the sense that highly educated and high earning natives are more likely to leave neighbourhoods that have tipped.

Essay II studies the relationship between the childhood neighbourhood's ethnic composition and economic outcomes in adulthood for second-generation immigrants and natives. The results reveal that a high concentration of immigrants in a neighbourhood is associated with a lower probability of second-generation immigrants continuing to higher education. Natives' earnings and educational attainment are negatively correlated with, and the probability of social assistance and unemployment are positively associated with a high immigrant concentration. Among non-Nordic second-generation immigrants, reliance on social assistance and unemployment are negatively correlated with the share of co-ethnics and positively associated with the proportion of other ethnic groups.

Essay III explores the role of social norms and attitudes about gender for labour market outcomes of immigrant men and women in Sweden. The results show that immigrants originating from countries with large gender disparities in labour force participation also have large gender gaps in labour force participation within their immigrant group on the Swedish labour market. In contrast, source country gender differences in earnings are not correlated with gender gaps in earnings within immigrant groups in Sweden. In addition, gender gaps in labour force participation among immigrants assimilate towards the corresponding gap among natives as time in Sweden increases.

Essay IV empirically tests the Jack-of-all-trades theory, which states that individuals who are more balanced in their abilities are more suitable for self-employment. Using Swedish Military Enlistment data, a measure of balance in endowed abilities is constructed and this balance measure is, in relation to previous research, less likely to be endogenous. The results support the Jack-of-all-trades theory, in the sense that propensity for being or becoming self-employed is greater for individuals with a balanced set of abilities. In addition, earnings from self-employment tend to be higher among individuals with a balanced set of skills.

Keywords: Ability balance; Earnings; Economic outcomes; Ethnic segregation; Gender gaps; Immigrants; Jack-of-all-trades theory; Labour force participation; Native flight; Native avoidance; Occupational choice; Self-employment; Tipping behaviour.

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Acknowledgments

Growing up I have wanted to become a chef, a professional football player, a writer, and a politician. Today I do not regret that I did not fulfil these plans and I am glad that I ended up at the PhD programme in Economics. From time to time being a PhD-student has been very challenging, but above all it has been an enriching experience and a great deal of fun. In the end, I cannot be anything but thankful for having had the opportunity to write this thesis. To complete it would not have been possible without the encouragement, support, and help from several persons.

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Växjö, April 2015
Emma Neuman

Introduction

This thesis consists of four empirical essays on the topics of ethnic segregation, gender economics and self-employment. All of the essays are closely connected to issues in labour economics. Research devoted to understanding, explaining and analysing the labour market has a long tradition within economic research. One of the key tasks of labour researchers is finding the reason for labour market disparities among different groups. One group that has received the attention of many labour economists is immigrants. The literature has shown that ethnic residential segregation is important for the labour market integration of immigrants. However, little is known about the underlying mechanisms giving rise to ethnic residential segregation. In addition, there is still a need for knowledge of how ethnic segregation is related to the economic outcomes of children of immigrants. It is also well known that women are at a disadvantage on the labour market in comparison to men with similar experience and education. Despite the large literature investigating potential causes behind gender gaps, disparities between men and women remain and further empirical research is needed.

Another factor which is important for labour market prospects is occupational choice. The decision to become self-employed or wage-employed can greatly influence a person's future labour market outcomes. Previous literature has contributed to our understanding of determinants of self-employment. However, there is still a need for further investigation of the importance of individual abilities for the self-employment decision and success.

This thesis will enrich our understanding of mechanisms behind the disparities among different groups on the labour market. The first three essays study differences between immigrants and natives, and between immigrant men and women; the fourth essay compares the self-employed to the wage-employed.

Relevance and summary of the essays

In both the United States and in European countries, the immigrant population tends to be spatially concentrated. In Sweden, the increased residential segregation of people who are and are not native-born is high on the political agenda. Researchers have for decades investigated the reasons for the emergence of ethnic segregation and its effect on the economic outcomes of the foreign-born population.¹ The first two essays in this thesis contribute to this literature by increasing our knowledge of the mechanisms behind ethnic segregation and its consequences for the economic outcomes of second-generation immigrants and natives in Sweden.

Essay I “Ethnic Segregation, Tipping Behavior, and Native Residential Mobility”, *International Migration Review*, 49(1) (2015), 36–69, (co-authors Lina Aldén and Mats Hammarstedt) focuses on how residential mobility in the native population contributes to ethnic segregation. The research on the dynamics of segregation recognises that the majority's preferences for residing in neighbourhoods with few ethnic minorities might be a contributing factor in the segregation process. Tipping is a process whereby a neighbourhood with only majority residents transforms to an all-minority neighbourhood. This process presumably begins when the neighbourhood reaches a critical value in the minority population, the tipping point, at which the majority population starts to move out of the neighbourhood. Schelling (1971) showed that social interactions in the majority group's preferences for a neighbourhood with only a few minority residents can result in a neighbourhood tipping. Even if this preference is weak, a likely outcome of the Schelling model is a fully segregated neighbourhood. Empirical support for tipping behaviour in the residential mobility of the white population has been found in the United States.²

In the first essay we expand this literature by applying the tipping framework to a European context and by studying residential segregation of natives and immigrants. This paper is the first to determine whether tipping stems from majority residents' departure from a neighbourhood (native flight) and/or from their avoidance of a neighbourhood (native avoidance) which has passed the tipping point. By applying regression discontinuity methods, we show that the growth in the native population in a neighbourhood discontinuously drops as the neighbourhood's proportion of non-European immigrants exceeds the identified tipping point. In contrast, we find no evidence for tipping behaviour

¹ See e.g. Borjas (1995); Cutler, Glaeser, and Vigdor (1999); Edin, Fredriksson, and Åslund (2003); Bayer, McMillan, and Rueben (2004); Damm (2009); Saiz and Wachter (2011); Patacchini and Zenou (2012).

² See Card, Mas, and Rothstein (2008)

in the native population growth around the tipping point identified for European immigrants. In addition, we find that tipping behaviour is associated with both native flight and native avoidance. Furthermore, tipping behaviour appears to be selective in the sense that natives with high educational attainment and the highest income are most likely to move out of neighbourhoods that have exceeded the tipping point.

Essay II “Ethnic Concentration and Economic Outcomes of Natives and Second-generation Immigrants” contributes to the literature on ethnic segregation and its consequences for individuals' economic outcomes. As mentioned, there is a large literature on the effects on economic outcomes for first-generation immigrants who reside in ethnic enclaves. However, less is known about the link between ethnic segregation and economic outcomes of children of immigrants (i.e. second-generation immigrants) and natives. In Essay II we investigate how the concentration of immigrants in the childhood neighbourhood is related to the short- and long-run earnings, unemployment, reliance on social assistance and educational attainment of second-generation immigrants and natives in Sweden. The results show that second-generation immigrants raised in immigrant-dense neighbourhoods are less likely to continue to higher education; the other outcomes are not correlated with the neighbourhood share of immigrants. However, it appears important to determine whether immigrants originate from the same region as the second-generation immigrant's parents or not. In addition, we find that non-Nordic second-generation immigrants who resided alongside many co-ethnics in childhood are less likely to be on social assistance or unemployed. In contrast, residing in a neighbourhood with many immigrants from other ethnic groups is associated with a higher probability of unemployment or social assistance usage for non-Nordic second-generation immigrants. Furthermore, natives are more likely to be in unemployment or use social assistance, less likely to continue to higher education and to have lower earnings if they had grown up in a neighbourhood with a high immigrant share. Overall, we find that the results are quite similar in the short- and long-run.

The third essay of this thesis studies gender gaps in labour market outcomes. One of the big changes in the economy during the twentieth century was the entrance of women into the labour market. Today women are more equal with men, but differences in earnings and labour market participation rates between men and women remain. In addition, advancements in gender equality have been unevenly spread around the world. This implies that gender gaps in labour market outcomes vary greatly across countries. To date, a large body of literature has investigated possible reasons for gender gaps in labour market outcomes. Within this literature it has been suggested that gender gaps can be attributed to cultural differences (i.e. differences across countries in attitudes

and norms about the appropriate role of women in society).³ Previous research has shown that immigrants in the United States originating from countries with large gender gaps in labour market outcomes also have large gender gaps in labour market outcomes within their immigrant group in the United States.⁴ So far, little is known about whether this finding holds also outside the United States. In **Essay III**, “Culture, Assimilation, and Gender Gaps in Labour Market Outcomes” we study how cultural differences in gender norms explain gender gaps in labour market outcomes within immigrant groups in Sweden. In addition, we expand the literature by investigating whether there is cultural assimilation in gender gaps (i.e. whether gender gaps within immigrant groups in Sweden assimilate towards the corresponding gender gap among native Swedes). Culture is measured by gender disparities in the source country at time of migration. We find clear evidence that the labour force participation of immigrants in Sweden is influenced by culture. Immigrants from countries with large gender differences in labour force participation have similarly large gender differences in labour force participation within their immigrant group in Sweden. As immigrants' length of time in Sweden increases, the gender gaps in their labour force participation assimilate towards the corresponding gap among native Swedes. However, gender gaps in earnings in the source country are not a strong predictor for differences between men's and women's earnings within immigrant groups in Sweden.

In the fourth essay of the thesis we focus on determinants behind the decision to become self-employed and to have self-employment success. Many researchers and policymakers view self-employment as a force for economic growth and innovation. To understand why some people choose to become self-employed and why they become successful in running their own business is important for the creation of policies conducive to self-employment and business survival. Previous research has shown that factors such as family traditions, liquidity constraints, attitudes towards risk and personal traits are important for the self-employment decision and performance.⁵ However, the literature has not reached a consensus on which personal traits are important for ‘self-employment ability’. Lazear (2005) suggests that people who are competent in many areas will choose self-employment and perform better as self-employed, in other words, self-employed people benefit from being so called Jack-of-all-Trades. In contrast to the wage-employed, who can be specialists, the self-employed are only as strong as their weakest skill. In

³ For an overview on how culture contributes to differences in individuals' and groups' economic and social outcomes see Fernández (2011).

⁴ See e.g. Antecol (2000) and (2001)

⁵ See e.g. Kihlstrom and Laffont, 1979; Evans and Jovanovic, 1989; Lentz and Laband, 1990; Holtz-Eakin, Joulfaian and Rosen, 1994; Dunn and Holtz-Eakin, 2000; Blanchflower and Oswald, 1998; Fairlie, 1999; Hout and Rosen, 2000; Andersson and Hammarstedt, 2010, 2011; Lindquist, Sol and Van Praag, 2015.

Essay IV “All About Balance? A Test of the Jack-of-all-Trades Theory Using Military Enlistment Data” (co-authors Lina Aldén and Mats Hammarstedt) we empirically test Lazear's Jack-of-all-Trades theory using a measure of ability balance which is an improvement of previous literature. So far, balance in skills has been measured by variations in education and job experience.⁶ However, a problem with using this measure is that individuals' choices might be influenced by an anticipation of future self-employment. In other words, those planning to be self-employed will strategically invest in more varied education and job experience. As a result, a high acquired balance in education and/or job experience might capture other unobservable individual characteristics. We utilise data from the Swedish Military Enlistment and measure ability balance by the variation in an individual's test score across four measures of specific cognitive skills and one general measure of non-cognitive ability. This implies that we consider endowed rather than acquired ability balance. As a result, our measure of ability balance is unlikely to be biased by anticipations of a future decision to become self-employed. In comparison to the only previous study⁷ with a similar approach, the main advantage of our data is that everyone taking the enlistment tests is 18 to 19 years of age and has a comparable level of education, which is a requirement to attain unbiased estimates of abilities. The results support the Jack-of-all-Trades theory, in the sense that the likelihood of being self-employed is higher for individuals with more balanced abilities. Furthermore, individuals' self-employment earnings and their companies' turnover, profits and number of employees tend to be higher if they have a more balanced skill set.

Policy implications and future research

The results presented in these four essays add to our understanding of disparities among different groups on the labour market. What policy implications do the results in these four essays have? To understand the mechanisms behind and consequences of ethnic segregation is highly relevant for the formation of policy recommendations that will integrate immigrants into the labour market. The results in Essay I show that natives tend to avoid and move out of neighbourhoods with a high concentration of non-European immigrants. This supports the idea that native residential mobility is an impetus for ethnic residential segregation. In light of these results, policies aimed at reducing ethnic segregation on the residential market must consider not only relocation of immigrants, at least those of non-European background,

⁶ See e.g. Wagner, 2003; Lazear, 2005; Silva, 2007; Stuetzner, Obschonka and Schmitt-Rodermund, 2013.

⁷ Hartog, Van Praag and Van der Sluis (2010) use results from five specific ability test undertaken at ages between 15 and 23 years to create a measure of balance in abilities and they find empirical support for the Jack-of-all-Trades theory in the United States.

but also the subsequent residential choices of natives. To formulate policies which directly affect natives' residential choices, there is a need for further research on how natives' attitudes towards residing alongside immigrants as well as how amenities in immigrant-dense neighbourhoods influence natives' residential choices. It would be especially useful to investigate how natives' housing preferences are formed and have evolved over time.

In Essay II we find that second-generation immigrants might benefit from sharing a neighbourhood with many co-ethnics, but growing up in neighbourhoods with a large number of immigrants from other ethnic groups tends to be associated with worse economic outcomes for second-generation immigrants. These results highlight the importance of distinguishing the segregation of natives and immigrants from the segregation of immigrants from different ethnic groups. However, in order to give specific policy recommendations, a better understanding of the underlying mechanisms behind the connection between neighbourhood ethnic composition and individual outcomes is needed.

The results in Essay III suggest that gender norms and attitudes are valuable explanations for differences between men and women on the labour market. Gender gaps in labour market participation rates within immigrant groups in Sweden tend to be higher for immigrants from countries with strong norms against women participating in labour market work. However, it appears that the influence of culture decreases and that cultural assimilation to the corresponding gender gap among natives takes place the longer that an immigrant lives in the source country. It is possible that the widespread availability of child care facilities and parental leave in Sweden contribute to the cultural assimilation. However, to conclude that the institutional setting adds momentum to the cultural assimilation of immigrants in Sweden, more research on other countries in other institutional settings is needed. The results in Essay III stress the need for additional research on how institutional changes are linked to shifts in immigrants' norms and attitudes about gender, and to changes in labour market behaviour.

Finally, Essay IV shows that people who are more balanced in their abilities are more likely to become and also perform better as self-employed. These results have important implications for increasing self-employment rates and business survival. More specifically, the results suggest that young people should be encouraged to acquire a range of skills and to develop their weakest skills, if they are to become successfully self-employed.

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I

Ethnic Segregation, Tipping Behavior, and Native Residential Mobility¹

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We study tipping behavior in residential mobility of the native population in Sweden between 1990 and 2007. Using regression discontinuity methods, we find that the native population growth in a neighborhood discontinuously drops once the share of non-European immigrants exceeds the identified tipping point. Native tipping behavior can be ascribed to both native flight and native avoidance. Natives with a high level of educational attainment and the highest labor earnings are more likely to move from neighborhoods that have tipped. We conclude that tipping behavior is likely to be associated with ethnic as well as to socio-economic segregation in Sweden.

INTRODUCTION

The question of immigrants' location choices in the host country has received the attention of researchers in the past few decades (*e.g.* Bartel 1989; Borjas 1999; Åslund 2005). The United States and several countries in Europe have experienced a large inflow of immigrants into certain geographical areas and cities leading to ethnic segregation. The driving forces behind this ethnic segregation as well as the presence of ethnic enclaves and their importance for the economic success among

¹The authors wish to thank Magnus Carlsson, Oskar Nordström Skans, Christina Håkansson as well as the seminar participants at Linnaeus University and SULCIS at Stockholm University for useful comments and suggestions. The authors also wish to thank participants at the 2012 EALE Conference in Bonn and the 2013 SNEE Conference in Mölle for their valuable comments. Finally, the authors are thankful to two anonymous referees as well as to the editor for useful comments and suggestions.

the foreign born have been widely studied (*e.g.* Cutler, Glaeser, and Vigdor 1999; Edin, Fredriksson, and Åslund 2003; Bayer, McMillan, and Rueben 2004; Saiz and Wachter 2011; Patacchini and Zenou 2012). Researchers have long been interested in the dynamics of segregation and have argued that the majority's preferences for neighborhoods with a low minority share may be an important factor. Schelling (1971) showed that social interaction in preferences may lead to extreme segregation. If the minority share of a neighborhood reaches a critical level, *a tipping point*, the neighborhood experiences an outflow of majority residents, leading to full segregation. Schelling showed that fully segregated neighborhoods are likely to be the outcome, even when the majority's preferences for living in neighborhoods with a low minority share are weak. In the Schelling model, integrated neighborhoods are unstable, and even small changes in the neighborhood composition lead to an all-majority or all-minority neighborhood (Card, Mas, and Rothstein 2008a). Card, Mas, and Rothstein (2008b) formalized a model in which an ethnically mixed neighborhood can remain stable as long as the minority share remains below the tipping point. However, when the minority share in the neighborhood exceeds this tipping point, all-majority residents will leave the neighborhood, resulting in full segregation. When applying their model to US data, Card, Mas, and Rothstein (2008b) documented tipping-like behavior among whites in several US cities. Further, they found that white tipping behavior varied among cities with different attitudes towards ethnic minorities.

In European cities, specific ethnic groups very seldom dominate certain residential neighborhoods as in the United States. In contrast, residential segregation is characterized by a spatial separation between the majority population and a mix of minority groups (*e.g.* Johnston, Forrest, and Poulsen 2002). The different pattern of ethnic residential segregation observed in Europe makes it interesting to explore whether tipping behavior exists in European countries. This paper examines tipping behavior among natives in Sweden; more specifically, we examine native residential mobility and its possible contribution to ethnic segregation in Sweden during the 1990s and between 2000 and 2007. The results have implications for research concerning the relationship between ethnic residential patterns and labor market outcomes as well as social outcomes such as school achievement for research for the Swedish case, *see* for example, Nordström Skans and Åslund 2010; Åslund et al. 2011. We use register

data from 1990, 2000, and 2007 and apply the method developed by Card, Mas, and Rothstein (2008b) to identify municipality-specific tipping points and to study tipping behavior among natives in Sweden's 12 largest municipalities.

Sweden is a suitable testing ground for analyzing tipping behavior for several reasons. Firstly, Sweden has a long history of immigration. In 2013, about 14 percent of Sweden's total population was foreign born. Secondly, the character of immigration to Sweden has changed. Even if the majority of the foreign-born population in Sweden still originates in European countries, the great majority of the immigrants coming to Sweden today are refugees and "tied movers" from Asia, Africa, and the Middle East. Apprehensions about the fact that these immigrants should prefer to settle in neighborhoods with a large share of immigrants from their own group have often been expressed. As in other European countries, there is a residential divide between natives and almost all immigrant groups, but especially between European and non-European immigrants. Thirdly, discrimination against ethnic groups in the Swedish housing market is well documented (Ahmed and Hammarstedt 2008; Ahmed, Andersson, and Hammarstedt 2010). Thus, we have good reasons to believe that natives tend to avoid or move out of areas with a large share of inhabitants from certain ethnic groups.

Apart from studying tipping behavior in the European context, we make two important contributions to previous literature. First, our data allows us to explore the extent to which the drop in the native population can be attributed to an increased out-migration rate or a decreased in-migration rate of natives. In US literature, this is termed "white flight" and "white avoidance" (*e.g.* Goering 1978; Frey 1979; Marshall 1979; Clark 1992; Quillian 2002). The importance of native flight and native avoidance to the increased immigrant concentration in Sweden has been addressed in a descriptive study by BråmÅ (2006). She finds that although both native flight and native avoidance can be attributed to the increased immigrant concentration, native avoidance appears to be the main driving force.

Secondly, our data makes it possible to study whether tipping behavior is associated with socio-economic segregation. The access to individual data enables us to explore possible selection in the outflow of natives from neighborhoods that have experienced tipping. If native migration is selective in the sense that individuals with, for example, high labor earnings are more likely to move out of such areas, tipping behavior may also be

associated with socio-economic segregation. More specifically, we explore whether tipping behavior is associated with segregation in terms of educational attainment and labor earnings.

Our empirical analyses proceed as follows: We define immigrants as foreign-born individuals and divide them into immigrants originating from European countries and immigrants originating from non-European countries. Individuals who were born in Sweden are defined as natives. The reason we make this distinction is that we want to explore whether natives respond differently to an increased inflow of European and non-European immigrants, respectively, to their neighborhood. We have reason to believe that this is the case, as previous research have documented discrimination against non-European immigrants on the Swedish labor and housing market as well as differences in labor market outcomes between non-European and European immigrants (Hammarstedt 2003; Carlsson and Rooth 2007; Hammarstedt and Shukur 2007; Ahmed and Hammarstedt 2008; Ahmed, Andersson, and Hammarstedt 2010). We apply the method introduced by Card, Mas, and Rothstein (2008b) to identify municipality-specific tipping points related to these two groups of immigrants. We then use regression discontinuity methods to quantify the effect of the tipping points on growth in the native population. Next, we explore the extent to which the (possible) decrease in native population growth is driven by native flight (*i.e.* increased out-migration), and/or native avoidance (*i.e.* reduced in-migration of natives). Finally, we study the extent to which residential segregation is associated with segregation in terms of educational attainment and labor earnings by exploring if the outmigration rate of natives differs by educational attainment and labor earnings.

In line with previous research, we find that ethnic segregation increased during the 1990s. We also find that non-European immigrants reside more densely concentrated within municipalities than European immigrants. Under the assumption that municipality-specific tipping points exist, we find support for tipping behavior in a majority of the 12 largest municipalities in Sweden. The estimated tipping points are significantly higher for European immigrants than for non-European immigrants. Furthermore, there is no statistically significant difference in the native population growth above and below the tipping point identified for European immigrants whereas the native population growth is considerably lower beyond the identified tipping point related to non-European immigrants. This drop in the growth rate of the native population around

the tipping point was between 6 and 7 percent in the 1990s and around 5 percent between 2000 and 2007. We also find that during the 1990s, this drop in the native population growth rate can be attributed to both native flight from areas with an increasing concentration of non-European immigrants and to that natives avoided moving into to such neighborhoods. During the second time period, native flight seems to have been driving the native tipping behavior. Thus, our results indicate that natives are more tolerant to residing in neighborhoods with European than with non-European immigrants but also that natives became somewhat more tolerant to residing in neighborhoods with non-European immigrants over time. Finally, given that out-movers are disproportionally replaced by in-movers of lower status, we find that tipping behavior is likely to be associated with increased socio-economic segregation as natives with high educational attainment and labor earnings are most prone to move out of neighborhoods that have experienced tipping [for research on how selective migration contributes to socio-economic segregation, *see e.g.* Friedrichs 1971; Power 1996; Skifter Andersen 2003]. Although our results cannot be given a causal interpretation, they clearly indicate that native tipping behavior is strongly associated with the segregation of non-European immigrants.

The paper is organized as follows. The Immigrant Population and Ethnic Segregation in Sweden offers an overview of immigration to Sweden since the Second World War and a description of levels and trends in segregation in Sweden from the 1990s and onwards. Theoretical Background provides the theoretical framework and Data presents the data. Empirical Specification presents the empirical models and Results explains the results. Conclusions summarizes and concludes.

THE IMMIGRANT POPULATION AND ETHNIC SEGREGATION IN SWEDEN

Immigrants and the Immigrant Population

Both the size and composition of Sweden's immigrant population have changed during the last decades. In 1940, only about 1 percent of the country's total population had been born abroad. By 1970, this share had risen to 7 percent. As of 2013, about 14 percent of Sweden's population is foreign born. After 1945, and during the 1950s and 1960s, refugees from Eastern Europe moved into Sweden. However, most of the immigration to Sweden from the 1950s until the mid-1970s was labor-force

migration resulting from the country's industrial and economic expansion. The labor-force migration consisted primarily of poorly educated immigrants from Finland, former Yugoslavia, Italy, and Greece. During the 1950s and 1960s, labor-force migrants also came from other Nordic countries and from countries in Western Europe such as West Germany.

In the mid-1960s, Swedish trade unions accused immigrants of depressing wages for low-paid workers. A more restrictive immigration policy and the deterioration of the labor market situation changed the character of immigration during the 1970s. As the labor-force migration of European immigrants tapered off, the number of refugees from non-European countries started to increase. In the mid-1970s, refugee migration from Latin America started to reach significant proportions, and during the 1980s, a much larger number of refugees came from Asia and Africa. During the 1990s, refugee migration continued, now dominated by refugees from former Yugoslavia and the Middle East. Refugee migration from countries in the Middle East has continued into the 21st century.

Table 1 shows how the immigrant population has changed. In 1970, about 60 percent of Sweden's foreign-born population had been born in other Nordic countries and about 35 percent in other European countries. Only about 5 percent were born outside Europe. In 2011, less than 20 percent were born in other Nordic countries, about 35 percent were born in other European countries, and almost 47 percent of the immigrant population were born in non-European countries.

Thus, the share of foreign-born immigrants with a non-European background has greatly increased. Further, recently arrived immigrants tend to settle in metropolitan areas such as Stockholm, Gothenburg, and Malmo or in other large municipalities. According to Statistics Sweden (2008), more than 90 percent of the immigrants in the 1997–2002 cohort resided in cities or metropolitan areas 5 years after their immigration.

TABLE 1
THE COMPOSITION OF THE FOREIGN-BORN POPULATION LIVING IN SWEDEN 1960–2011

Region of birth	1960	1970	1980	1990	2000	2008	2011
Nordic countries	58.1	59.7	54.4	40.3	27.9	21.0	18.2
Other European countries	37.0	34.9	33.8	32.1	32.9	35.8	35.3
Non-European countries	4.9	5.4	11.8	27.6	39.2	43.2	46.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Statistics Sweden, *Statistical Yearbook* and *Population Statistics*, different volumes.

Ethnic Segregation in Sweden

The aim of this paper is to examine native residential mobility and its possible contribution to ethnic segregation in Sweden during the 1990s and between 2000 and 2007. The question is, then, to what extent the increased share of immigrants with a European and the increased share of immigrants with a non-European background have lead to increased ethnic segregation in Sweden during that period. The evolution of ethnic segregation in Sweden during the period 1990–2007 is highlighted with the help of calculations of an index of dissimilarity calculated for European and non-European immigrants separately and presented in Table 2. The index of dissimilarity is calculated as:

$$\frac{1}{2} \sum_{i=1}^N \left| \frac{i_i}{I} - \frac{n_i}{N} \right|$$

where i_i refers to the immigrant population in the i th neighborhood and I refers to the immigrant population in the municipality. Further, n_i is the native population in the i th neighborhood, while N is the native population in the municipality. The index score should be interpreted as

TABLE 2
ETHNIC SEGREGATION IN MUNICIPALITIES IN 1990, 2000 AND 2007. EUROPEAN AND NON-EUROPEAN IMMIGRANTS COMPARED TO NATIVES

Municipality	Population size(1000) ^a	Number of neighborhoods	Index of dissimilarity					
			European immigrants			Non-European immigrants		
			1990	2000	2007	1990	2000	2007
Stockholm	1441	849	19.3	18.9	19.8	45.9	47.6	46.8
Uppsala	147	247	20.0	20.0	19.4	55.4	48.6	43.8
Linköping	105	171	16.6	20.9	24.9	41.1	42.2	46.8
Norrköping	99	82	18.7	26.7	26.7	48.0	46.6	43.2
Göteborg	377	774	29.8	33.4	33.4	49.9	52.5	48.8
Jönköping	94	70	20.4	25.3	25.7	52.5	48.5	47.4
Malmö	209	327	28.3	34.0	31.6	47.0	50.5	45.0
Lund	77	107	19.3	19.7	18.1	38.2	36.4	32.0
Helsingborg	96	41	21.3	25.7	26.6	31.2	39.3	37.8
Västerås	93	134	16.0	18.1	18.2	39.8	40.8	41.2
Umeå	81	83	18.3	20.9	17.1	51.6	43.5	41.9
Örebro	104	168	19.6	28.6	29.0	46.9	53.2	52.1
Total ^b			21.6	23.5	23.9	46.7	48.0	46.2

Notes: ^aAverage for years 1990, 2000 and 2007.

^bAverage for the twelve municipalities. Weighted by the size of the municipalities' immigrant population.

the percentage of the immigrant group that would have to move to a different neighborhood to produce a distribution equal to that of the native population within the municipality.

The table reveals that ethnic segregation increased in Sweden between 1990 and 2000. Furthermore, the table also reveals that the index of dissimilarity is considerably higher for non-European than for European immigrants indicating that non-European immigrants reside more densely concentrated than European immigrants. The index of dissimilarity increased from 21.6 in 1990 to 23.5 in 2000 for European immigrants and from 46.7 in 1990 to 48.0 in 2000 for non-European immigrants. During the period 2000–2007, segregation among European immigrants continued to increase, while segregation among non-European immigrants decreased. In 2007, index of dissimilarity was 23.9 for European immigrants and 46.2 for non-European immigrants.

To sum up, immigrants from non-European countries reside more densely concentrated than European immigrants. Previous research has documented discrimination against non-European immigrants on the housing market in Sweden. Against this background, we have reason to believe that a large share of non-European immigrants residing in certain neighborhoods also may affect the residential mobility of natives in such neighborhoods.

THEORETICAL BACKGROUND

The concept of neighborhood tipping originated in US research on the residential segregation of the white majority population and the black minority population. Neighborhood tipping was the process in which a neighborhood's composition changed from all-white to all-black. In this process, there was a critical threshold, or tipping point, where the inflow of black residents led to an outflow of white residents, a phenomenon that was termed "white flight" (*e.g.* Goering 1978; Frey 1979; Marshall 1979). Since then, the concept of white avoidance has been used to account for the observation of a reduced in-migration of white residents to neighborhoods with an increased concentration of black residents (*e.g.* Clark 1992; Quillian 2002). Studies on possible explanations to white flight and white avoidance point towards a combination of whites' aversion to having black neighbors and their desire to avoid neighborhoods with characteristics that are associated with African Americans, such as poverty and social problems (*e.g.* Farley et al. 1994; Zubrinsky 2000). In

regard to their relative importance, studies on neighborhood preferences show that whites seem to be more sensitive to the ethnic mix in a neighborhood when it comes to moving in to a neighborhood than when moving out (*e.g.* Clark 1991; Farley et al. 1994; Zubrinsky and Bobo 1996).

Social interaction models have been applied to study neighborhood tipping and especially to explain how a majority's preferences for neighborhoods with low minority shares may give rise to residential segregation (Schelling 1971; Becker and Murphy 2000; Card, Mas, and Rothstein 2008b). In these models, the social interaction effect stems from the assumption that people care about the size of the minority share in their neighborhood. It is assumed that the majority population prefers to live in neighborhoods with low minority shares and that the strength of these preferences varies. In the social interaction model introduced by Schelling (1971), there are two groups of people: a majority and a minority. The members of these groups have preferences towards living in an area with a particular share of the members of the other group that varies from very low to very high. Further, there is a neighborhood in which both groups want to live, given that the share of the other group members does not exceed the individual tolerance level. Once an individual's tolerance level is reached, he or she will migrate to a neighborhood that suits his/her preferences. Based on these assumptions, a small change in the neighborhood composition will result in the tolerance level being exceeded for some individuals who will then move out. The new neighborhood composition will in turn induce others to move out, while those who can accept the neighborhood composition will move in. This process will continue until the neighborhood is fully segregated. The main conclusion of the model is that in the presence of social interaction in the majority's preferences, a fully segregated area is likely to be the outcome even when the majority's preferences for a low minority share are weak. Whether the majority or the minority group dominates the area depends on how the process starts; thus tipping can be two-sided. In two-sided tipping models, such as Schelling's, a tipping point is an unstable mixed equilibrium (an integrated neighborhood) bound to be transitioning to one out of two stable equilibria, either an all-majority or an all-minority neighborhood (Card, Mas, and Rothstein 2008a).

Card, Mas, and Rothstein (2008a) formalized a one-sided tipping model in which, unlike the Schelling model, a mixed neighborhood can

remain stable as long as its minority share remains below the tipping point.² This is made possible by the assumption that there, apart from a social interaction effect, is specificity in the preferences for location choice. Such specificity can, for example, arise because people care about the amenities in the neighborhood, such as local cultural and social institutions, and that these amenities are more important for some individuals than for others. When both neighborhood composition and neighborhood amenities affect an individual's location choice, some individuals are willing to live in a neighborhood, even if they have neighbors from the minority group, because they like the amenities. However, as the minority share in the neighborhood increases, the social interaction effect, that is the preference for neighborhoods with low minority shares, eventually dominates in which case, there is an outflow of majority residents. In this model, the tipping point is the maximum minority share at which a mixed neighborhood can be stable (Card, Mas, and Rothstein 2008a). Thus, a neighborhood can remain mixed as long as the minority share is below the tipping point. Once the minority share exceeds this critical level, the neighborhood tips, there is an outflow of majority residents and the neighborhood moves towards an all-majority neighborhood. The location of the tipping point is to some extent determined by the majority population's tolerance of minority neighbors; the stronger the preferences among the majority against minority neighbors are, the lower the tipping point is expected to be.³

Based on the theoretical model by Card, Mas, and Rothstein (2008b), we have good reasons to believe that native residential mobility may have contributed to the residential segregation in Sweden. It has been documented that ethnic discrimination exists on the Swedish housing market and that this discrimination above all is directed towards non-European immigrants (Ahmed and Hammarstedt 2008; Ahmed, Andersson, and Hammarstedt 2010). This suggests that natives care about the ethnic composition in their neighborhood and may have preferences for neighborhoods with a low immigrant concentration, in particular, a low non-European immigrant concentration. Thus, it is likely that an

²The model is based on the social interaction model formalized by Becker and Murphy (2000).

³Card, Mas, and Rothstein (2008a) have tested whether tipping is one- or two-sided by studying the residential mobility of Census tracts in metropolitan areas in the US and find evidence of one-sided tipping behavior.

increased immigrant concentration in a neighborhood affects native residential mobility leading to tipping-like behavior.

Following Card, Mas, and Rothstein (2008b) we identify tipping points at the municipality level, in other words a common tipping point, m^* , for all neighborhoods within a municipality. This implies that within a municipality, there may be neighborhoods where the immigrant concentration has not yet reached the common tipping point and neighborhoods where the immigrant concentration has reached and passed m^* and, thus, have experienced tipping behavior and a decrease in the native population. Further, it is important to note that preferences for living in neighborhoods with a low immigrant concentration may be attributed to negative attitudes against immigrant neighbors but also indirectly to the possible negative effects that an increased immigrant concentration may have on local amenities, such as reduced quality of local social and cultural institutions (Farley et al. 1994; Andersson 1998; Zubrinsky 2000). Both aspects may result in an increased out-migration or decreased in-migration of natives. Due to differences in labor market attachment, information about job openings and economic resources, immigrants and natives may have different opportunities to leave a certain area. In this study, the purpose is not to isolate these effects but to study the process of tipping behavior and explore how a neighborhood's native population growth is related to the immigrant concentration in the neighborhood.

DATA

We study tipping behavior in the 12 largest Swedish municipalities in 2007: Stockholm, Göteborg, Malmö, Uppsala, Linköping, Västerås, Örebro, Norrköping, Helsingborg, Jönköping, Umeå, and Lund (SCB, Befolkning. Folkmängden efter kommun, civilstånd och kön. År 1968–2010). The municipality of Stockholm is too small to be representative for the city of Stockholm, and therefore we study Stockholm at the county level. We focus on changes in native population growth between 1990 and 2000 and between 2000 and 2007.

To study tipping behavior within these municipalities, we use individual data from the register-based longitudinal data base LISA (Longitudinal Integration Database for Health Insurance and Labour Market Studies) developed by Statistics Sweden. We have information on neighborhood of residence of all individuals living in Sweden, 16 years and older, as well as on their demographic characteristics, labor

market characteristics, and use of social benefits in the years 1990, 2000, and 2007.

Neighborhoods are based on SAMS areas (Small Area Market Statistics) created by Statistics Sweden. The SAMS areas are based on classifications made by Swedish municipalities to simplify community planning. The areas were created to obtain small geographical areas that are homogenous in terms of type of housing, household income, and educational attainment *within* the area. The SAMS division is the finest geographical division that can be obtained for Sweden. Although the SAMS units should be constant over time, some smaller adjustments have been made over the years to improve the quality. Because we have access to data on the individuals who live in the SAMS areas, we are able us to explore possible selection in terms of socio-economic characteristics in the outflow of natives from neighborhoods that have tipped.

In total, there are 9,200 SAMS in Sweden with an average of 1,000 inhabitants. In the 12 municipalities included in this study, there are 3,135 SAMS areas in 1990, 3,203 in 2000, and 3,233 in 2007. To obtain neighborhood units that are constant over time, we only include SAMS areas that are present in the data set in 1990, 2000 and in 2007. After these selections, the total number of neighborhoods is 3,053 in 1990, 2000, and in 2007.

We exclude sparsely populated SAMS areas because in these areas even a very small inflow, or outflow, of inhabitants may cause tipping behavior. Therefore, we only include SAMS areas with more than 200 inhabitants. Further, following Card, Mas, and Rothstein (2008a,b), we exclude outliers in terms of neighborhood population growth. Thus, we exclude SAMS areas with (1) a native population growth in each period that is more than five times higher than the base-year total population and (2) a total population growth in each period that is more than five standard deviations higher than the average population growth in the municipality. After these restrictions, the sample used to study tipping behavior comprises 2,276 neighborhoods in 1990–2000 and 2,414 neighborhoods in 2000–2007.

In the empirical analysis, we explore how natives respond to the share of European and non-European immigrants, respectively, residing in their neighborhood. An individual is defined as native if he/she was born in Sweden, whereas an individual is defined as a European (non-European) immigrant if he/she was born in a European (non-European) country.

Table 3 presents descriptive statistics of average changes in the European and non-European immigrant shares over time and the growth in the native population in the neighborhoods included in the sample. It emerges that between 1990 and 2000, the average share of European immigrants in the neighborhoods decreased from about 9 percent to roughly 7 percent, while the share of non-European immigrants rose from roughly 3 percent to 6 percent. The average growth in the native population, on the other hand, decreased from about 5 percent in 1990–2000 to about 3 percent in 2000–2007. There was also a decrease in the average growth in the total population from 9 percent to about 7 percent.

EMPIRICAL SPECIFICATION

Identification of Tipping Points

We follow the method employed by Card, Mas, and Rothstein (2008b) to identify municipality-specific tipping points. The one-sided tipping model predicts that the share of natives should fall discontinuously once the minority share passes some critical value. We apply a method similar to that used for the identification structural breaks in time series analysis to identify this unknown critical value of the European and non-European immigrant shares of the 12 Swedish municipalities at which there is a clear shift in the native population growth.

We estimate a model that relates the mean percentage change in native population of neighborhood i in municipality c in 1990–2000 and in 2000–2007 to the share of immigrants in the base year of each time period. Let $m^*_{c,t-1}$ denote the municipality-specific tipping point where $t-1$ is the base year (= 1990, 2000). We test for the candidate tipping points for immigrant shares between 1 and 60 percent. For each candidate

TABLE 3
DESCRIPTIVE STATISTICS OF THE NEIGHBORHOODS INCLUDED IN THE SAMPLE

	European immigrants		Non-European immigrants	
	1990–2000	2000–2007	1990–2000	2000–2007
Mean% immigrants, base year = 1990, 2000	9.4	9.6	3.4	6.0
Growth in total population (%)	8.9	6.5	8.9	6.5
Growth in native population (%)	4.6	3.0	4.6	3.0
Number of SAMS areas	2,276	2,414	2,276	2,414

tipping point, we estimate the following regression model for each municipality, c , and for each time period:

$$dn_{i,c,t} = \alpha_c + d_c 1[m_{i,c,t-1} > m_{c,t-1}^*] + \varepsilon_{i,c,t} \quad (1)$$

The dependent variable, $dn_{i,c,t}$ is the growth rate of the neighborhoods' native population in each municipality and in each time period. Specifically, $dn_{i,c,t} = (N_{i,c,t} - N_{i,c,t-1}) / P_{i,c,t-1}$ where $N_{i,c,t}$ is the number of native residents of neighborhood i in municipality c in the year t ($=2000, 2007$), $N_{i,c,t-1}$ is the number of native residents in the base year $t-1$ ($=1990, 2000$), and $P_{i,c,t-1}$ is the neighborhood's total population in the base year. $m_{i,c,t-1}$ is the base-year share immigrants of neighborhood i in municipality c . Specifically, $m_{i,c,t-1} = M_{i,c,t-1} / P_{i,c,t-1}$, where $M_{i,c,t-1}$ is the number of immigrants, respectively, of neighborhood i in municipality c in the base year. To study whether the natives respond differently to the concentration of European and non-European immigrants in the neighborhood, we estimate equation (1) with $m_{i,c,t-1}$ equal to (1) the share of European immigrant and (2) the share of non-European immigrants. d_c is a dummy variable that equals 1 if the neighborhood immigrant share is larger than the candidate tipping point and 0 otherwise. α_c is a constant term and $\varepsilon_{i,c,t}$ is a random term.

All candidate tipping points between immigrant shares of 1–60 percent are tested, and the tipping point of a municipality is identified by choosing the value of $m_{c,t-1}^*$ that yields the highest R^2 -value. This value represents the European and non-European immigrant shares at which the municipality experience tipping (*i.e.* where the neighborhood growth in the native population changes discontinuously). Following Card, Mas, and Rothstein (2008b), we use a random subsample of two-thirds of the neighborhoods for each municipality to identify the tipping points. The remaining one-third random subsample is used to quantify the discontinuity.⁴ We identify two sets of candidate tipping points for the 12 Swedish municipalities: one set relating to the share of European immigrants and one set relating the share on non-European immigrants.

⁴The reason for subsampling is that if we use the same data to identify the tipping points and to quantify the discontinuity in the native population growth, we run the risk of rejecting the null hypothesis that there is no discontinuity too often (*see* Leamer 1978).

The Effect of Tipping on Native Population Growth

Next, we explore whether the candidate tipping points described above results in tipping behavior among natives. In other words, we want to investigate whether the native population growth in fact drops significantly once a neighborhood's immigrant concentration has surpassed the municipality-specific tipping point relating to the share of European and non-European immigrants, respectively. For this purpose, we follow Card, Mas, and Rothstein (2008b) and use regression discontinuity methods, which allow us to explore whether the native population growth is statistically significantly smaller in neighborhoods with an immigrant share that is larger than the tipping point than in neighborhoods with smaller immigrant shares. Apart from identifying whether there is a drop in the native population growth, we also estimate the size of the (possible) drop.

In these estimations, we use the one-third random sample of the neighborhoods not used for the identification of the tipping points. From this subsample, we use and pool the neighborhoods of the municipalities with an *identified* candidate tipping point. We estimate the following model:

$$\text{dn}_{i,c,t} = \alpha_c + d_c 1 \left[m_{i,c,t-1} > m_{c,t-1}^* \right] + h(m_{i,c,t-1} - m_{c,t-1}^*) + \mu_c + \gamma_i + \varepsilon_{i,c,t}, \quad (2)$$

where the dependent variable, $\text{dn}_{i,c,t}$ as before is the neighborhood growth rate of the native population in 1990–2000 and in 2000–2007. The explanatory variable of interest is d_c – that is, a dummy variable equals 1 if the share of immigrants in the base year (= 1990, 2000), $m_{i,c,t-1}$, is larger the identified municipality-specific tipping point, $m_{i,c,t-1}^*$, and 0 otherwise. A negative coefficient on d_c implies that the native population growth is statistically significantly smaller in neighborhoods with an immigrant share that is larger than the value of the tipping point than in neighborhoods with immigrant concentrations that are smaller than the tipping point. To study if natives respond differently to the concentration of European and non-European immigrants in the neighborhood, we estimate equation (2) with $m_{i,c,t-1}$ equal to (1) the share of European immigrant and (2) the share of non-European immigrants. We include a quartic polynomial in the deviation of the immigrant share from the municipality-specific tipping point in order to allow for non-linearity. We

also include municipality fixed effects, μ_c and control variables measured at the neighborhood level, namely unemployment rate and mean individual disposable income. Finally, $\varepsilon_{i,c,t}$ is a random error.

Native Flight and Native Avoidance

The (possible) discontinuous drop in the native population growth at the estimated tipping point can be a result of increased out-migration of natives, referred to as *native flight*, and/or to reduced in-migration of natives to the neighborhood, referred to as *native avoidance*. To explore each of the two explanations, we estimate two models similar to that described by equation (2) above. In the regression model used to study the importance of native flight, the dependent variable is the share of natives in neighborhood i in municipality c in 1990 and 2000, that had moved out by the year 2000 and 2007, respectively:

$$\begin{aligned} [(N_{i,c} \text{ out}_{t,t-1})/P_{i,c,t-1}] = & \alpha_c + d_c 1[m_{i,c,t-1} > m_{c,t-1}^*] \\ & + h(m_{i,c,t-1} - m_{c,t-1}^*) + \mu_c + \gamma_i + \varepsilon_{i,c,t} \end{aligned} \quad (3)$$

The (possible) drop in the native population growth can be attributed to native flight, if the estimated coefficient for d_c in equation (3) is positive. This means that the share of natives that had moved out in 1990–2000 and in 2000–2007, respectively, is larger in neighborhoods with an immigrant concentration that is larger than the identified tipping point than in neighborhoods with immigrant concentrations that are smaller than the critical threshold value.

In the regression model used to study native avoidance, the dependent variable is that share of natives in neighborhood i in municipality c that moved in to the neighborhood in 1990–2000 and in 2000–2007, respectively:

$$\begin{aligned} [(N_{i,c} \text{ in}_{t,t-1})/P_{i,c,t-1}] = & \alpha_c + d_c 1[m_{i,c,t-1} > m_{c,t-1}^*] \\ & + h(m_{i,c,t-1} - m_{c,t-1}^*) + \mu_c + \gamma_i + \varepsilon_{i,c,t} \end{aligned} \quad (4)$$

If native avoidance is driving the (possible) drop in the native population growth, the estimated coefficient for d_c should be negative. In that case, the share of natives that moved into a specific neighborhood is

smaller in neighborhoods with an immigrant share that is larger than the tipping point than in neighborhoods with an immigrant share that is lower than the tipping point.

As in the estimation of equation (2), we include a quartic polynomial, municipality fixed effects, and the unemployment rate and average disposable income at the neighborhood level. As shown in equation (5), the change in the neighborhood's native population growth consists of four parts: out- and in-migration of natives and of people exiting (by death) and entering (by turning 16) the unbalanced panel. If we assume that there is no systematic pattern in how people leave and enter the sample, the estimated effect of tipping on in- and out-migration rates of natives from equations (3) and (4) should add up to the estimated effect of tipping on the native population growth from estimating equation (2).⁵

$$\begin{aligned} [(N_{i,c,t} - N_{i,c,t-1})/N_{i,c,t-1}] = & [N_{i,c} \text{ in}_{t,t-1}/N_{i,c,t-1}] \\ & - [N_{i,c} \text{ out}_{t,t-1}/N_{i,c,t-1}] \\ & - [N_{i,c} \text{ exit}_{t,t-1}/N_{i,c,t-1}] \\ & + [N_{i,c} \text{ enter}_{t,t-1}/N_{i,c,t-1}] \end{aligned} \quad (5)$$

The Effect of Tipping on Socio-Economic Segregation

Finally, we explore the extent to which native tipping behavior is selective in the sense that individuals with a high educational attainment and high labor earnings are more likely to move out from neighborhoods that have tipped than are individuals with a low educational attainment and low labor earnings. For this purpose we use a specification similar to equation (3) to estimate the effect of tipping on native flight for different educational and income groups. We estimate the following model:

⁵We do not explore whether there are systemic differences in exit rates (mortality rates) from and entry rates to the neighborhoods. Even if such differences exist, they should not affect our results on native flight and native avoidance, as both outmigration and immigration are conditioned on observing the neighborhood the individual moves from and the neighborhood the individual moves to. However, they can affect our estimate of the effect of tipping on native population growth and may therefore be one reason for why the effects of native flight and native avoidance do not sum up to the estimated change in native population growth in Native Flight and Native Avoidance.

$$\begin{aligned} [(N_{g,i,c} \text{ out}_{t,t-1})/P_{g,i,c,t-1}] = & \alpha_c + d_c 1[m_{i,c,t-1} > m_{c,t-1}^*] \\ & + b(m_{i,c,t-1} - m_{c,t-1}^*) + \mu_c + \gamma_i + \varepsilon_{i,c,t}, \end{aligned} \quad (6)$$

The dependent variable is calculated as the share of natives in group g in neighborhood i in municipality c in 1990 and 2000, that had moved out from neighborhood i by the year 2000 and 2007, respectively. If there is selective out-migration among natives, the estimated coefficients of d_c should be positive and larger in magnitude for natives with a high educational attainment and high labor earnings than for the other educational and income groups. We estimate equation (6) for three educational groups: individuals who have completed (1) primary school, (2) secondary school, and (3) a university degree.⁶ Equation 6 is also estimated for four income percentile groups based on the distribution of annual labor earnings: (1) 1st–25th percentile, (2) 26th–50th percentile, (3) 51st–75th percentile, and (4) 76th–100th percentile. Annual labor earnings comprise pre-tax earnings from employment and other types of income that is related to the employment, such as sick leave and parental leave. As labor earnings are likely to differ by gender and with age and since the gender and age composition may differ among neighborhoods, we use annual labor earnings net of age and gender. This is done by first estimating annual labor earnings controlling for age and gender for natives in working age, that is, in the ages 25–64. We then obtain labor earnings net of age and gender by deducting predicted earnings from the earnings observed in the data. Natives are then divided into the income groups defined above on the basis of this earnings measure.

RESULTS

Identification of Candidate Tipping Points

Table 4 shows the results from the estimation of equation (1). Between 1990 and 2000, we can identify a statistically significant and precise candidate tipping point for 9 and 10 of the 12 municipalities in Sweden for

⁶Individuals with missing information about their educational attainment are excluded.

TABLE 4
OVERVIEW OF CANDIDATE TIPPING POINTS

	European immigrants		Non-European immigrants	
	1990–2000	2000–2007	1990–2000	2000–2007
Mean municipality tipping point	9.5	9.8	3.2	4.1
Min municipality tipping point	5.8	3.8	0.3	1.3
Max municipality tipping point	19.3	22.5	8.2	19.0
Number of municipalities	9	9	10	9
with an identified tipping point				
Number of SAMS areas in the municipalities with an identified tipping point	1,370	1,462	1,444	1,385

European immigrants and non-European immigrants, respectively.⁷ For both time periods, that is, in 1990–2000 and 2000–2007, the candidate tipping points identified for the share of European immigrants are larger than the tipping points related to the share of non-European immigrants. This suggests that natives may be more tolerant to residing in areas with European immigrants than in neighborhoods with non-European immigrants. Table 4 further shows that the size of the candidate tipping points increases between the two time periods, especially the tipping points for non-European immigrants. One possible explanation to this pattern is that natives became more tolerant to residing in neighborhoods with non-European immigrants over time.⁸

The Effect of Tipping on Native Population Growth

Next, we explore whether there is tipping behavior among natives, that is, whether there is a negative drop in the native population growth in neighborhoods with an immigrant share larger than the candidate tipping points identified in Identification of Candidate Tipping Points. We also study whether natives respond differently to the share of European immigrants and non-European immigrants, respectively, in their neighborhood. For this purpose, we pool the municipalities with an identified tipping point and estimate a regression discontinuity model using the remaining third of the sample, not used for identification of the tipping points. We

⁷See Tables A1 and A2 in Appendix A for regression results divided by European and non-European immigrants and by municipality and time period.

⁸Research has shown that native attitudes towards immigrants in Sweden have become more positive over the years (see Demker 2010).

TABLE 5
REGRESSION DISCONTINUITY MODEL FOR CHANGES IN THE NATIVE POPULATION GROWTH AROUND
TIPPING POINT FOR SHARE OF EUROPEAN AND NON-EUROPEAN IMMIGRANTS (ROBUST STANDARD ERRORS
CLUSTERED ON THE MUNICIPALITY LEVEL WITHIN PARENTHESES)

	European immigrants		Non-European immigrants	
	(1)	(2)	(3)	(4)
1990–2000				
Beyond tipping point	0.0397 (0.0386)	0.0450 (0.0361)	–0.0628*** (0.0180)	–0.0650*** (0.0143)
Municipality fixed effects	Y	Y	Y	Y
Polynomial in immigrant share	Quartic	Quartic	Quartic	Quartic
Neighborhood Controls	N	Y	N	Y
Number of observations	686	686	725	725
R ²	0.0925	0.102	0.0970	0.0976
2000–2007				
Beyond tipping point	0.0146 (0.0095)	0.0137 (0.0094)	–0.0479*** (0.0133)	–0.0475*** (0.0130)
Municipality fixed effects	Y	Y	Y	Y
Polynomial in immigrant share	Quartic	Quartic	Quartic	Quartic
Neighborhood controls	N	Y	N	Y
Number of observations	730	730	690	690
R ²	0.127	0.128	0.151	0.151

Note: Controls at the neighborhood level comprise average disposable income level and unemployment rate. *** indicates statistical significance at 1 percent level, ** at the 5-percent level, and * at the 10 percent level.

estimate two specifications, one without and one with neighborhood controls.⁹

Columns (1) and (2) in Table 5 present the results from estimations relating to the share of European immigrants, where specification in column (1) does not include neighborhood controls, while the specification in column (2) does. For both time periods, the results give no evidence of a drop in the native population growth around the tipping point. The estimated coefficients are positive, indicating a larger native population growth in neighborhoods with a share of European immigrants that was higher than the candidate tipping point than in neighborhoods with lower concentrations of European immigrants, but the effect is not statistically significant. Thus, we find no evidence of native tipping behavior relating to changes in the share European immigrants in the neighborhood.

Turning to how natives respond to changes in the share of non-European immigrants, columns (3) and (4) show a negative and statistically significant effect in both time periods. The effect is robust to the

⁹We have estimated the regressions varying the degree of the polynomial in the immigrant share between one and four and also by including a polynomial in the neighborhood control variables up to level four. The results were not affected by this.

inclusion of neighborhood controls and indicates that there was a drop in the native population growth around the tipping point. For the period 1990–2000, the magnitude of the effect is about 6.5 percent (*see* column [4]), implying that the neighborhoods with a non-European immigrant share that was higher than the value of the municipality tipping point had a native population growth rate that was 6.5 percent lower than the neighborhoods with lower concentrations of non-European immigrants. In 2000–2007, the drop in the native population growth was smaller amounting to 4.8 percent (*see* column [4]).

Native Flight and Native Avoidance

In the above section, we found that natives appear to respond to changes in the share of non-European immigrants in their neighborhood, but not to the concentration of European immigrants. Therefore, in this section, we focus on natives' response to changes in the share of non-European immigrants and explore the extent to which the observed drop in the native population growth at the tipping point identified in the section above can be attributed to an increased out-migration of natives, "native flight" and/or an decreased in-migration of natives, "native avoidance". We estimate two specifications, one without and one with neighborhood controls.¹⁰

For time period 1990–2000, Table 6 reveals that the native tipping behavior relating to the share of non-European immigrants appears to have been driven both by native flight and native avoidance. Columns (1) and (2) show the effect of tipping on the outmigration of natives and in the first time period, the effect is positive and statistically significant but decreases somewhat when neighborhood controls are included. Based on the result in column (2), the effect amounts to 3.3 percent, implying that neighborhoods with a non-European immigrant share larger than the municipality-specific tipping point had, on average, a 3.3 percent higher outflow of natives compared with the neighborhoods with a lower concentration of non-European immigrants.

¹⁰The model has been tested with the degree of the polynomial in the immigrant share varying between one and four and also by including a polynomial in the neighborhood control variables up to level four. Altering the specification in this way had no effect on the results.

TABLE 6
REGRESSION DISCONTINUITY MODEL OF NATIVE FLIGHT AND NATIVE AVOIDANCE AROUND TIPPING POINT
FOR SHARE OF NON-EUROPEAN IMMIGRANTS (ROBUST STANDARD ERRORS CLUSTERED ON THE MUNICIPAL-
ITY LEVEL WITHIN PARENTHESES)

	Native flight (1)	Native flight (2)	Native avoidance (3)	Native avoidance (4)
1990–2000				
Beyond tipping point	0.0428*** (0.0115)	0.0326** (0.0128)	–0.0171 (0.0137)	–0.0220* (0.0105)
Municipality fixed effects	Y	Y	Y	Y
Polynomial in the immigrant share	Quartic	Quartic	Quartic	Quartic
Neighborhood controls	N	Y	N	Y
Number of observations	725	725	725	725
R ²	0.315	0.328	0.176	0.177
2000–2007				
Beyond tipping point	0.0464*** (0.0071)	0.0439*** (0.0075)	0.0238 (0.0167)	0.0233 (0.0162)
Municipality fixed effects	Y	Y	Y	Y
Polynomial in immigrant share	Quartic	Quartic	Quartic	Quartic
Neighborhood controls	N	Y	N	Y
Number of observations	690	690	690	690
R ²	0.295	0.308	0.156	0.160

Note: Controls at the neighborhood level comprise average disposable income level and unemployment rate. *** indicates statistical significance at 1 percent level, ** at the 5-percent level, and * at the 10 percent level.

Turning to columns (3) and (4) in Table 6, which shows the results when the dependent variable is the share of natives moving in to a neighborhood, the effect of tipping on the propensity to move is negative but statistically insignificant in column (3). However, when we include neighborhood controls in column (4), the effect increases somewhat to 2.2 percent and becomes statistically significant. Thus, in 1990–2000, the in-migration rate of the natives was, on average, 2.2 percent lower in neighborhoods with a non-European immigrant share higher than the tipping point value than in neighborhoods with lower concentrations. Note that the effects of tipping on native flight and native avoidance nearly sum up to the drop in the native population growth of 6.5 percent found in Table 5 (*see* column [4]). The reason for not summing up exactly may be due systematic differences in exits from the sample by death and entry reaching the age threshold 16 across the neighborhoods.

In 2000–2007, the estimated effect of tipping for native flight is positive and statistically significant, whereas the estimated effect of tipping for native avoidance is not statistically significant. In column (2), the effect for native flight amounts to 4.4 percent, indicating that the outmigration rate of the natives was, on average, 4.4 percent higher in

neighborhoods with an immigrant share exceeding the tipping point than in neighborhoods with smaller non-European immigrant shares. Comparing this effect to the estimated drop in the native population growth of 4.8 percent in Table 5 (*see* column [4]), suggests that natives leaving neighborhoods with a high concentration of non-European immigrants was the main driving force of the native tipping behavior in 2000–2007. In contrast to the 1990s, there is no evidence of natives avoiding moving in to such neighborhoods.

Sensitivity Checks

We have conducted sensitivity checks to check the robustness of the results. Different dimensions of robustness have been checked. First, one may argue that the tipping point may differ within large metropolitan areas such as Stockholm. In our previous estimations, we included the entire county of Stockholm. In our sensitivity checks, the county of Stockholm was divided into four subareas, which were homogeneous within each subarea with respect to residents' average disposable income. The results from these estimations, in all essential, turned out to be the same as the results previously presented. All results and all definitions are available from the authors upon request.

In a second step, we ran all estimations presented above for SAMS areas with more than 400 inhabitants, to check for how sensitive the results are to neighborhood size. The results relating to the effect of tipping on the native population growth are in line with the results presented above. Further, the finding that the drop in the native population growth around the tipping point was driven by native flight both in 1990–2000 and in 2000–2007 is also robust to changes in the neighborhood size; the estimated effect is positive, and its magnitude remain fairly constant. However, the effect for native avoidance found in 1990–2000 is no longer statistically significant. The robustness of the results for native flight combined with the fact that the magnitude of the effect for native flight is larger than that of native avoidance for the time period 1990–2000 (*see* Table 6, columns [2] and [4]), suggest that native flight appears to have been the main driving force to the drop in the native population growth observed both in 1990–2000 and in 2000–2007. The results from these estimations are available from the authors upon request.

The Effect of Tipping on Socio-Economic Segregation

The results in section The Effect of Tipping on Native Population Growth and Native Flight and Native Avoidance point at the existence of native tipping behavior relating to changes in the concentration of non-European immigrant both in 1990–2000 and in 2000–2007 and that this behavior was driven mainly by native flight. In this section, we explore the extent to which native tipping behavior, apart from residential segregation, may be associated with socio-economic segregation in terms of educational attainment and labor earnings.

Table 7 shows descriptive statistics of annual labor earnings and educational attainment for native movers and stayers residing in neighborhoods with a non-European immigrant share larger than the identified tipping point, in 1990–2000 and 2000–2007, respectively. For both time periods, natives who moved from neighborhoods that had tipped had, on average, a higher educational attainment than natives who did not move. For example, in 1990–2000, the share with a university degree was 9 percent higher among the movers than among the stayers, and the corresponding share was 16 percent higher in 2000–2007. Further, Table 7 reveals that in both time periods, natives who moved had slightly higher annual labor earnings than natives that did not move. Thus, Table 7 suggests that natives who moved from neighborhoods that had tipped were positive selected in terms of educational attainment and labor earnings.

TABLE 7
EDUCATIONAL ATTAINMENT AND ANNUAL LABOR EARNINGS OF NATIVE STAYERS AND MOVERS RESIDING IN NEIGHBORHOODS THAT HAVE EXPERIENCED TIPPING

Variable	Period 1990–2000			Period 2000–2007		
	Movers	Stayers	Movers / Stayers	Movers	Stayers	Movers / Stayers
Educational attainment						
Primary school	20.5	25.8	0.79	10.8	15.6	0.69
Secondary school	45.4	43.0	1.05	42.5	44.1	0.96
University degree	34.1	31.2	1.09	46.7	40.3	1.16
Annual labor earnings in the first year of the period	153,000	152,000	1.01	221,000	213,000	1.04
Number of observations	334,253	632,852		363,901	880,408	

Note: The descriptive statistics for annual labor earnings are restricted to individuals age 25–64 (in working age). Annual labor earnings are measured in 1990 for the period 1990–2000 and in 2000 for the period 2000–2007.

To explore this further, we study the extent to which the native flight behavior differs among natives with different levels educational attainment and annual labor earnings. The results from the estimation of equation (7) are presented in Table 8.

Columns (1) – (4) show the results for natives with different levels of educational attainment. Column (1) presents the pooled result for all educational groups and in both time periods, the estimated effect similar to those found in the estimations for native flight in Table 6. Further, both in 1990–2000 and in 2000–2007, Table 8 suggests that the outflow of natives from neighborhoods that had tipped was highest among natives with a relatively high educational attainment. In 1990–2000, the effect of tipping on native flight amounted to 4.4 and 5.8 percent for natives with secondary schooling and with a university degree, respectively. Thus, among natives with a university degree, neighborhoods with a non-European immigrant share above the municipality specific tipping point had, on average, a 5.8 percent higher outflow of natives compared to the neighborhoods with a lower concentration of non-European immigrants. In 2000–2007, the corresponding effects are 5.8 percent for natives with secondary schooling and 7.8 percent for natives with a university degree. In both time periods, among natives with primary schooling, there is no statistically significant difference in the outflow of natives between neighborhoods that have tipped and neighborhoods with immigrant concentrations smaller than the tipping point.¹¹

Table 8 also shows the results from the estimation of native flight for the different income percentile groups. Column (5) shows the pooled results including all income percentile groups, which again are comparable to the results found in Table 6. Columns (6) – (9) present the results for each income percentile group. In the first period, 1990–2000, the effect of tipping on the outmigration among natives in the top of the earnings distribution, that is, among the 25 percent with the highest labor earnings, was about 6.3 percent compared with about 3 percent for natives

¹¹ t-tests show that in 1990–2000, the differences in the effects of tipping on native flight among natives with different educational attainment are not statistically significant. However, in 2000–2007, the effect for natives with a university degree education group is statistically significantly higher than the effects for natives with primary and secondary schooling. In addition, the effect for natives with secondary schooling is statistically significantly higher for than that for natives with primary. The t-tests are available from the authors on request.

TABLE 8
REGRESSION DISCONTINUITY MODEL FOR NATIVE FLIGHT FOR DIFFERENT LEVELS OF EDUCATIONAL ATTAINMENT AND ANNUAL LABOR EARNINGS (ROBUST STANDARD ERRORS CLUSTERED ON THE MUNICIPALITY LEVEL WITHIN PARENTHESES)

	All education groups (1)	Primary School (2)	Secondary School (3)	University degree (4)	All income groups (5)	Percentile <26th (6)	Percentile 26th–50th (7)	Percentile 51th–75th (8)	Percentile >75th (9)
1990–2000									
Beyond tipping point	0.0421*** (0.0107)	0.0244 (0.0190)	0.0438*** (0.0117)	0.0581*** (0.0137)	0.0423*** (0.0092)	0.0385*** (0.0112)	0.0328** (0.0112)	0.0250* (0.0119)	0.0628*** (0.0135)
Municipality fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Polynomial in the immigrant share	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic
Neighborhood controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of observations	2175	725	725	725	2900	725	725	725	725
R^2	0.258	0.302	0.289	0.286	0.251	0.341	0.387	0.390	0.270
2000–2007									
Beyond tipping point	0.0489*** (0.0062)	0.0103 (0.0098)	0.0588*** (0.0100)	0.0775*** (0.0110)	0.0600*** (0.0085)	0.0407*** (0.0085)	0.0575*** (0.0119)	0.0607*** (0.0130)	0.0778*** (0.0112)
Municipality fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Polynomial in immigrant share	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic
Neighborhood controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of observations	2070	690	690	690	2760	690	690	690	690
R^2	0.212	0.304	0.316	0.245	0.138	0.249	0.307	0.311	0.337

Note: Controls at the neighborhood level comprise average disposable income level and unemployment rate. *** indicates statistical significance at the 1 percent level, ** at the 5-percent level, and * at the 10 percent level.

with relatively lower earnings, suggesting that in 1990–2000, high-income earners were more likely than natives with lower labor earnings to move out of neighborhoods that had tipped.¹² We observe a similar pattern in 2000–2007; the effect of tipping on native flight for the different income groups increases as we move up the earnings distribution from about 4 percent for natives with the lowest earnings to about 8 percent for natives with the highest earnings.¹³

To sum up, Table 8 shows that, given that native out-movers are disproportionately replaced by in-movers of lower status, native tipping behavior may be associated with increased socio-economic segregation both in terms of educational attainment and labor earnings, as the outmigration rate of individuals with a high educational attainment and high labor earnings from neighborhoods that have tipped, appears to be higher than for natives with a low educational attainment and low labor earnings.¹⁴

CONCLUSIONS

This paper has studied how natives' residential mobility is associated with ethnic geographical segregation using Swedish individual level data for the years 1990–2007. Specifically, we have examined the existence of native tipping behavior related to the concentration of European and non-European immigrants and, in contrast to previous research, we have been able to examine whether tipping behavior can be attributed to native flight and/or native avoidance and the extent to which tipping behavior may be associated with increased socio-economic segregation.

We find that geographical ethnic segregation increased during the 1990s and remained fairly constant between 2000 and 2007. We also find

¹²t-tests show that the difference between natives with the highest and the lowest earnings is statistically significant. The differences in the estimated coefficients among the other income groups are not statistically significant.

¹³t-tests show that the coefficient for "beyond tipping point" is statistically significantly higher in all income groups in comparison to the lowest (<26th) percentile group. Between the other groups, there are no statistically significant differences.

¹⁴We have also estimated the effect of tipping on native population growth for the different educational and earnings percentile groups. In all essentials, these results point in the same direction as the results presented in Table 8. The results from these estimations are available from upon request.

that non-European immigrants reside more densely concentrated within municipalities than European immigrants. Such segregation may have implications for labor market outcomes, welfare dependency, as well as school achievement in Sweden's immigrant population.

As in previous research using US data, we find support for tipping behavior among natives in a majority of Sweden's 12 largest municipalities. However, the estimated tipping points are significantly higher for European immigrants than for non-European immigrants. In addition, we find no statistically significant difference in the native population growth between neighborhoods with a European immigrant share that is larger than the tipping point and neighborhoods with lower concentrations of European immigrants. In contrast, when we turn to how natives respond to the concentration of non-European immigrants, we find that the native population growth is considerably smaller in neighborhoods that have tipped, although the difference in growth rates decreases somewhat between 1990–2000 and 2000–2007.

A possible explanation to the different responses of natives to the concentration of European and non-European immigrants in their neighborhood may be that natives are more tolerant towards residing in neighborhoods with a relatively high concentration of European immigrants compared to residing in neighborhoods with a large share of non-European immigrants. This is in line with previous research that shows that non-European immigrants are discriminated against both on the labor and housing market and that European immigrants are better attached to the Swedish labor market (Hammarstedt 2003; Carlsson and Rooth 2007; Hammarstedt and Shukur 2007; Ahmed and Hammarstedt 2008; Ahmed, Andersson, and Hammarstedt 2010). This finding suggests that it is the characteristics of immigrants that matters for native tipping behavior rather than immigrant status or immigration *per se*. However, even if natives are less tolerant towards having non-European immigrant neighbors, the fact that we find smaller tipping points relating to the concentration of non-European immigrants as well as a smaller drop in the native population growth in 2000–2007 compared with the 1990s, suggest that natives have become more tolerant over time towards living in neighborhoods with relatively high concentrations of non-European immigrants. It is important to note that natives' preferences for living in neighborhoods with a concentration of non-European immigrants may be a result of natives having negative attitudes towards having non-European immigrant neighbors but

also of the possible negative effects that an increased immigrant concentration may have on local amenities, such as schools and other social institutions. In this paper, we are not able to isolate these two effects.

The access to individual data has enabled us to examine the mechanisms behind the native tipping behavior relating to the concentration of non-European immigrants. First, our results show that both in 1990–2000 and 2000–2007, the drop in the native population growth in neighborhoods that have tipped, appears to be driven mainly by native flight, that is, an increased outmigration of natives, although there is some evidence of native avoidance in the 1990s. Secondly, we also explored the extent to which tipping behavior among natives, apart from ethnic segregation, may be associated with socioeconomic segregation. We find that natives with high educational attainment and high labor earnings are more likely to leave neighborhoods that have tipped than are natives with low educational attainment and low labor earnings. Given that native out-movers are disproportionately replaced in-movers of lower socio-economic status, this suggests that native tipping behavior is also likely to be associated with increased socio-economic segregation in terms of educational attainment and labor earnings.

Finally, the existence and implications of ethnic geographical segregation are often debated among both policymakers and among researchers. So are the existence of ethnic enclaves and their advantages and disadvantages. There is also an ongoing debate on the extent to which ethnic segregation is self-chosen or driven by ethnic discrimination on the housing market. This paper has shed new light on the mechanisms and driving forces behind ethnic geographical segregation and the creation of ethnic enclaves. Even if ethnic segregation is self-chosen in the sense that immigrants prefer to reside near other immigrants from their own country of origin, this segregation is reinforced by the fact that it also affects the residential mobility behavior of natives. Even though our results cannot be given a causal interpretation, they clearly show that natives tend to move out of areas with a high concentration of non-European immigrants, suggesting that native residential mobility behavior is one of the driving forces behind the existence of ethnic geographical segregation.

APPENDIX A

TABLE A1
IDENTIFICATION OF MUNICIPALITY TIPPING POINTS AND RESULTS FROM REGRESSION DISCONTINUITY
MODEL FOR POPULATION CHANGES AROUND THE TIPPING POINT FOR SHARE OF EUROPEAN IMMIGRANTS
(ROBUST STANDARD ERRORS WITHIN PARENTHESES)^A

	Native population growth					
	Stockholm 1990–2000	Stockholm 2000–2007	Göteborg 1990–2000	Göteborg 2000–2007	Malmö 1990–2000	Malmö 2000–2007
Beyond tipping point	–0.0869*** (0.0277)	–0.0536*** (0.0195)	–0.127*** (0.0321)	–0.0528*** (0.0174)	–0.152*** (0.0265)	–0.0307* (0.0167)
Number of observations	450	498	370	410	139	152
R ²	0.021	0.015	0.041	0.022	0.194	0.022
Tipping point%	0.06	0.14	0.17	0.22	0.19	0.09
	Uppsala 1990–2000	Uppsala 2000–2007	Linköping 1990–2000	Linköping 2000–2007	Västerås 1990–2000	Västerås 2000–2007
Beyond tipping point	–0.0594** (0.0263)	–0.0652*** (0.0221)	0.381* (0.205)	–0.0889 (0.111)	–0.149*** (0.0461)	–0.0669** (0.0253)
Number of observations	100	115	61	75	70	69
R ²	0.050	0.071	0.055	0.009	0.134	0.094
Tipping point%	0.07	0.09	0.06	0.09	0.07	0.09
	Örebro 1990–2000	Örebro 2000–2007	Norrköping 1990–2000	Norrköping 2000–2007	Helsingborg 1990–2000	Helsingborg 2000–2007
Beyond tipping point	–0.189*** (0.0471)	–0.0703** (0.0266)	–0.139*** (0.0422)	–0.0555*** (0.0202)	–0.0763*** (0.0227)	–0.0439 (0.0263)
Number of observations	73	79	51	52	27	25
R ²	0.185	0.083	0.182	0.131	0.311	0.108
Tipping point%	0.06	0.04	0.09	0.07	0.08	0.10
	Jönköping 1990–2000	Jönköping 2000–2007	Umeå 1990–2000	Umeå 2000–2007	Lund 1990–2000	Lund 2000–2007
Beyond tipping point	–0.107** (0.0484)	–0.0694** (0.0276)	0.307** (0.133)	–0.0278 (0.0542)	0.145* (0.0848)	–0.0403** (0.0196)
Number of observations	42	41	43	44	40	41

TABLE A1 (CONTINUED)
IDENTIFICATION OF MUNICIPALITY TIPPING POINTS AND RESULTS FROM REGRESSION DISCONTINUITY
MODEL FOR POPULATION CHANGES AROUND THE TIPPING POINT FOR SHARE OF EUROPEAN IMMIGRANTS
(ROBUST STANDARD ERRORS WITHIN PARENTHESES)^A

	Jönköping 1990–2000	Jönköping 2000–2007	Umeå 1990–2000	Umeå 2000–2007	Lund 1990–2000	Lund 2000–2007
R^2	0.110	0.140	0.116	0.006	0.072	0.098
Tipping point%	0.07	0.10	0.09	0.03	0.03	0.05

Notes: *** indicates statistical significance at 1 percent level, ** at the 5-percent level, and * at the 10 percent level.

^AWe have excluded obvious outliers in order to obtain tipping points that are not driven by a few observations. By calculating how much an observation influences the regression model as a whole (*i.e.* how much the predicted values change as a result of including and excluding a particular observation), SAMS areas with a $|DfFIT| > 2 \cdot \sqrt{k/N}$ were excluded. k is the number of parameters (including the intercept) and N is the sample size.

TABLE A2
IDENTIFICATION OF MUNICIPALITY TIPPING POINTS AND RESULTS FROM REGRESSION DISCONTINUITY
MODEL FOR POPULATION CHANGES AROUND THE TIPPING POINT FOR SHARE OF NON-EUROPEAN IMMI-
GRANTS(ROBUST STANDARD ERRORS WITHIN PARENTHESES)^A

	Native population growth					
	Stockholm 1990–2000	Stockholm 2000–2007	Göteborg 1990–2000	Göteborg 2000–2007	Malmö 1990–2000	Malmö 2000–2007
Beyond tipping point	–0.117*** (0.0148)	–0.0941*** (0.0152)	–0.0874*** (0.0335)	–0.0383*** (0.0113)	–0.0853*** (0.0222)	0.0390** (0.0195)
Number of observations	448	498	363	410	147	152
R^2	0.122	0.072	0.018	0.027	0.092	0.026
Tipping point%	0.01	0.03	0.08	0.02	0.03	0.10
	Uppsala 1990–2000	Uppsala 2000–2007	Linköping 1990–2000	Linköping 2000–2007	Västerås 1990–2000	Västerås 2000–2007
Beyond tipping point	–0.0986** (0.0409)	–0.0621*** (0.0153)	–0.379** (0.148)	–0.0821*** (0.0278)	–0.0985*** (0.0333)	–0.0786*** (0.0250)
Number of observations	98	115	57	75	70	69
R^2	0.057	0.128	0.106	0.107	0.114	0.128
Tipping point%	0.003	0.03	0.06	0.03	0.01	0.02
	Örebro 1990–2000	Örebro 2000–2007	Norrköping 1990–2000	Norrköping 2000–2007	Helsingborg 1990–2000	Helsingborg 2000–2007
Beyond tipping point	–0.150*** (0.0339)	–0.0643** (0.0266)	–0.108*** (0.0258)	–0.140*** (0.0410)	–0.0418 (0.0393)	–0.0359 (0.0278)

TABLE A2 (CONTINUED)
IDENTIFICATION OF MUNICIPALITY TIPPING POINTS AND RESULTS FROM REGRESSION DISCONTINUITY
MODEL FOR POPULATION CHANGES AROUND THE TIPPING POINT FOR SHARE OF NON-EUROPEAN IMMI-
GRANTS(ROBUST STANDARD ERRORS WITHIN PARENTHESES)^A

	Örebro 1990–2000	Örebro 2000–2007	Norrköping 1990–2000	Norrköping 2000–2007	Helsingborg 1990–2000	Helsingborg 2000–2007
Number of observations	73	79	48	52	28	24
R^2	0.215	0.070	0.277	0.188	0.042	0.070
Tipping point%	0.03	0.01	0.03	0.19	0.02	0.02
	Jönköping 1990–2000	Jönköping 2000–2007	Umeå 1990–2000	Umeå 2000–2007	Lund 1990–2000	Lund 2000–2007
Beyond tipping point	–0.104*** (0.0381)	–0.0775*** (0.0250)	0.307** (0.133)	–0.0713** (0.0347)	–0.0962* (0.0503)	–0.0305 (0.0204)
Number of observations	42	43	43	44	39	43
R^2	0.156	0.190	0.116	0.091	0.090	0.052
Tipping point%	0.01	0.02	0.14	0.02	0.06	0.02

Notes: ***indicates statistical significance at 1 percent level, ** at the 5-percent level, and * at the 10 percent level.

^AWe have excluded obvious outliers in order to obtain tipping points that are not driven by a few observations. By calculating how much an observation influences the regression model as a whole (*i.e.* how much the predicted values change as a result of including and excluding a particular observation), SAMS areas with a $|DFFIT| > 2\sqrt{SQRT(k/N)}$ were excluded. k is the number of parameters (including the intercept) and N is the sample size.

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II

Ethnic Concentration and Economic Outcomes of Natives and Second-generation Immigrants

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Abstract

The purpose of this paper is to investigate the link between childhood neighbourhood ethnic composition and short- and long-run economic outcomes of second-generation immigrants and natives in Sweden. The results show that second-generation immigrants raised in immigrant-dense neighbourhoods have a lower probability to continue to higher education, whereas, their earnings, unemployment and social assistance tendencies are unaffected. On the contrary, natives are more likely to be in unemployment or use social assistance, less prone to continue to higher education and have lower earnings if they resided in a neighbourhood with a high immigrant share in childhood. Moreover, the social assistance and unemployment of non-Nordic second-generation immigrants appears to be negatively correlated with the neighbourhood share of co-ethnics and positively correlated with the neighbourhood proportion of other ethnic groups. Overall, we find that the results are very similar in the short- and long-run.

JEL classification: J15; R23

Keywords: Economic outcomes; Ethnic segregation; Natives; Neighbourhood; Second-generation immigrants

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1. Introduction

In Sweden, as in other countries, research has shown that first-generation immigrants perform worse on the labour market in comparison to natives (e.g. Gustafsson and Zheng, 2006; Hammarstedt and Shukur, 2006, 2007). Moreover there is a large literature on the intergenerational transmission of human capital from first-generation immigrants to their children (e.g. Maani, 1994 for Australia; Aydemir et al., 2009 for Canada; Van Ours and Veenmann, 2004 for the Netherlands; Hammarstedt and Palme, 2012; Hammarstedt, 2009; Niknami 2012, for Sweden; Card et al., 2000 for US.). This literature notes the relevance of parental characteristics for labour market outcomes and educational attainment of the child generation. Although some groups of immigrants improve their labour market position across generations, there is still a difference between second-generation immigrants and individuals with native-born parents (e.g. Rooth and Ekberg, 2003).

Furthermore, in Sweden children with foreign background are concentrated in particular neighbourhoods (Statistics Sweden, 2007). It is possible that the immigrated parents' choice of host country location has affected the prospects of their native-born children. Previous research has shown that childhood area can be important for outcomes later in life (see Ginther et al., 2000 for an overview). Therefore the role of ethnic residential segregation in explaining the gap in outcomes between children of immigrants and native children is of particular interest.

The purpose of this paper is to study the relationship between childhood neighbourhood ethnic composition and economic outcomes in adulthood of second-generation immigrants and natives. Firstly, we explore if immigrant concentration in childhood neighbourhood is associated with outcomes in adulthood. This analysis will be conducted both for second-generation immigrant and native children. Secondly, it investigates if childhood neighbourhood share of immigrants with same ethnic background (henceforth own-group share) and share of immigrants with other descent (henceforth other-group share) is correlated with economic outcomes later in life. The analysis includes four outcomes: earnings, unemployment, social assistance reliance, and the probability of having higher education. Furthermore, it distinguishes short- from long-term associations and looks at possible heterogeneous responses related to gender and ethnicity.

Previous literature has focused mainly on the consequences for adults from residing in areas with high immigrant/ethnic concentration (e.g. Borjas, 1995; Edin et al., 2003); less attention has been paid to children raised in immigrant-dense areas. Some studies, however, have examined the economic outcomes for immigrant children (e.g. Grönqvist, 2006; Åslund et al., 2011). In contrast to earlier research this paper focuses on second-generation immigrants and their performance in comparison to natives, which says something about the integration process rather than the consequences for immigrants per se. Also, in contrast to earlier studies on Sweden, we study ethnic concentration at neighbourhood level (around 2,000 residents) which is substantially smaller than the municipalities (on average 30,000 residents) frequently used in previous research. We argue that a smaller neighbourhood size is more appropriate in a study of children, since they are likely to take influence from their school and close neighbours. For adults it might be of value to study a larger geographical unit in order to take into account that workplace might be located far from the home. This study contributes to the literature by investigating a large variety of outcomes, looking at both immigrant, own ethnic group and other ethnic group concentration and including both short- and long-run correlations.

We make use of Swedish register data for the years 1990 to 2007. A *second-generation immigrant* is a person born in Sweden and whose parents were both born outside Sweden; *natives* are people born in Sweden to two Swedish-born parents. Individuals with one Swedish-born parent are therefore excluded from the analysis.¹ The child cohorts we follow were 10 to 14 years of age when we observe their childhood neighbourhood in 1990. Their short-run economic outcomes are observed in 2000, and, their long-run economic outcomes in 2007.

The results show that second-generation immigrants raised in immigrant-dense neighbourhoods have a lower probability to continue to higher education, whereas, their earnings, unemployment and social assistance tendencies are unaffected. Moreover, we find that residing alongside a large share of co-ethnics in childhood is associated with a lower probability of reliance on social assistance and a lower degree of unemployment for non-

¹ In line with previous research, we exclude individuals with unclear ethnic group belonging, i.e. with parents from different regions or with one native parent (see e.g. Algan et al., 2010). In addition, having one native parent has a positive impact on economic outcomes for second-generation immigrants in Sweden (Rooth and Ekberg, 2003) and thus it is unclear if individuals with parents of mixed ethnicities should be included with natives or with second-generation immigrants.

Nordic second-generation immigrants. These results can be interpreted as the ethnic group being a substitute for the social security system and important for labour market networks. In contrast, a high concentration of immigrants from other ethnic groups is associated with a higher probability of social assistance usage and unemployment in adulthood for non-Nordic second-generation immigrants.

On the contrary, immigrant concentration is negatively and more strongly associated with natives' economic outcomes. One explanation for this could be that all children raised in immigrant-dense neighbourhoods come to lack some knowledge of mainstream society, but for second-generation immigrants there are also some gains. However, it is also possible that natives suffer more from bad neighbourhood quality or that parental sorting is more present among natives, two facts that we are not able to control for in this study.

We conclude that when analysing ethnic residential segregation patterns it is important to include both the role of own-group, other-group and immigrant concentration, especially since the ethnic segregation in Sweden is characterised by the grouping of immigrants from different ethnic groups into certain neighbourhoods.

The paper is organised as follows. Section 2 consists of a literature review and describes the possible mechanisms by which ethnic concentration can affect children's economic outcomes. The data, definitions and a description of the ethnic residential segregation in Sweden are described in section 3. The empirical model is presented in section 4. Section 5 presents the results and section 6 concludes.

2. Theoretical Framework and Literature Review

Early literature on the topic of migration focused on the assimilation of first generation immigrants. In classic models it has been shown that immigrants are at an earnings disadvantage at arrival in the host country, but that they tend to catch up with natives over time (e.g. Chiswick, 1978; Borjas, 1985). More recently the children of first generation immigrants have also been in focus and empirical evidence points to a pattern where differences in terms of labour market attachment seem to remain also for them (e.g. Algan et al., 2010 for France, Germany and the UK; Rooth and Ekberg, 2003 for Sweden). The literature regarding ethnic clustering of the immigrant population is included within the broad

literature that tries to explain why the gap between natives and second-generation immigrants still remains.

2.1 The Costs of Ethnic Residential Segregation

It is possible that residing ethnically segregated has adverse effects on individuals' economic outcomes. Cutler and Glaeser (1997) propose that people, and especially youths, living in a minority-dominated neighbourhood might fail to acquire necessary skills, values and knowledge about the mainstream society. With less native influence the integration of immigrants becomes more complicated and this process is possibly reinforced among the children of immigrants, who might never acquire knowledge about the mainstream society. Similarly, Lazear (1999) shows that immigrants are more likely to be fluent in English when their community contains few co-residents from their country. He argues that a common culture and language is an important part of assimilation, since minority groups that acquire skills in the native culture and language have more potential trading partners. The language proficiency of children of immigrants can clearly default if the language spoken in school and at home is not the national native language. In addition, second-generation children, by virtue of being influenced by minority cultural and social values, might later face discrimination on the labour and housing market (Carlsson, 2010).

The existing literature has yet not reached a consensus on the magnitude or direction of the effect on native earnings from an increased immigration (e.g. Borjas, 2003; Ottaviano and Peri, 2012). Furthermore, it is possible that also the clustering of immigrants in certain areas matters for natives' labour market success. Andersson (1998) argues that both native and immigrant children might face difficulties learning the national native language if the neighbourhood and, thereby the schools located there, are to a large extent made up of children of foreign-born parents. The empirical evidence supporting this hypothesis is mixed. In Denmark, Israel and Sweden, native students' educational achievements are found to be negatively affected by a high immigrant concentration in their school (e.g. Jensen and Rasmussen, 2011 for Denmark; Gould et al., 2009 for Israel; Szulkin and Jonsson, 2007 for Sweden.). However, studies on the Netherlands and the US have shown no effects (e.g. Angrist and Lang, 2004; Guryan, 2004 for US; Ohinata and Van Ours, 2013 for the Netherlands.).

Furthermore, it is possible that native children face other problems related to the socialisation process in a similar way as described above for immigrant children. For instance, Cutler and Glaeser (1997) show that residential segregation has a small positive effect on outcomes of whites. However, an increased immigrant concentration might be negatively related to the quality of local social institutions (see e.g. Andersson, 1998; Cutler et al., 2008). Then it would be hard to distinguish effects from segregation per se from effects of neighbourhood quality. As pointed out by Manski (2000), studies concerning neighbourhood effects need to distinguish between whether observed differences in individual outcomes are a result of the actual neighbourhood group characteristic of interest, rather than related to unobserved group-aggregate characteristics of the persons residing in the neighbourhood. It is also important to keep in mind that residential location of the children is not random and, can be related to (unobservable) parental characteristics. Edin et al. (2003) show that selection is important in the sense that first generation immigrants tend to be better off if they move away from ethnic enclaves. It is possible that also children of immigrants who self-select into less immigrant-dense areas are better off. In addition native parents might self-select into certain areas, a pattern that is found in Aldén et al. (2013) whom show that native Swedes with a high level of educational attainment and earnings are more likely to move from neighbourhoods when they reach a threshold share of non-European immigrants.

In addition to the effect from ethnic clustering on labour market outcomes, there has been an ongoing discussion about the relationship between ethnic clustering and welfare benefits usage. Åslund and Fredriksson (2009) show that the likelihood to be dependent on welfare payments increases in neighbourhoods in which a large share of the ethnic community is already dependent on welfare. Bertrand et al. (2000) found similar evidence for network effects for language groups in the US. This pattern of adapting to the behaviour of co-residents might apply to second-generation immigrants who spent their childhood residing in immigrant-dense areas where a large share of the immigrant population depended on the social security system.

2.2 The Benefits of Ethnic Residential Segregation

Cutler and Glaeser (1997) argue that an increased ethnic segregation might result in less segregation across income and skill groups within the immigrant/ethnic group. Immigrant children from a less affluent background could gain from more affluent immigrant children

remaining in the immigrant-dense neighbourhoods, creating learning opportunities and attracting good teachers. This human capital externality hypothesis is supported by the findings in Edin et al. (2003).

Moreover, a high concentration of own-group residents could form a large social network and thereby improve the possibilities for employment. The Swedish labour market is characterised by a substantial ethnic workplace segregation (Åslund and Nordström Skans, 2010), a situation that suggests that co-ethnic contacts are important. Patacchini and Zenou (2012) find that in the UK ethnic networks are important for employment outcomes. Furthermore, among the self-employed networks can be of importance, since immigrant entrepreneurs have reason to hire people who understand their language and working culture. Andersson and Hammarstedt (2012) show that in Sweden the presence of ethnic enclaves increases the propensity for self-employment among immigrants from the Middle East. However, if ethnic clustering fosters ethnic networks, these networks could just as well substitute for welfare use (Barrett and McCarthy 2008).

2.3 Heterogeneity in Consequences of Segregation

In the extensive literature regarding how neighbourhood characteristics affect individual outcomes there is a large variety in the timing of when the exposure to the neighbourhood is studied and when the effects of this exposure is assumed to set in. So far, little attention has been paid to whether these differences in time since exposure actually matters. However, Ohinata and Van Ours (2013) mean that short-run effects will differ from long-run responses, since effects in the longer run might build on accumulative exposure. Therefore it is important to further investigate if the childhood neighbourhood ethnic composition affects individuals differently in the short- and long run.

There is also reason to believe that ethnic segregation can have differential effects for women and men. Skyt Nielsen et al. (2003) find that the labour market outcomes of second-generation immigrant males is negatively affected by a high immigrant share in their childhood neighbourhood, while second-generation immigrant women's outcomes are unaffected. Åslund et al. (2011) find a larger positive effect on the educational attainment of first-generation immigrant boys from living in an ethnic enclave during childhood in comparison to girls. Furthermore, it has been shown that second-generation immigrants in Sweden with a non-European background fare worse on the labour market in comparison to

natives and individuals with a European background (e.g. Rooth and Ekberg, 2003). Therefore it is also of interest to investigate whether this is true also regarding consequences of ethnic segregation.

3. Data, Definitions and Ethnic Residential Segregation in Sweden

3.1 Data and Definitions

This study uses the register-data base LISA (Longitudinal Integration Database for Health Insurance and Labour Market Studies) from Statistics Sweden, which provides information on demographic and labour market characteristics from 1990 to 2007 for individuals, 16 years and older, living in Sweden. In addition the data enable us to link individuals to both their parents and their neighbourhood (Small Area Market Statistics, or SAMS) of residence in the year 1990. We focus on second-generation immigrants and natives born in Sweden between 1976 and 1980. Since the children in our analysis are not included in the register-data in 1990, we use information on their parents' place of residence in 1990. It is more common for children in Sweden to live with their mother (Statistics Sweden, 2005), therefore we match on mother's place of residence in case parents do not cohabitate. Our sample contains 467,923 observations. We impose the following restrictions on our sample. First, in order to identify the ethnic group, we include only second-generation immigrant children whose parents have immigrated from the same region (48,100 observations excluded). Secondly, we include only children where childhood neighbourhood is known (for either mother or father) and where the neighbourhood has at least 200 inhabitants (12,822 observations excluded). Lastly, we exclude individuals with missing information in year 2000 or 2007 on uptake of social assistance (13,431 observations excluded). Our final sample contains 373,811 native children and 19,759 second-generation immigrant children. Figure A1 in the Appendix gives a detailed description of our data and sample.

We measure parental and neighbourhood characteristics for the parents in the year 1990. Neighbourhoods are based on SAMS areas, which contain an average of 2,000 residents. The *neighbourhood immigrant share* (I_j) is calculated as the number of first- and second-generation immigrants, i.e. those who were born abroad or who had at least one parent born abroad, divided by the total population in neighbourhood j . The *neighbourhood own-group share* (E_{gj}) is calculated as the number of members of an ethnic group g , i.e. first-generation immigrants originating from region g and second-generation immigrants with both parents

from group g , divided by the total number of residents in neighbourhood j . In this calculation we exclude the individual's own parents if they reside in the same neighbourhood as the child. The *neighbourhood other-group share* (O_{gj}) is calculated as the number of members of an ethnic group different than g , i.e. first-generation immigrants originating from a region other than region g and second-generation immigrants with both parents not belonging to group g , j divided by the total number of residents in neighbourhood j .

$$I_j = \frac{Immigrants_j}{Total\ population_j} \quad E_{gj} = \frac{Ethnic\ group\ residents_{gj}}{Total\ population_j} \quad O_{gj} = \frac{\sum_{k=1}^g Residents_{gj}(k \neq g)}{Total\ population_j}$$

The ethnic groups are based on region of origin (Nordic, Western, Eastern Europe, Southern Europe, the Middle East, Asia, Africa and Latin America) since the data because of confidentiality reasons do not provide information on country of origin for all countries. Grouping countries into regions comes with the drawback that people with different ethnic backgrounds are included in the same group, while the use of country level could come with the opposite problem -- that ethnicity spans national borders. To decrease these problems the groups of countries that comprise a region have been chosen so that countries included in the same group are similar in terms of culture, geographical location and language. For further information on the construction of regions see Table A1 in the Appendix.

The children's short-run economic outcomes are observed for the year 2000 when individuals in our sample are ages 20 to 24 years and the long-run economic outcomes are observed in 2007 when they are between 27 and 31 years. Because of data availability we are not able to study long-run outcomes beyond 2007. In addition, if we were to study short-run outcomes before the year 2000, a large share in our sample would not yet have entered the labour market. We study four economic outcomes; earnings, unemployment, social assistance reliance, and the probability of having higher education. In Sweden, social assistance is means-tested and paid to satisfy needs that cannot be met by labour earnings or other assets. For further definitions please see figure A1 in the appendix.

3.2 Descriptive Statistics

Table A2 in the Appendix presents descriptive statistics for the individuals in the sample. Generally, second-generation immigrants have lower educational attainment², worse labour market outcomes and are more likely to receive social assistance. Displayed are also parental background variables³, measured in the year 1990. As expected, the parental generation shows the same tendencies as its children; lower educational attainment and earnings among the immigrated parents.

In figure A2 in the appendix individual outcomes are plotted against percentiles in the neighbourhood immigrant share. It appears that individuals residing in very immigrant dense neighbourhoods have worse outcomes. There is also some indication that individual outcomes are non-linearly related to the neighbourhood immigrant share. In figure A3 in the appendix the outcomes of second-generation immigrants are plotted against the neighbourhood share of immigrants from other ethnic groups and the share of immigrants from the same ethnic group. It appears that social assistance usage in the first period (higher education propensity in both periods) seems to be increasing (decreasing) in both the own-group share and other-group share. Moreover, unemployment rates are higher for second-generation immigrants residing in a neighbourhood with a high other-group share.

Furthermore, figure A4 in the appendix describes how parental characteristics are related to the immigrant share. From figure A4 it appears that the earnings and educational attainment of individuals' fathers and mothers are lower if they reside in very immigrant dense neighbourhoods. In figure A5 in the appendix parental characteristics are related to the own-group share and other-group share for second-generation immigrants. In general the patterns are in line with figure A4. These descriptive results indicate that we need to take into account the possibility that parents with worse outcomes are selected into neighbourhoods with high immigrant, own-group and other-group shares.

² Missing values are replaced by primary educational level and regressions include an indicator variable for missing information. Results are robust to excluding individuals with missing information.

³ Missing values for educational level are replaced by primary educational level. Missing values for earnings are replaced by the mean of mother/father earnings in each group (second-generation immigrant female, second-generation immigrant male, native female and native male). Regressions include an indicator variable for missing information. Results are robust to excluding individuals with missing information.

3.3 Ethnic Residential Segregation in Sweden

Table 1 gives a description of the characteristics of all Sweden's neighbourhoods according to their immigrant share. Neighbourhoods with less than 5 per cent or more than 40 per cent immigrants are relatively few and sparsely populated. Such neighbourhoods are characterised by the highest unemployment rates and lowest mean incomes. A majority of the neighbourhoods contain between 5 and 15 per cent immigrants and in these neighbourhoods we find the lowest unemployment rates. Around 15 per cent of the neighbourhoods have an immigrant share in the range of 15 to 20 per cent and the income level is highest in these neighbourhoods.

Table 1: Immigrant concentration, income level and unemployment rate in SAMS areas in Sweden 1990

Immigrant share (%)	Neighbourhoods (%)	Individuals (%)	Mean income neighbourhood	Unemployment neighbourhood (%)
			Mean income all neighbourhoods	Average unemployment all neighbourhoods (%)
0 - 5	12.8	7.0	0.84	1.03
5- 10	32.3	30.2	0.95	0.95
10 -15	21.3	23.1	1.02	0.93
15-20	12.5	15.9	1.07	1.06
20-40	13.9	19.9	1.07	0.98
>40	7.0	3.9	0.87	1.59

Table 2 depicts the ethnic concentration in the neighbourhoods where the individuals in our sample resided in childhood. The childhood neighbourhood immigrant share is nearly 20 percentage points higher for second-generation immigrants in comparison to natives. In the neighbourhood with the highest immigrant concentration, nearly 80 per cent of the residents are of immigrant background. Furthermore, on average a neighbourhood has an own-group share of about 10 per cent and an other-group share around 22 per cent. In general, we can conclude from comparing the figures in column one and six that all immigrants are overexposed to individuals from their own ethnic group. In particular, for the average Middle Eastern immigrant the share of own-group residents in their neighbourhood is about 13 times higher than the share in the total population (1.2 per cent).

The last column of Table 2 reports sample sizes at group level. It emerges that almost half (44 per cent) of the second-generation immigrants has a Nordic background. Southern Europe comprises nearly 23 per cent of the sample, while about 7 per cent have an Eastern European

background. Furthermore, people with Middle Eastern background amount to approximately 17 per cent of the sample. The remaining ethnic groups comprise 1.5 to 3.9 per cent of the sample.

Table 2: Ethnic concentration in childhood neighbourhood for sample individuals

	Mean	St. dev	Min	Max	Observations	Share in tot. population
<i>Immigrant Share (%)</i>						
Native	13.1	8.5	0.4	78.3	373,811	
Second-generation immigrant	31.6	19.2	2.6	78.3	19,759	
<i>Other-Group Share (%)</i>						
All second-generation immigrants	22.1	15.0	1.0	76.2	19,759	
<i>Own-Group Share (%)</i>						
All second-generation immigrants	9.3	9.0	0	65.8	19,759	
Nordic	11.4	9.0	0.4	65.8	8,757	5.3
Western	1.8	1.7	0	25.5	286	1.3
East Europe	3.3	2.8	0	16.7	1,375	1.4
South Europe	6.8	7.2	0	36.6	4,463	1.1
The Middle East	13.3	10.7	0	34.9	3,373	1.2
Asia	2.3	2.4	0	13.5	380	0.5
Africa	1.8	1.7	0	7.1	366	0.3
Latin America	3.4	3.0	0	11.9	759	0.5

4. Empirical specification

In order to answer whether ethnic composition of childhood neighbourhood is related to the economic outcomes experienced in adulthood, we estimate equation (1) separately for second-generation immigrants and natives.

$$Y_{icjt} = \beta X_{it} + \eta P_{it-1} + \gamma N_{t-1} + \delta I_{ijt-1} + \alpha_{ct-1} + \alpha_e + \varepsilon_{ijct} \quad (1)$$

The economic outcome, Y , is measured in the year t [= 2000, 2007] for each individual, i , residing in neighbourhood, j , located in municipality, c . The coefficient of interest is δ , which measures the correlation between *immigrant share* in the neighbourhood at point $t-1$ [=1990] and economic outcomes in year t . In order to control for non-linearity we also include immigrant share in squares. We will in addition include a set of individual characteristics, X (age, educational level, marital status and children), parental characteristics, P (educational

level, earnings, marital status and years since migration) and neighbourhood level control variables, N (unemployment rate, income level, proportion of persons with university degree, and share of flats⁴). α_c measures municipality fixed effects, α_e ethnic group fixed effects and ε is a random error term. For a detailed description of the variables see Table A3 in the Appendix.

We measure the correlation between economic outcomes and immigrant concentration using variation across neighbourhoods within a municipality and then there is a possibility that we omit neighbourhood factors that correlate with the neighbourhood's immigrant share and affect economic outcomes. This problem can be mitigated by including neighbourhood controls that proxy for the quality of the neighbourhood. Further, it is possible that the included parental variables are not able to control entirely for parental sorting. Because of these two drawbacks and the lack of valid instrumental variables, we will not claim causal effects. We discuss these drawbacks in Section 5.4.

The economic outcomes studied are yearly earnings, probability of being in unemployment, probability of receiving social assistance and probability of having higher education. By choosing these outcome variables we are able to give an overall picture of the life-work-situation for individuals in our sample. All equations will be estimated using OLS, i.e. we use a linear probability model (LPM) for unemployment, social assistance and higher education. The reason for not using a probit or logit specification is that including fixed effects on both ethnic group and municipality level results in a *separation problem*, i.e. that success or failure is entirely predicted by a set of covariates (e.g. Zorn, 2005). For the earnings equation we specify a model with the logarithm of earnings.⁵

The role of ethnic concentration for second-generation immigrants will be decomposed by estimating the following model (2)

⁴ The share of flats (shared dwelling) is measured in the year 2000 and aims to proxy for neighbourhood housing price, which captures the willingness to pay for living in the neighbourhood and the neighbourhood's quality. This is the best proxy available in our data. The SAMS areas are constructed to be homogenous in terms of housing type within neighbourhoods and also to be consistent over time, so it seems reasonable to expect that the share of flats is similar in 1990 and 2000. Also, within a municipality it is reasonable to expect that the higher the share of flats, the lower is the average cost for residing in the area.

⁵ Estimations using a logit model generated marginal effects very similar to the LPM. Note that in the LPM δ will be interpreted as the change in probability (in percentage points) from a one percentage point increase in the immigrant share.

$$Y_{icjt} = \beta X_{it} + \eta P_{it-1} + \gamma N_{t-1} + \delta_1 E_{ijt-1} + \delta_2 O_{ijt-1} + \alpha_{ct-1} + \alpha_e + \varepsilon_{ijct} \quad (2)$$

where all variables are defined as above. The coefficients of interest are $\hat{\partial}_1$, that measures the correlation between *own-group share* and economic outcomes and $\hat{\partial}_2$, that measures the correlation between *other-group share* and economic outcomes.⁶ It is possible to specify (2) with neighbourhood fixed effects, since the ethnic group shares varies for the ethnic groups within a neighbourhood. That would imply that we would not have problems with possible omitted neighbourhood variables. For comparative reasons we will use a specification with municipality fixed effects and we will then include neighbourhood controls as in specification (1).

5. Results

5.1 Short-run Results

Table 3 shows the short-run results from the estimation of equation (1) and (2). First, columns (1) to (3) give the OLS regression results for short-run labour earnings. For second-generation immigrants we find no statistically significant correlations between immigrant share, own-group share or other-group share and earnings. Whereas for natives an increase in the neighbourhood immigrant share by 10 percentage points is associated with about 1.9 per cent lower earnings.

Secondly, columns (4) to (6) display the results from the estimation of a LPM for the probability of receiving social assistance. Since the results for the probability of being in unemployment are very similar to these we exclude the results for unemployment, but keep in mind that they would have a similar interpretation. For second-generation immigrants we find no statistically significant correlations. For natives the correlation between immigrant share and the probability of being a recipient of social assistance is positive and statistically significant and it amounts to an about 2.4 percentage points increased probability of social assistance usage from an increase of the immigrant share by 10 percentage points.

⁶ We do not include a quadratic term in own-group and other-group since graphical inspection and regressions do not support non-linearity.

Table 3: Short-run estimates: Neighbourhood ethnic concentration and economic outcomes

VARIABLES	Earnings			Social assistance			Higher education		
	Second-generation immigrant		Native	Second-generation immigrant		Native	Second-generation immigrant		Native
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Immigrant share	-0.402 [0.346]		-0.189* [0.100]	0.064 [0.102]		0.235*** [0.028]	-0.201** [0.088]		-0.165*** [0.035]
Immigrant share squared	0.383 [0.369]		0.158 [0.158]	-0.076 [0.113]		-0.131*** [0.051]	0.170* [0.091]		0.192*** [0.052]
Own-group share		0.070 [0.192]			-0.053 [0.070]			0.030 [0.040]	
Other-group share		-0.096 [0.119]			0.021 [0.037]			-0.070** [0.029]	
Gender	0.118*** [0.021]	0.119*** [0.021]	0.151*** [0.004]	-0.016*** [0.005]	-0.016*** [0.005]	-0.013*** [0.001]	-0.079*** [0.006]	-0.078*** [0.006]	-0.099*** [0.001]
Age	1.087*** [0.277]	1.085*** [0.278]	1.715*** [0.054]	0.035 [0.064]	0.035 [0.064]	0.018 [0.012]	0.265*** [0.066]	0.265*** [0.066]	0.605*** [0.018]
Age squared	-0.022*** [0.006]	-0.022*** [0.006]	-0.036*** [0.001]	-0.001 [0.001]	-0.001 [0.001]	-0.000* [0.000]	-0.005*** [0.002]	-0.005*** [0.002]	-0.012*** [0.000]
Secondary school	0.352*** [0.028]	0.351*** [0.028]	0.296*** [0.007]	-0.165*** [0.009]	-0.165*** [0.009]	-0.186*** [0.002]			
Higher education	0.277*** [0.056]	0.277*** [0.056]	0.245*** [0.011]	-0.218*** [0.010]	-0.218*** [0.010]	-0.212*** [0.003]			
Married	0.096** [0.042]	0.096** [0.042]	0.017 [0.011]	-0.005 [0.012]	-0.005 [0.012]	-0.022*** [0.004]	-0.090*** [0.009]	-0.090*** [0.009]	-0.032*** [0.005]
Children	-0.101*** [0.030]	-0.100*** [0.030]	-0.147*** [0.006]	0.091*** [0.010]	0.091*** [0.010]	0.080*** [0.002]	-0.081*** [0.007]	-0.081*** [0.007]	-0.160*** [0.002]
Mother secondary school	-0.039* [0.023]	-0.038* [0.023]	-0.002 [0.004]	-0.015** [0.007]	-0.016** [0.007]	-0.018*** [0.001]	0.023*** [0.006]	0.024*** [0.006]	0.054*** [0.002]
Mother higher education	-0.239*** [0.050]	-0.238*** [0.050]	-0.128*** [0.007]	-0.024** [0.010]	-0.024** [0.010]	-0.022*** [0.002]	0.133*** [0.012]	0.133*** [0.012]	0.169*** [0.002]

Table 3 continued

Father secondary school	-0.040* [0.022]	-0.038* [0.022]	-0.027*** [0.004]	0.010 [0.006]	0.009 [0.006]	-0.003*** [0.001]	0.029*** [0.006]	0.029*** [0.006]	0.045*** [0.002]
Father higher education	-0.099** [0.049]	-0.099** [0.049]	-0.153*** [0.007]	0.008 [0.011]	0.008 [0.011]	-0.007*** [0.002]	0.100*** [0.012]	0.100*** [0.012]	0.145*** [0.003]
Father earnings	0.005*** [0.001]	0.005*** [0.001]	0.002*** [0.000]	-0.003*** [0.000]	-0.003*** [0.000]	-0.001*** [0.000]	0.003*** [0.000]	0.003*** [0.000]	0.002*** [0.000]
Mother earnings	0.006*** [0.002]	0.006*** [0.002]	0.005*** [0.000]	-0.004*** [0.000]	-0.004*** [0.000]	-0.002*** [0.000]	0.001*** [0.000]	0.001*** [0.000]	0.002*** [0.000]
Divorced	-0.008 [0.028]	-0.007 [0.028]	-0.032*** [0.006]	0.073*** [0.009]	0.072*** [0.009]	0.062*** [0.002]	-0.063*** [0.007]	-0.062*** [0.007]	-0.066*** [0.002]
Unemployment rate	0.116 [1.509]	-0.211 [1.497]	-1.901*** [0.364]	1.160** [0.461]	1.195*** [0.453]	0.996*** [0.101]	0.031 [0.384]	-0.144 [0.376]	-0.522*** [0.110]
Mean income level	-0.001 [0.013]	-0.007 [0.012]	0.015*** [0.002]	-0.000 [0.003]	0.001 [0.003]	0.002*** [0.001]	0.003 [0.003]	-0.000 [0.003]	0.001 [0.001]
Share highly educated	-0.586* [0.320]	-0.486 [0.308]	-0.928*** [0.057]	-0.038 [0.072]	-0.056 [0.070]	-0.001 [0.012]	0.011 [0.071]	0.053 [0.068]	0.214*** [0.018]
Share flats	-0.105** [0.051]	-0.129*** [0.045]	-0.069*** [0.010]	0.026* [0.014]	0.030** [0.013]	0.035*** [0.003]	0.023* [0.013]	0.012 [0.012]	-0.003 [0.004]
Years since migration 15-24 years	0.016 [0.028]	0.018 [0.028]		-0.001 [0.008]	-0.001 [0.008]		0.010 [0.007]	0.011 [0.007]	
25-34 years	0.012 [0.037]	0.013 [0.037]		-0.002 [0.010]	-0.002 [0.010]		0.024** [0.010]	0.025*** [0.010]	
≥35 years	-0.011 [0.066]	-0.007 [0.066]		0.012 [0.017]	0.011 [0.017]		0.049*** [0.017]	0.050*** [0.018]	
Observations	10,751 0.123	10,751 0.123	199,303 0.111	19,759 0.136	19,759 0.137	373,811 0.117	19,759 0.136	19,759 0.136	373,811 0.174
R-squared									

Notes: Regressions include municipality fixed effects for all groups and indicators for ethnic group for second-generation immigrants. Earnings regressions exclude individuals with income below or equal to zero and students. *** indicates statistical significance at 1 per cent level, ** at the 5-per cent level, and * at the 10 per cent level. Robust standard errors clustered on SAMS and ethnic group level for immigrants and SAMS level for natives in brackets.

Finally, columns (7) to (9) show the estimations from a LPM for the probability of being enrolled in higher education. The results show that the probability of having higher education decreases with about 2 percentage points if a second-generation immigrant resided in a neighbourhood with a 10 percentage point higher immigrant share in childhood. This appears to be driven by the presence of immigrants from other ethnic groups rather than from the own group, since an increase in the share of the other-group by 10 percentage points decreases the probability of starting higher education with nearly 1 percentage point. Similarly for natives we find a negative association between immigrant concentration and the probability of having higher education.

5.2 Long-run Results

Table 4 shows the long-run results from the estimation of equation (1) and (2). Columns (1) to (3) display the results for the estimation of long-run earnings. Overall, the results are very much in line with the short-run results.

The long-run estimates for the probability of social assistance usage among second-generation immigrants appear to be in line with the results found in the short-run, but now stronger and statistically significant. The coefficients in column (5) show that an increase in the own-group (other-group) share by 10 percentage points is associated with an about 0.7 percentage point decrease (0.6 percentage point increase) in the probability of social assistance usage. For natives, a 10 percentage point higher immigrant share is associated with an about 0.7 percentage point increase in the probability of receiving social assistance. Again we do not display the results for unemployment, which are similar to the results for social assistance reliance.

Finally, in line with the short-run results, there is a negative association between immigrant concentration and educational attainment in both groups, which amounts to around 3 percentage points from a 10 percentage points increase in the immigrant share. Similarly as in the short run a high other-group share decreases the probability of having higher education for second generation immigrants.

Table 4: Long-run estimates: Neighbourhood ethnic concentration and economic outcomes

VARIABLES	Earnings			Social assistance			Higher education		
	Second-generation immigrant		Native	Second-generation immigrant		Native	Second-generation immigrant		Native
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Immigrant share	0.065 [0.250]		-0.194*** [0.072]	0.031 [0.061]		0.071*** [0.015]	-0.288*** [0.109]		-0.332*** [0.041]
Immigrant share squared	-0.109 [0.271]		0.140 [0.117]	-0.014 [0.071]		0.019 [0.030]	0.240** [0.113]		0.303*** [0.059]
Own-group share		0.023 [0.138]			-0.072** [0.033]			-0.030 [0.055]	
Other-group share		-0.059 [0.097]			0.055** [0.025]			-0.078** [0.038]	
Gender	0.257*** [0.015]	0.257*** [0.015]	0.289*** [0.003]	-0.006** [0.003]	-0.007** [0.003]	-0.005*** [0.001]	-0.139*** [0.007]	-0.139*** [0.007]	-0.164*** [0.002]
Age	0.646** [0.261]	0.645** [0.261]	0.729*** [0.048]	-0.071 [0.057]	-0.071 [0.057]	-0.049*** [0.009]	-0.075 [0.110]	-0.074 [0.110]	-0.067*** [0.026]
Age squared	-0.010** [0.004]	-0.010** [0.004]	-0.012*** [0.001]	0.001 [0.001]	0.001 [0.001]	0.001*** [0.000]	0.001 [0.002]	0.001 [0.002]	0.001*** [0.000]
Secondary school	0.267*** [0.026]	0.267*** [0.026]	0.229*** [0.007]	-0.103*** [0.007]	-0.103*** [0.007]	-0.094*** [0.002]			
Higher education	0.330*** [0.029]	0.330*** [0.029]	0.241*** [0.007]	-0.130*** [0.007]	-0.130*** [0.007]	-0.109*** [0.002]			
Married	0.095*** [0.018]	0.095*** [0.018]	0.078*** [0.003]	-0.030*** [0.004]	-0.030*** [0.004]	-0.012*** [0.001]	0.042*** [0.009]	0.042*** [0.009]	0.083*** [0.002]
Children	0.054*** [0.017]	0.054*** [0.017]	-0.024*** [0.003]	-0.006 [0.004]	-0.006 [0.004]	-0.006*** [0.001]	-0.159*** [0.007]	-0.159*** [0.007]	-0.160*** [0.002]
Mother secondary school	-0.001 [0.017]	-0.001 [0.017]	0.016*** [0.003]	-0.009** [0.004]	-0.009** [0.004]	-0.006*** [0.001]	0.068*** [0.008]	0.068*** [0.008]	0.097*** [0.002]
Mother higher education	-0.047 [0.032]	-0.047 [0.032]	-0.021*** [0.005]	-0.014** [0.006]	-0.014** [0.006]	-0.004*** [0.001]	0.205*** [0.015]	0.206*** [0.014]	0.254*** [0.003]

Table 4 continued

Father secondary school	-0.024 [0.017]	-0.024 [0.017]	-0.007** [0.003]	0.008** [0.004]	0.007* [0.004]	-0.000 [0.001]	0.049*** [0.008]	0.049*** [0.008]	0.072*** [0.002]
Father higher education	-0.056* [0.033]	-0.056* [0.033]	-0.048*** [0.005]	0.009 [0.006]	0.009 [0.006]	0.002** [0.001]	0.163*** [0.014]	0.163*** [0.014]	0.213*** [0.003]
Father earnings	0.006*** [0.001]	0.006*** [0.001]	0.005*** [0.000]	-0.001*** [0.000]	-0.001*** [0.000]	-0.000*** [0.000]	0.003*** [0.000]	0.003*** [0.000]	0.003*** [0.000]
Mother earnings	0.005*** [0.001]	0.005*** [0.001]	0.005*** [0.000]	-0.002*** [0.000]	-0.002*** [0.000]	-0.001*** [0.000]	0.003*** [0.001]	0.003*** [0.001]	0.003*** [0.000]
Divorced	-0.044** [0.022]	-0.043** [0.022]	-0.066*** [0.005]	0.026*** [0.006]	0.025*** [0.006]	0.017*** [0.001]	-0.063*** [0.008]	-0.063*** [0.009]	-0.084*** [0.002]
Unemployment rate	-0.717 [1.067]	-0.637 [1.049]	-0.751*** [0.240]	0.205 [0.254]	0.230 [0.248]	0.346*** [0.058]	-0.249 [0.470]	-0.480 [0.461]	-0.748*** [0.132]
Mean income level	-0.007 [0.009]	-0.006 [0.008]	0.013*** [0.002]	0.002 [0.002]	0.003 [0.002]	0.001*** [0.000]	0.002 [0.004]	-0.001 [0.004]	0.003*** [0.001]
Share highly educated	-0.337* [0.197]	-0.349* [0.192]	-0.393*** [0.037]	-0.035 [0.043]	-0.048 [0.042]	-0.007 [0.007]	0.161* [0.085]	0.213*** [0.083]	0.371*** [0.020]
Share flats	-0.083** [0.036]	-0.077** [0.033]	-0.053*** [0.007]	0.017** [0.008]	0.018** [0.008]	0.015*** [0.001]	0.007 [0.016]	-0.008 [0.015]	0.006 [0.004]
Years since migration 15-24 years	0.021 [0.020]	0.021 [0.020]		-0.003 [0.005]	-0.003 [0.005]		-0.005 [0.009]	-0.005 [0.009]	
25-34 years	0.015 [0.027]	0.015 [0.027]		-0.008 [0.006]	-0.008 [0.006]		0.010 [0.012]	0.011 [0.012]	
≥35 years	0.016 [0.047]	0.016 [0.047]		-0.009 [0.011]	-0.009 [0.011]		0.021 [0.022]	0.022 [0.022]	
Observations	16,732	16,732	345,103	19,759	19,759	373,811	19,759	19,759	373,811
R-squared	0.069	0.069	0.060	0.087	0.088	0.052	0.166	0.166	0.203

Notes: *** indicates statistical significance at 1 per cent level, ** at the 5-per cent level, and * at the 10 per cent level. For further details see Table 3.

5.3 *Additional Results*

Based on findings in previous literature (e.g. Skyt Nielsen et al., 2003; Åslund et al., 2011), we have reason to believe that ethnic residential segregation can have a larger impact on men's outcomes in comparison to women. Therefore we have checked whether there is evidence for heterogeneous responses for men and women. Moreover, we distinguish between three immigrant categories Nordic, European and non-European, since earlier research has shown differential effects on labour market outcomes for second-generation immigrants in relation to their parents' country of origin (e.g. Rooth and Ekberg, 2003).

Overall we find no evidence for different responses for women and men.⁷ As regards differences for Nordic, European and non-European second-generation immigrants we find heterogeneous responses in social assistance reliance. In the regressions Nordic immigrants is the omitted category. From Table 5 we see that the coefficient for the interaction between the immigrant group dummy and own-group share is negative and statistically significant for the European group and negative but not statistically significant for non-European second-generation immigrants. This implies that the association between own-group share and social assistance usage is stronger (i.e. more negative) for European in contrast to Nordic immigrants. Furthermore, the positive association between the other-group share and social assistance reliance in the short-run is strongest for the group of European second-generation immigrants.

⁷ These results are not displayed but available from the author upon request.

Table 5: Heterogeneous responses in social assistance usage for Nordic, European and non-European second-generation immigrants

VARIABLES	Short-run		Long-run	
	Social assistance		Social assistance	
	(1)	(2)	(3)	(4)
Immigrant share	-0.013 [0.047]		0.043 [0.029]	
Immigrant share*European	0.061 [0.072]		-0.015 [0.049]	
Immigrant share*non-European	0.034 [0.085]		-0.046 [0.045]	
Own-group share		0.136 [0.109]		0.061 [0.065]
Own-group share *European		-0.350** [0.174]		-0.242*** [0.091]
Own-group share *non-European		-0.229 [0.171]		-0.135 [0.089]
Other-group share		-0.061 [0.053]		0.031 [0.034]
Other-group share *European		0.174** [0.084]		0.055 [0.058]
Other-group share *non-European		0.141 [0.098]		0.001 [0.059]

Notes: For further details see Table 3. In addition all included variables are interacted with dummies for group (European and non-European, leaving Nordic as baseline). Number of observations are 19,759. *** indicates statistical significance at 1 per cent level, ** at the 5-per cent level, and * at the 10 per cent level.

We have found that a high share of other ethnic groups in the neighbourhood is associated with worse outcomes for second-generation immigrants. This could be driven by the predominance of a particular ethnic group or a result of presence of other immigrants, irrespectively of which ethnic group they belong to. To investigate this further we have estimated equation (2) including a diversity index⁸ instead of the variable other-group. Overall, the diversity index was not statistically significantly, i.e. residing alongside immigrants from many different countries is not negative per se for second-generation immigrants. Are then particular groups of immigrants driving the results? We test this by estimating regressions like equation (2), but including the neighbourhood share of a particular ethnic group as the variable of interest (and omitting the individuals belonging to this group from the regression). The results for social assistance are displayed in Table 6 and show that

⁸ We follow Alesina and La Ferrara (2005) and specify the index of diversity (fractionalization) as $DI = 1 - \sum_g s_g^2$ where $s_g = \frac{\text{Ethnic group residents}_{gj}}{O_{gj}}$ (notations see page 10). This index measures the probability that two randomly drawn individuals in the other-group comes from different ethnic groups.

in particular residing alongside other immigrants from the Nordic countries, Latin America, the Middle East, and Africa is positively associated with social assistance usage.

Table 6: Heterogeneity in other-group share: neighbourhood ethnic group concentration and social assistance usage

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Short run</i>								
Other group-share	0.381** [0.150]	-0.394 [0.637]	0.039 [0.244]	-0.268** [0.131]	-0.003 [0.078]	0.196 [0.323]	0.493 [0.351]	0.434* [0.241]
Group	Nordic	Western	East Europe	South Europe	The Middle East	Asia	Africa	Latin America
Observations	11,002	19,473	18,384	15,296	16,386	19,379	19,393	19,000
R-squared	0.123	0.136	0.133	0.145	0.156	0.138	0.137	0.137
<i>Long run</i>								
Other group-share	0.084 [0.086]	-0.421 [0.345]	0.170 [0.147]	-0.027 [0.074]	0.107* [0.059]	0.265 [0.173]	0.337* [0.189]	0.273** [0.133]
Group	Nordic	Western	East Europe	South Europe	The Middle East	Asia	Africa	Latin America
Observations	11,002	19,473	18,384	15,296	16,386	19,379	19,393	19,000
R-squared	0.090	0.087	0.084	0.094	0.098	0.089	0.088	0.088

Notes: *** indicates statistical significance at 1 per cent level, ** at the 5-per cent level, and * at the 10 per cent level. For further details see Table 3.

5.4 Parental Sorting and Neighbourhood Quality

A drawback with this study is that the results could be biased by parental sorting. If low-ability parents select into the most immigrant-dense neighbourhoods and have children with unfavourable outcomes, the correlation between immigrant share and economic outcomes will be biased. Figure A4 and A5 suggest that the observable parental characteristics are worse for individuals residing in immigrant-dense neighbourhoods. We have investigated parental sorting further by estimating the probability that a parent shifts neighbourhood between 1990 and 2000 on parental characteristics and the growth rate in immigrant share.⁹ The results presented in Table 7 show that parents with lower educational attainment, lower earnings, and who are divorced are most likely to move. Native mothers and fathers are more likely to move if they reside in a neighbourhood with an increasing immigrant population, while the opposite holds for mothers of second-generation immigrants. However, there is not much evidence for that parents with particular characteristics sort out of neighbourhoods in which the immigrant population is increasing. The exception is highly educated fathers and high earning mothers of second-generation immigrants. However, we cannot rule out that there is sorting in other

⁹ Because of data limitations we cannot study parental residential choice before 1990. The growth rate in immigrant share is calculated as: $\text{Immigrant share growth} = \frac{\text{Immigrants}_{2000} - \text{Immigrants}_{1990}}{\text{Total population}_{1990}}$

unobservable parental characteristics or that the settlement choices of parents were taken prior to 1990, when the children were younger.

Table 7: Parental residential choice in 1990 and 2000, parental variables and growth rate in immigrant share

VARIABLES	Second-generation immigrant		Native	
	Mother (1)	Father (2)	Mother (3)	Father (4)
Immigrant share growth	-0.305** [0.130]	-0.011 [0.122]	0.660*** [0.061]	0.868*** [0.068]
Secondary school	-0.000 [0.012]	0.007 [0.012]	-0.031*** [0.003]	0.011*** [0.003]
Higher education	-0.024 [0.020]	0.012 [0.019]	-0.042*** [0.003]	0.035*** [0.004]
Earnings	-0.005*** [0.001]	-0.005*** [0.001]	-0.000 [0.000]	-0.002*** [0.000]
Divorced	0.211*** [0.014]	0.230*** [0.015]	0.291*** [0.004]	0.278*** [0.004]
Years since migration	-0.008*** [0.001]	-0.009*** [0.001]		
Secondary school*immigrant share growth	0.155 [0.096]	0.201** [0.086]	0.014 [0.045]	-0.114* [0.064]
Higher education*immigrant share growth	0.166 [0.172]	0.240* [0.143]	-0.150*** [0.057]	-0.285*** [0.056]
Earnings*immigrant share growth	0.020*** [0.007]	0.002 [0.005]	-0.004 [0.003]	-0.009*** [0.004]
Divorced*immigrant share growth	-0.357*** [0.092]	-0.223** [0.107]	-0.292*** [0.046]	-0.216*** [0.073]
Years since migration*immigrant share growth	0.017** [0.007]	0.006 [0.006]		
Observations	19,092	17,438	373,799	365,621
R-squared	0.079	0.093	0.066	0.069
Share moving (%)	45	47	33	32

Notes: Dependent variable is probability of having moved between neighbourhoods between 1990 and 2000. Municipality fixed effects are included. Years since migration is continuous and measured in number of years. *** indicates statistical significance at 1 per cent level, ** at the 5-per cent level, and * at the 10 per cent level. Robust standard errors in brackets.

Furthermore, we have estimated our regressions omitting parental characteristics. Bertrand et al. (2000) argue that if omitting observable variables has little effects on the coefficients, it is likely that including unobservable variables (if they were known) would not alter the results. Table 8 displays the results from these regressions. For natives, the results are quite robust to including or excluding parental characteristics. For second-generation immigrants the coefficients are smaller in magnitude when parental variables are added, but the statistical significance is not altered. Overall, the results in Table 7 and Table 8 support the idea that high-performing parents of second-generation immigrants have sorted into neighbourhoods

with low immigrant shares, while native parents with high earnings and educational attainment do not seem to be more prone to sort into neighbourhoods with few immigrants.

Another issue is that it is possible that omitted neighbourhood variables bias our results. In general, our included neighbourhood control variables reduce the neighbourhood heterogeneity quite much. The neighbourhood controls explain about 70 per cent of the variation in the neighbourhood's immigrant, own-group or other-group share within a municipality and also some of these control variables are significant in the main regressions (see Table 3 and 4). However, the remaining unexplained variation in the ethnic shares could be random or related to other factors that are (i) uncorrelated with economic outcomes or (ii) correlated with economic outcomes. In case (ii) our results will be biased. For instance, it could be the case that neighbourhoods with a high share of immigrants have lower quality of social institutions (such as schools) and this could either directly lead to worse economic outcomes for individuals who resided there as children or indirectly affect them by future discrimination on the labour market.

Table 8: Parental sorting: Regressions with and without parental control variables

Table 1. Estimated coefficients and standard errors from ordered probit regressions												
VARIABLES	Short run					Long run						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>Earnings</i>												
Immigrant share	-0.394 [0.347]	-0.402 [0.346]			-0.200** [0.102]	-0.189* [0.100]	-0.009 [0.250]	0.065 [0.250]			-0.194*** [0.072]	-0.220*** [0.073]
Own-group share			0.165 [0.194]	0.070 [0.192]					0.071 [0.140]	0.023 [0.138]		
Other-group share			-0.079 [0.119]	-0.096 [0.119]					-0.059 [0.098]	-0.059 [0.097]		
Parental controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
<i>Social assistance</i>												
Immigrant share	0.117 [0.104]	0.064 [0.102]			0.279*** [0.030]	0.235*** [0.028]	0.058 [0.061]	0.031 [0.061]			0.072*** [0.015]	0.071*** [0.015]
Own-group share			-0.095 [0.071]	-0.053 [0.070]					-0.088*** [0.033]	-0.072** [0.033]		
Other-group share			0.036 [0.038]	0.021 [0.037]					0.061** [0.025]	0.055** [0.025]		
Parental controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
<i>Higher education</i>												
Immigrant share	-0.321*** [0.091]	-0.201** [0.088]			-0.165*** [0.035]	-0.165*** [0.035]	-0.462*** [0.115]	-0.288*** [0.109]			-0.329*** [0.041]	-0.332*** [0.041]
Own-group share			0.030 [0.042]	0.030 [0.040]					-0.048 [0.059]	-0.030 [0.055]		
Other-group share			-0.115*** [0.030]	-0.070** [0.029]					-0.140*** [0.040]	-0.078** [0.038]		
Parental controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes: *** indicates statistical significance at 1 per cent level, ** at the 5-per cent level, and * at the 10 per cent level. For further details see Table 3.

6. Conclusions

In this paper we set out to determine whether economic outcomes of second-generation immigrants and natives in Sweden are associated with the ethnic composition in their childhood neighbourhood. Economic theory suggests that the neighbourhood ethnic composition can both harm and benefit individual's economic outcomes and, thus, it remains an empirical question to decide on the total net-contribution.

The results presented in this paper show that second-generation immigrants raised in immigrant-dense neighbourhoods have a lower probability to continue to higher education, whereas, their earnings, unemployment and social assistance tendencies are unaffected. This could be related to the fact that immigrant-dense neighbourhoods lack role-models who have attended higher-education and/or because anticipations of future discrimination on the labour market (e.g. Carlsson, 2010) implying low returns to education. Their labour market outcomes might be unaffected since the immigrant community on the other hand provides them with the networks needed to find a job (e.g. Edin et al., 2003).

On the contrary, immigrant concentration is strongly correlated with all four outcomes for natives. We should keep in mind that natives on average fare better than second-generation immigrants to start with, i.e. residing in an immigrant-dense area does not imply that natives do worse than second-generation immigrants in total. Stronger correlations for natives are consistent with the results found in Skyt Nilesen et al. (2003) for Denmark. One explanation could be that both natives and second-generation immigrants raised in immigrant-dense neighbourhoods come to lack certain knowledge of mainstream society, but for second-generation immigrants the immigrant neighbours also provide gains (network effects and/or human capital spill-over). It is also possible that omitted neighbourhood variables bias the estimates more for natives than for immigrants, i.e. that bad neighbourhood amenities are more severe for natives. Finally, the descriptive results for parental sorting on observables did not suggest that native parents are more negatively selected than parents of second-generation immigrants. However, it is still possible that native parents are more negatively selected in terms of unobservable parental variables, which would yield a larger bias for natives.

Furthermore, the analysis shows that it is important to distinguish between immigrants with similar ethnic background and immigrants from other ethnic groups. It appears that a larger

own ethnic group share is associated with a lower probability to be reliant on social assistance or unemployed for second-generation immigrants. This indicates that the ethnic group might be a substitute for the social security system and important for labour market networks. A positive impact from residing in ethnically dense areas is in line with earlier results presented for adult migrants (e.g. Edin et al., 2003; Damm, 2009) and first-generation immigrant children (e.g. Åslund et al., 2011). In contrast, a high share of immigrants from other ethnic groups is rather associated with worse economic outcomes and this appears to be driven by presence of particular ethnic groups, rather than presence of immigrants from many different ethnic groups.

Overall our analysis showed rather small differences in the short and long run. Nevertheless, we find that in the long-run the social assistance usage and unemployment probability are more strongly correlated with the ethnic composition for second-generation immigrants. For natives the correlation gets weaker. We cannot conclude that this is driven solely by a longer time since exposure to childhood neighbourhood. It could also be related to changes in the business cycle between the year 2000 and 2007. It would be fruitful to further investigate how the results change when the time-window between exposure to ethnic concentration and the measurement of outcomes is widened, unfortunately, this is not possible with the data used here.

Recent research has contributed to the literature on the impact of residing in an ethnic enclave on the economic outcomes of first-generation immigrants. However, ethnic residential segregation in Europe is characterised by immigrants with different ethnic backgrounds residing in the same areas. We conclude that when analysing ethnic residential segregation patterns it is important to distinguish between residing alongside many co-ethnics and living in a neighbourhood with a high share of immigrants originating from different parts of the world. It appears that second-generation immigrant children residing alongside many co-ethnics might benefit from this in adulthood. However residing close to immigrants from other ethnic groups might hamper economic outcomes in the future. In order to understand the policy implications there is a need to understand the mechanisms at work when it comes to the connection between neighbourhood ethnic composition and individual outcomes.

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Appendix

Table A1: Definition of ethnic groups

Ethnic group	Included countries and areas
Nordic	Denmark, Finland, Norway, or Iceland.
Western	Belgium, France, Ireland, Luxemburg, the Netherlands, Great Britain and Northern Ireland, Germany, Austria, Switzerland, Israel, the United States, Canada or Oceania.
Eastern Europe	Poland, Slovakia, the Czech Republic, Czechoslovakia, the DDR, Hungary, Bulgaria, Rumania, Russia, Ukraine, Belarus, Estonia, Latvia, Lithuania, or the Soviet Union.
Southern Europe	Greece, Italy, Portugal, Spain, Albania, Bosnia-Herzegovina, Gibraltar, Yugoslavia, Croatia, Macedonia, Moldavia, Serbia and Montenegro, Cyprus, Malta, or Slovenia.
Africa	Entire African continent included.
Asia	Afghanistan, Armenia, Azerbaijan, Bangladesh, the Philippines, Georgia, India, Indonesia, Japan, Cambodia, Kazakhstan, China, North Korea, South Korea, Laos, Malaysia, Mongolia, Nepal, Pakistan, Sri Lanka, Thailand, Uzbekistan, Turkmenistan, Hong Kong, or Vietnam.
Latin America	Central America, South America, the Caribbean and Mexico included.
The Middle East	Turkey, the United Arab Emirates, Bahrain, Iraq, Iran, Jordan, Kuwait, Lebanon, Oman, Pakistan, Palestine, Qatar, Saudi Arabia, Syria, the West Bank, or Yemen.

Table A2: Descriptive statistics

	Second-generation immigrants		Natives	
	2000	2007	2000	2007
<i>Individual characteristics</i>				
Age	21.9	28.9	22.0	29.0
Education (%)				
Primary	21.3	16.4	11.7	8.1
Secondary	59.9	50.1	62.5	44.4
Post-secondary or tertiary	16.4	32.3	25.1	46.9
Married (%)	6.8	25.5	1.8	18.5
Children under age 10 (%)	13.4	35.7	7.8	35.0
Annual Earnings	892	1,911	980	2,241
Unemployed (%)	19.8	14.8	10.1	6.7
Social assistance (%)	17.8	5.9	8.5	2.7
<i>Parental characteristics</i>				
Divorced (%)	17.8		12.7	
Mother education (%)				
Primary	56.3		24.4	
Secondary	33.4		47.9	
Post-secondary or tertiary	10.3		27.7	
Father education (%)				
Primary	52.6		31.6	
Secondary	37.1		42.9	
Post-secondary or tertiary	10.3		25.5	
Mother Annual Earnings	934		1,118	
Father Annual Earnings	1,283		1,898	
Parents' years since migration (%)				
<15	25.4			
15-24	58.2			
25-34	13.5			
>35	2.9			
Number of observations	19,759	19,759	373,811	373,811

Notes: Displayed are sample means. Primary includes unknown educational level. Children shows share with at least one child below age 10. Years since migration measured for parent with longest time since migration. Earnings are displayed in 100s Swedish Kronor (SEK) and 1 SEK \approx 0.16 American Dollars (USD) in year 2007.

Table A3: Construction of variables included in regressions

Variable	Description
<i>Dependent variable</i>	
Ln(Earnings)	Continuous
Unemployment	1 if unemployed in 2000/2007, 0 otherwise.
Social assistance	1 if receives social assistance in 2000/2007, 0 otherwise.
Higher education	1 if any post-secondary or tertiary education in 2000/2007, 0 otherwise.
<i>Independent variables</i>	
Immigrant share	Continuous
Own-group share	Continuous
Other-group share	Continuous
Age	Continuous
Age squared	Continuous
Primary School	Reference
Secondary School	1 if completed secondary school, 0 otherwise
Higher education	1 if any post-secondary or tertiary education in 2000/2007, 0 otherwise
Married	1 if married, 0 otherwise.
Children	1 if at least one child below age 10 years, 0 otherwise.
Mother/Father Primary School	Reference. Includes unknown educational level.
Mother/Father Secondary School	1 if completed secondary school, 0 otherwise
Mother/Father Higher education education	1 if any post-secondary or tertiary education, 0 otherwise
Divorced	1 if parents divorced, 0 otherwise.
Mother/ Father Earnings	Continuous
Years since migration (YSM) <14 years	Reference
YSM 15-24 years	1 if YSM for parent with longest time since migration in 1990 is 15 -24 years, 0 otherwise.
YSM 25-34 years	1 if YSM for parent with longest time since migration in 1990 is 25 - 34 years, 0 otherwise.
YSM ≥35 years	1 if YSM for parent with longest time since migration in 1990 is over 35 years, 0 otherwise.
Neighbourhood unemployment rate	Continuous
Neighbourhood mean income level	Continuous
Neighbourhood share high educated	Continuous
Neighbourhood share flats	Continuous

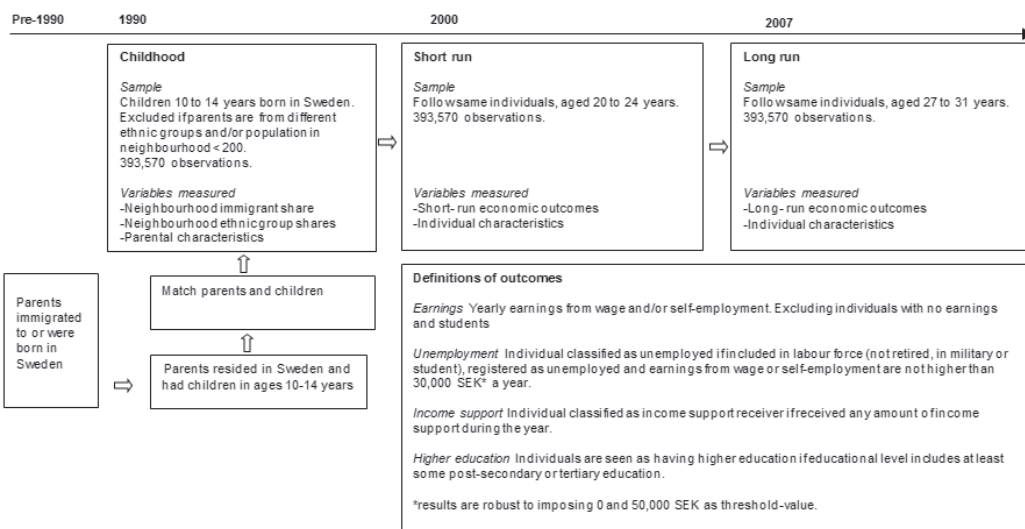


Figure A1: Data structure and definitions

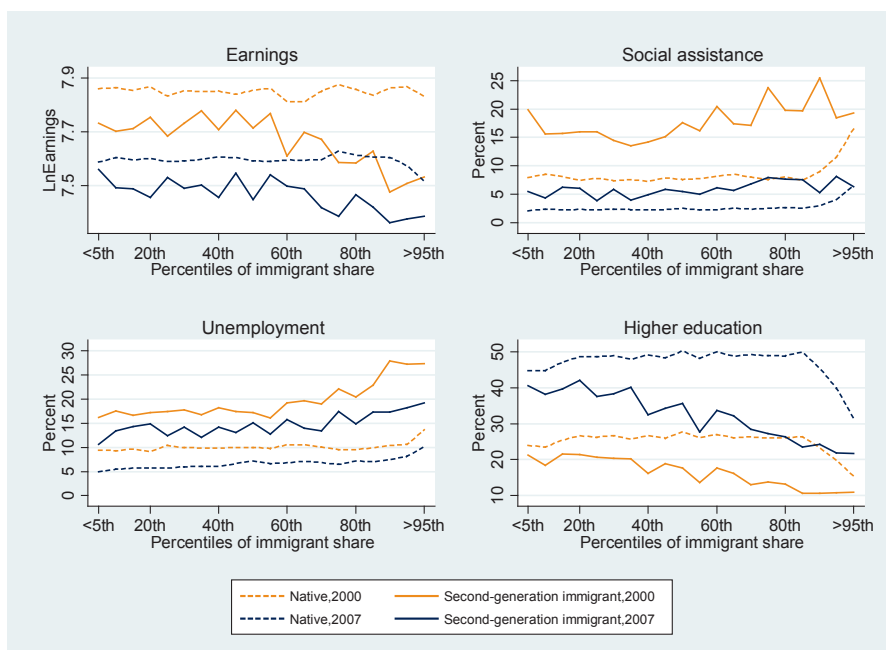


Figure A2: Individual outcomes for percentiles in immigrant share

Notes: Percentile values in immigrant share for second-generation immigrants: 5th: 8.7, 50th: 26.0, 95th: 71.8, and for natives: 5th: 4.4, 50th: 10.8, 95th: 28.3.

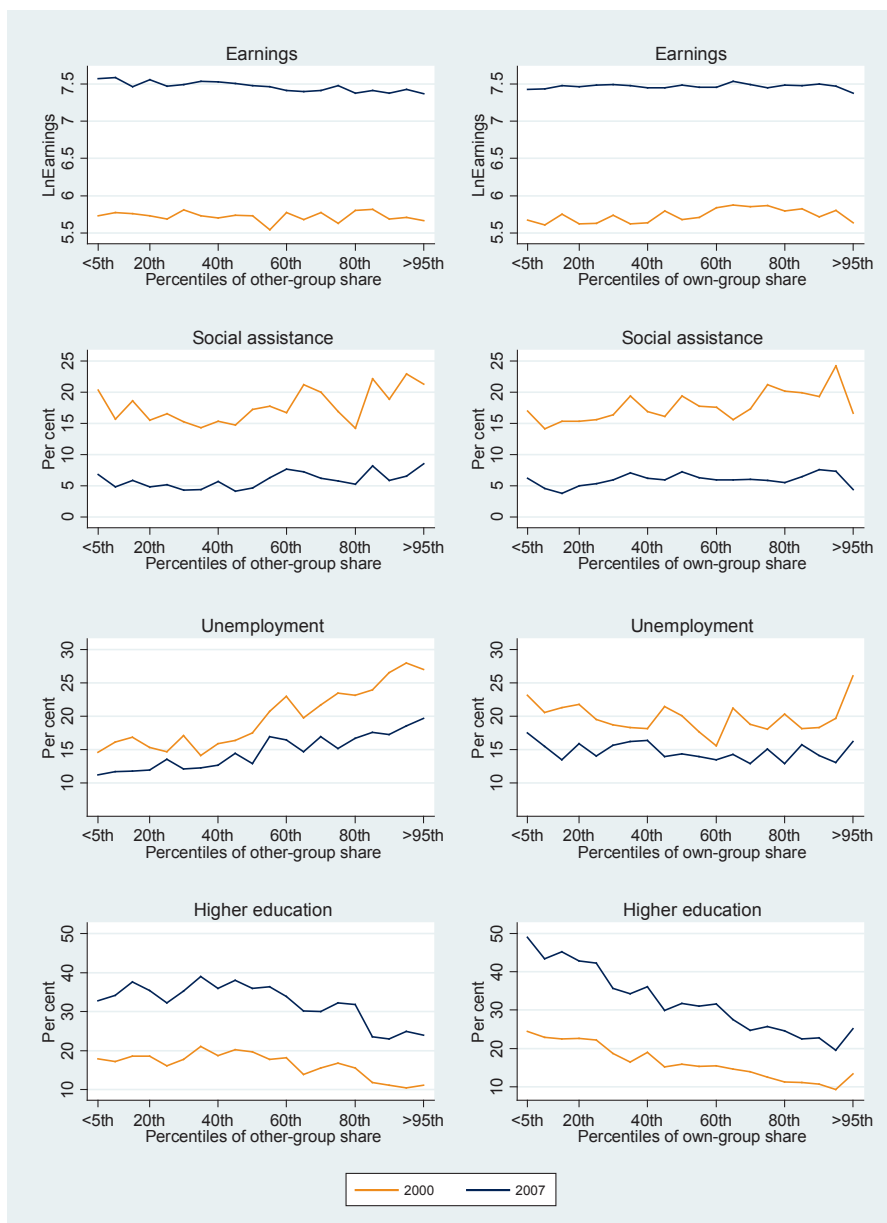


Figure A3: Individual outcomes for percentiles in other-group and own-group share

Notes: Displayed are outcomes for second-generation immigrants. Percentile values in own-group share: 5th: 0.6, 50th: 6.6, 95th: 27.4. Percentile values in other-group share: 5th: 5.0, 50th: 17.9, 95th: 51.7.

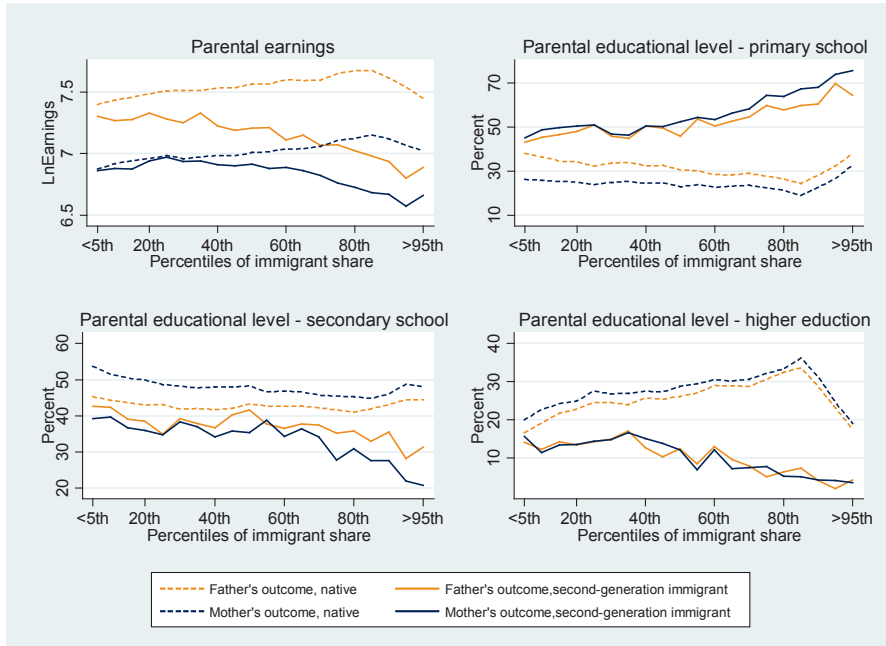


Figure A4: Parental outcomes for percentiles in immigrant share

Notes: Parental outcomes in the year 1990. Percentile values in immigrant share for second-generation immigrants: 5th: 8.7, 50th: 26.0, 95th: 71.8, and for natives: 5th: 4.4, 50th: 10.8, 95th: 28.3.

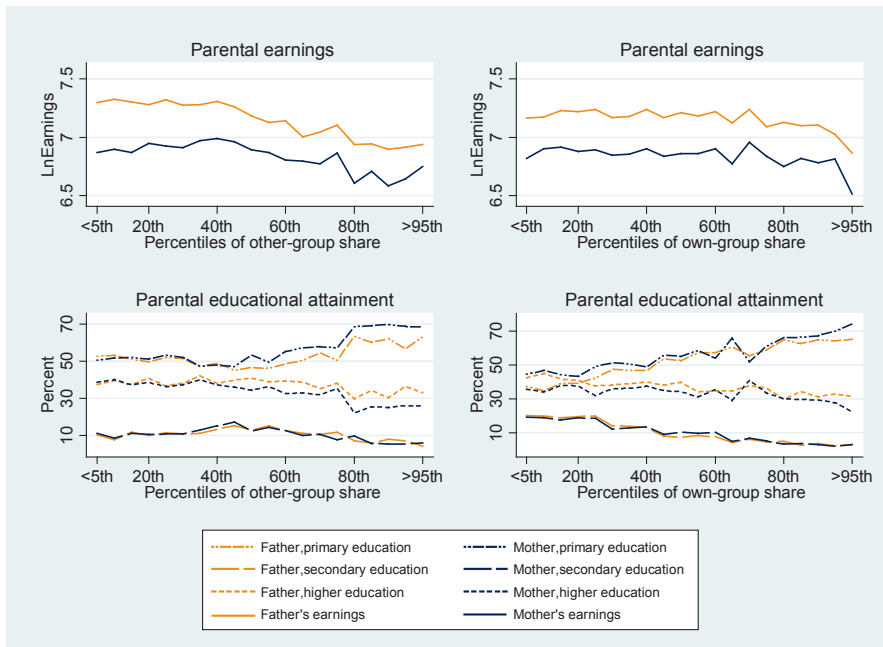


Figure A5: Parental outcomes for percentiles in other-group and own-group share

Notes: Displayed are outcomes for parents of second-generation immigrants. Parental outcomes in the year 1990. Percentile values in own-group share: 5th: 0.6, 50th: 6.6, 95th: 27.4. Percentile values in other-group share: 5th: 5.0, 50th: 17.9, 95th: 51.7.

III

Culture, Assimilation, and Gender Gaps in Labour Market Outcomes

Emma Neuman^{*}

Abstract

This paper analyses the role of social norms and attitudes about gender (i.e. culture) for labour market behaviour and cultural assimilation of immigrants in Sweden. Using gender gap in the source country as proxies for culture, we find that the labour force participation of immigrants in Sweden is related to their source country culture, in the sense that immigrants originating from countries with large gender disparities in labour force participation rates (LFPR) also have high gender gaps in LFPR within their immigrant group on the Swedish labour market. In contrast, gender disparities in earnings in the source country are not associated with gender gaps in earnings within immigrant groups in Sweden. In addition, we find that the longer immigrants remain in Sweden the more likely the gender gaps in LFPR among immigrants are to resemble the gender disparity between the earnings of Swedish men and women. These results suggest that culture is one explanation of the gender gaps in LFPR and that cultural assimilation takes place as time since exposure to the culture of the source country increases.

JEL-classification: J15; J16; J22; J31

Keywords: Culture; Earnings; Gender gap; Immigrant assimilation; Labour force participation

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1. Introduction

The creation of a strong and functional labour market is at the heart of high individual and societal welfare. Central to this process is ensuring equal opportunities to participate in the labour market work and a fair wage. Although progress has been made, in most countries more men than women participate in labour market work and men earn more than women. In addition, the advancements in gender equality have been unevenly spread around the world and therefore gender disparities in wages and labour force participation rates (henceforth LFPR) vary greatly (e.g. Blau and Kahn, 1996, 2000, 2003; Antecol, 2000, 2001). Antecol (2000) reports that in 1990 the gender gap in wages ranged from a low 2.2 percent in Sweden to a high 89.4 percent in Afghanistan.

A growing body of literature has investigated gender gaps in labour market outcomes (e.g. Albrecht, Björklund and Vroman, 2003; Blau and Kahn, 1996, 2000). There has also been an increasing interest in explaining the differences in men's and women's wages across countries. There are a few possible explanations in the literature. Firstly, international variation in gender gaps could stem from differences in the extent of employment discrimination against women. Secondly, differences in countries' wage structure could lead to differences in wages between men and women. Thirdly, the provision of gender-specific institutions, such as parental leave and child-care facilities, could cause gender gaps. Lastly, a society's culture (i.e. social norms, values, attitudes and beliefs about gender and the appropriate role of women) can affect the labour market behaviour of both women and men.

In general, discrimination, institutional setting and culture are all likely to be part of the explanation for the differences in gender gaps. The main tasks are to separate apart these explanations and test them empirically in a meaningful way. One way to do this is to compare immigrants from different source countries within the same labour market, implying that the institutional setting and degree of discrimination are similar for all immigrants but that cultural background is not. This is known in the literature as the epidemiological approach and has been used to study the impact of culture on a variety of outcomes.¹ For instance, the work of Antecol (2000, 2001, 2003) reveals that disparities in immigrant men's and women's wages and LFPR in the United States are explained by gender gaps in these outcomes in

¹ For an overview of this literature see e.g. Fernández (2011).

immigrants' source countries. In other words, she finds evidence that culture is transmitted across countries and affects gender gaps in labour market outcomes.

In this paper we build on this literature by investigating the extent to which culture explains gender gaps in terms of LFPR and earnings, within cohort-immigrant groups in Sweden. More specifically, the aim of this paper explores the degree to which gender gaps in earnings and LFPR in the source country explains gender gaps in the same outcomes within cohort-immigrant groups in Sweden. In addition, we investigate whether this association changes as time spent in Sweden increases, by following cohorts of immigrants in Sweden for up to 18 years. Furthermore, we explore whether gender gaps within cohort-immigrant groups tend to assimilate to those among Swedish natives.

We use longitudinal register data from Statistics Sweden, including all individuals older than 16 years residing in Sweden from 1990 to 2007. The data provides information on individual and labour market characteristics, as well as on country of birth. We append this data with to information on source country earnings and LFPR for the years 1970, 1980, 1990 and 2000. The data on source country wages and LFPR for males and females is collected mainly from the International Labour Organization's (ILO) database on labour statistics (LABORSTA).

The analysis will be performed on immigrants from 25 countries (see Table 2). Using a variety of countries is important because of international contrasts in gender disparities. It is necessary to include countries with significant differences (such as Afghanistan) in addition to those with minor ones (such as the Nordic countries) to capture cultural differences. In addition, previous literature on the assimilation of immigrants on the Swedish labour market has concluded that immigrants from countries outside the OECD tend to have the largest gaps in employment and earnings relative natives (e.g. Edin LaLonde and Åslund, 2000; Gustafsson and Zheng, 2006; Hammarstedt, 2003) and that immigrants from countries with high rates of self-employment are more likely to be self-employed than Swedish natives (Hammarstedt and Shukur, 2009). Therefore it is interesting to see whether similar assimilation patterns are found in relation to gender disparities. Furthermore, as pointed out early in the assimilation literature by Borjas (1985), it is important to consider within-cohort effects since the quality of immigrants can change across cohorts and thus bias the estimations of assimilation patterns. This objection is relevant also in a study of immigrants in Sweden

(see e.g. Hammarstedt and Shukur, 2006) and therefore each immigrant group is divided into three cohorts based on year of arrival (1970-1979, 1980-1989 and 1990-1999).

This paper contributes to the literature on the role of culture in explaining gender gaps in labour market outcomes by expanding the literature to the Swedish setting. This is of particular importance since Sweden is one of the world's most gender-equal countries (Hausmann, Tyson and Saadia, various years). Previous research has been conducted mainly in the United States. In comparison to the United States, Sweden offers more and farther-reaching gender-specific institutions, such as parental leave and child-care facilities, and the wage system is more collective than is the individualised US system. Hence, we investigate whether culture is transmitted and explains gender gaps in labour market outcomes in a society where gender equality is more emphasised and widespread than in the United States.

Apart from extending the literature to the Swedish case, the longitudinal data allows us to make two additional contributions. First, we estimate within cohort-immigrant group gender gaps (i.e. we measure the relationship between gender gaps in the source country closely before arrival of the immigrant cohort in Sweden and the within-cohort gender gaps for the subsequent years in Sweden). This allows us to consider the changes in gender disparities over time in many source countries, something that previous studies have not done. Secondly, we broaden the literature on culture and economics by investigating whether or not cultural influences are permanent. We also investigate whether gender gaps among immigrants eventually come to resemble those among natives.

The results show that being from a country with a wide gender gap in LFPR increases the likelihood of that gap persisting in LFPR within a cohort-immigrant group in Sweden. We interpret this result as evidence for culture (i.e. social norms, values, attitudes and beliefs about gender) being an important factor in variations in gender gaps in LFPR across Sweden's immigrant groups. Furthermore, the results show that immigrants from countries with large gender disparities in earnings tend to have smaller gender gaps in earnings on the Swedish labour market. However, these results are not robust to the inclusion of source country control variables; and, in addition, estimations of selection equations indicate that the results are biased by selection into participation among women on the labour market.

In addition, we find that the more time an immigrant group has spent in Sweden, the more similar its gender gap in LFPR is to that of the native population. We conclude that cultural norms regarding labour force participation of women are likely to be transmitted across countries, but their importance diminishes as time passes and perhaps as behaviour adapts to the institutional setting and culture in the new country.

The remainder of the paper is organised as follows. Section 2 offers an overview of the literature on gender differences on the labour market. Section 3 briefly describes immigration to Sweden. Section 4 provides a background of gender-specific institutions in Sweden. Section 5 presents the data and descriptive statistics. Section 6 presents the empirical model and Section 7 explains the results. Finally, Section 8 concludes.

2. Literature review

Research has shown that women tend to have lower labour market participation rates and earnings than men (e.g. Albrecht, Björklund and Vroman, 2003; Blau and Kahn, 1996, 2000). Some of these gender gaps in labour market outcomes remain unexplained even after controlling for individual differences in education and experience. Among the reasons for these differences, the literature has suggested norms and attitudes about gender roles, productivity differences, and discrimination.

Becker (1985) argues that women's higher responsibility for family and household work might lead to lower relative earnings and labour market participation and, in addition, discourage women from investing in human capital. Furthermore, women might put less effort into market work than men because of the greater number of hours they spend on household work, which in turn leads to lower productivity and wages (Becker, 1985). Moreover, it is possible that women earn lower wages because they are discriminated against on the labour market. In Becker's (1957) model, labour market discrimination against women is attributed to discriminatory tastes expressed by employers, customers, and/or co-workers. Another possibility is that discrimination results from employers' expectation that female employees are less productive than their male co-workers (e.g. Aigner and Cain, 1977).

Furthermore, it has been suggested that gender gaps in labour market outcomes, rather than being related to the demand-side of the labour market, are explained by supply-side related

factors. For Sweden, Carlsson (2011) provides evidence that occupational segregation by gender on the labour market seems to be driven by employees' own preferences, not by employer discrimination. In other words, women might choose low-wage occupations or not to work at all because of norms and attitudes about their role on the labour market. Numerous studies have investigated whether the beliefs, attitudes and social norms about gender, usually referred to as culture, contribute to gender gaps, by comparing outcomes for women in different countries and cultures. For instance, in a cross-country study, Albrecht, Edin and Vroman (2000) show that if women who are favour of mothers working full-time are more likely to work full-time themselves. Fortin (2005) draws a similar conclusion: that in countries where women are perceived mainly as homemakers, women tend to have worse labour-market outcomes. This suggests that gender norms are important for women's labour market behaviour.

However, a major drawback with cross-country studies is that they neglect to control for institutional differences across countries, such as child-care and parental leave policies, which might be correlated both with culture and gender gaps. In order to avoid bias from institutional differences, the role of culture has been investigated by comparing immigrants: people within the same labour market who have different cultural backgrounds. In the literature, this is known as the epidemiological method (Fernández, 2008) and has been used to study the impact of culture on a variety of outcomes.² The premise is that immigrants differ in terms of their culture, but share the institutional setting and economic environment in their new host country. Antecol (2000, 2001) shows that cultural factors explain part of the inter-ethnic variation in gender gaps in wages and LFPR across immigrant groups in the United States. Similarly, Blau, Kahn, and Papps (2011) find that immigrant women who have migrated from countries with high female LFPR work more than do immigrant women from countries with low female LFPR. Men's LFPR, however, is not affected by female LFPR in the source country.

To the best of our knowledge, Bredtmann and Otten's (2013) is the only study expanding the literature on the effect of culture on gender gaps in immigrants' labour market outcomes outside of the United States. However, this study does not examine gender gaps per se. Bredtmann and Otten (2013) use survey-data from the European Social Survey 2002-2011

² For an overview see e.g. Fernández (2011).

and finds a positive correlation between female host-country LFPR and female source country LFPR. Hence, the extent to which the relationship between culture and gender gaps observed on the labour market in the United States holds in other contexts still merits investigation.

To date, few studies have investigated whether the impact of culture on gender gaps remains or diminishes with the passage of time since migration. As pointed out by Blau (1992) it is reasonable to believe that the cultural climate in which women and men have been brought up is likely to affect their post-migration behaviour. As a result, outcomes among immigrants are likely to differ from outcomes among natives. In addition, Blau argues that the longer an immigrant remains in the new host country, the more these differences will diminish as behaviour adjusts to the economic and social conditions in the new country. Several studies have shown that cultural factors continue to shape labour market outcomes among second-generation immigrants in the United States and in Canada, but that the impact is smaller than for first-generation immigrants (e.g. Antecol 2000; Eylem Gevrek, Gevrek, and Gupta, 2013; Fernández and Fogli, 2009).

We argue that a more direct way to study the possible diminishing impact of culture is to investigate whether first-generation immigrants assimilate towards the native level for gender gaps in labour market outcomes. In other words, we compare gender gaps within immigrant groups with corresponding gaps among comparable natives over time. Blau, Kahn, and Papps (2011) is so far the study that is closest to applying this approach and they find that work hours of female immigrants assimilate towards the levels of comparable female natives over time. This study differs from theirs that we study gender gaps in labour market outcomes and not solely the outcomes of women. We argue that gender gaps provide information that is more likely to be linked to culture and gender norms than to women's outcomes, since low participation of females when male participation rates are also low is not necessarily related to gender norms. In general, our approach is line with methods used in the extensive literature on immigrants' labour market assimilation, in which the development over time of immigrants' earnings relative natives' earnings is investigated. Overall, assimilation studies have concluded that immigrants' earnings grow relative to natives' as time in the host country increases, but immigrants never seem to catch up with natives (e.g. for United States Borjas, 1995; e.g. for Sweden Hammarstedt, 2003; Edin, Lalonde and Åslund, 2000). It remains an open question whether this pattern holds for gender gaps among immigrants.

3. Immigration to Sweden during the 1970s, 1980s, and 1990s³

Since the beginning of the 1950s, Sweden has become home to many thousands of immigrants. The share of the Swedish population born abroad increased from about 7 per cent in 1970 to around 13 per cent in 2000 (Statistics Sweden, various years). At the same time, the composition of the foreign-born population has changed. In the 1970s, immigration from the Nordic countries and other Europe was still prevalent, but immigration of refugees from South America, mainly Chile, and the Middle Eastern countries increased in the wake of political conflict in these areas. In the 1980s, refugee immigration from South America continued, while more refugees came from Asian and African countries, especially Ethiopia. During the 1990s, the influx of refugees from Asia and Africa continued, but more than half of the immigrants arriving during this period were refugees from what had been Yugoslavia. From 1970 to 2000 the migration flows have shifted from consisting mainly of labour-force migrants from Europe and especially from Sweden's Nordic neighbours, to be more likely to comprise refugees and tied-movers from outside of Europe.

4. Institutional background

In this paper we focus on outcomes of immigrants who have different cultural backgrounds, but who share Sweden's institutional setting and economic environment. We are interested in how their cultural backgrounds affect their labour market behaviour in Sweden. Since immigrants cannot literally take with them the institutional setting from their source countries, source country institutions should not affect the initial level of the gender gap among immigrants upon their arrival in Sweden. However, institutional differences between the source countries and Sweden might affect the longer-term persistence or narrowing of gender gaps among immigrants. It is reasonable to expect that the more pronounced the differences between the institutional backgrounds of Sweden and the source country, the longer it will take to adapt to the Swedish institutional setting. More specifically, women who find that Sweden has a more comprehensive parental leave system and extensive child-care facilities than their source country might not immediately adjust their labour market behaviour. Furthermore, Sweden's institutional setting is most likely to factor in the evolution of gender gaps among immigrants over time. The less the individualisation in the Swedish institutional rights (i.e. the more rights that are given to the household rather than the individual) the more likely cultural influences are to remain over time. In other words, cultural assimilation most

³ A detailed background on immigration to Sweden is given in Lundh and Ohlsson (1999).

be seen in light of Sweden's institutional setting and its differences from institutions in other countries. In order to present these results in a broader perspective and to draw comparisons with previous studies, institutional differences across countries must be taken into account. Therefore, we will give a short history of the development of gender-specific institutions in Sweden and compare this to the gender-specific institutional progress in other parts of the world. By 'gender-specific institutions' we mean changes in the institutional setting that especially affect women's position on the labour market, such as equal opportunity legislation, parental leave and child-care policies, and the educational system.

4.1 Equal opportunity legislation

An important step towards employers' equal treatment of men and women is legislation against discrimination based on gender. In 1960, an agreement forbidding separate male and female wages was made between Sweden's Confederation of Trade Unions (LO) and the Employers' Confederation (SAF) (Svensson, 1997). Almost 20 years later, with the passage of the 1979 Act on Equality between Men and Women at Work, gender discrimination on the labour market prohibited under Swedish law (Meyerson and Petersen, 1997). Anti-discriminatory legislation had already been enacted in the United States in 1963, in the United Kingdom in 1970, and other OECD countries during the 1980s (Blau and Kahn, 1996).

However, there are countries in which the laws prohibiting gender discrimination are either not prevalent or limited by legislation on other areas. For instance, in most Arab countries women have the right to work but family laws restrict this right to certain occupations and to situations that require the husband's consent (United Nations Development Programme, 2006).

Apart from anti-discrimination legislation, a country's tax system might also affect labour market behaviour. The extent to which taxation is based on the household unit or on the individual level might matter for the participation of women. Smith, Dex, Vlasblom and Callan (2003) show that countries whose tax system includes a degree of joint taxation have lower participation rates among women. In Sweden, taxation has been made on individual level since 1971 (Statistics Sweden, 2012). In the UK, individual taxation was imposed during the 1990s; in Germany, taxation is still based partly on the household level (e.g. Smith, Dex, Vlasblom and Callan, 2003). Other countries that still apply a degree of joint taxation include

both high-income countries such as the United States, Denmark, Greece, and Poland and low-income countries such as Ethiopia (Hausmann, Tyson and Saadia, 2013).

4.2 Parental leave and childcare provision

Apart from legislatively prohibiting direct discriminatory treatment of women, it is possible to affect women's behaviour by changing their incentives to work. Edin and Richardsson (2002) mean that Sweden's high female LFPR might be explained by the combination of reforms providing maternity/parental leave, subsidized child-care and employment security. However, as argued by Blau and Kahn (1996) the a priori relationship between parental leave and labour market outcomes is unclear. On the one hand, short periods of leave might preclude the need for permanent withdrawal from the labour market. On the other hand, longer periods of parental leave can lead to deterioration of human capital, making it harder to return to work and possibly decreasing wages upon re-entry.

In an international context, Sweden's tax-financed system for parental leave and child-care is among the most generous in the world (e.g. Anxo et al., 2011; Blau and Kahn, 1996; Ruhm, 1998). Women in Sweden have been entitled to unpaid maternal leave for four weeks after childbirth since 1901; paid leave was implemented in 1955 and in 1989 was extended to 15 months (Statistics Sweden, 2012). In addition, the Swedish system has allowed mothers and fathers to share parental leave since 1974. A more recent development in the Swedish parental leave system (and also in the other Nordic countries) is the “daddy month” implemented in 1995, which reserves one non-transferable month of the parental leave to the father or mother. This was extended to two months in 2002. Moreover, parents in Sweden who return to market work after parental leave are ensured job security and the public child care. According to Rønsen and Sundström (2002), Sweden and the other Nordic countries have the most extensive publicly subsidized child-care provisions in Europe.

In line with the developments in Sweden, the average length of paid parental leave in the OECD countries has increased since 1980. Since the 1980s, Turkey, the United Kingdom and the United States have been among the OECD countries with the shortest periods of paid parental leave, while Sweden, Hungary and Poland provide the longest (e.g. Thévenon and Solaz, 2014). According to Rubery (2002), however, policies in most European countries aim at making it easier for women to combine domestic and market work, not at encouraging men

to take on more of the household responsibilities. Rubery (2002) points at the Nordic countries as an exception, since the “daddy months” show an interest in engaging fathers in taking more responsibility for child-rearing and thus promote the full integration of women. Still Sweden's system is not fully individualised, one parent can still take the majority of leave. The development of gender-specific institutions in Sweden and other OECD countries is a stark contrast to what is found in the Arab world where there is a lack of social support for child care. The responsibility for child care falls mainly on mothers, and this discourages many women in the Arab world from performing market work at all (United Nations Development Programme, 2006).

4.3 Educational system

According to Fortin (2005), ensuring women's access to higher education has been and remains the main policy instrument to ensure equal opportunities for women on the labour market. Stanfors (2003) reports that gender equality in educational attainment was established for individuals born in Sweden in the late 1930s and early 1940s. This development was the result of reforms in the Swedish educational system during the 1960s, which opened up higher education to women (Edin and Richardsson, 2002). Women were soon as well-educated as men. Since the 1970s, more Swedish women than men enter colleges and universities (Stanfors, 2003). There are today few differences in the educational level of men and women in Sweden, although men are much more likely to major in technical subjects and women are overrepresented in teaching and nursing (Stanfors, 2003).

In most countries, women have caught up with men in educational attainment. For OECD countries there is no gender gap in male and female participation in primary and secondary education (OECD, 2011). However, in countries in South and West Asia, Sub-Saharan Africa and in the Middle East girls still are less likely than boys to attend primary and secondary school (UNESCO, 2010).

5. Data and descriptive statistics

5.1 Data

In this paper we make use of longitudinal register data from LISA (Longitudinal Integration Database for Health Insurance and Labour Market Studies) developed by Statistics Sweden. The data covers the period 1990 to 2007 and includes information on country of birth, year of

immigration and other demographic characteristics and labour market outcomes, for everyone older than 16 years residing in Sweden. This means that we can follow everyone who lived in Sweden between 1990 and 2007.

We study immigrants arriving in Sweden between 1970 and 1999. They are divided into three cohorts based on their year of arrival: 1) 1970 to 1979; 2) 1980 to 1989; and 3) 1990 to 1999. We use ten-year cohorts because they generate sufficiently large sample sizes. Furthermore, the sample is restricted to source countries for which the place of birth is reported at the country level and each cohort contains at least 120 observations. As a result, analysis is performed on 25 source countries (see Table 2), divided into three cohorts. We follow these cohort-immigrant groups over time in Sweden. We measure labour market outcomes for immigrants belonging to the 1970s cohort between 1990 and 1999. The reason for not including the latest eight years is that our sample sizes for individuals in working age is too small. For the 1980s cohort, outcomes will be observed for the years 1990 to 2007; for the 1990s cohort, outcomes are measured for 2000 to 2007.

We impose several restrictions on our sample. First, the sample is restricted to immigrants who arrived when they were older than 16 years, making it more likely that they had been affected by gender norms in their source country. In addition, only individuals between the ages of 25 to 54 years are included, since these ages are likely to include people of working age both in Sweden and the source countries. These restrictions give a total number of 739,033 unique individual-year observations for the 1970s cohort, 1,780,332 for the 1980s cohort and 1,153,769 for the 1990s cohort. In addition, earnings' regressions will be estimated only for individuals with positive earnings and who are not full-time students or self-employed, resulting in 518,770 individual-year observations for the 1970s cohort, 1,050,903 for the 1980s cohort, and 681,268 for the 1990s cohort. (For sample sizes by immigrant group level see Appendix A, Table A1.)

We append the register data with data on source country earnings and LFPR for males and females, collected from the International Labour Organization's (ILO) database on labour statistics (LABORSTA). The LFPR is defined as the share of employed or unemployed individuals out of the total population. When data is not provided by ILO, it has been collected elsewhere. (All exceptions are listed in Table A2 in Appendix A.) GDP per capita

and educational attainment in the source countries have been collected from the World Bank.⁴ Each cohort is assigned the value of the source-country characteristics for the earliest arrival year of the years included in the cohort: 1970 for the 1970s cohort, 1980 for the 1980s cohort and 1990 for the 1990s cohort. This implies that the source-country variables are measured before migration took place. The advantage of this approach is that it allows culture of the source country to change over time, whereas in studies measuring culture of the source country both before and after migration such changes might bias the results.

Although we try to make the measurements of source country variables comparable across countries, still there are some important differences in how they are measured. As regards earnings, our preferred measure is gender gaps in yearly earnings, since this is the information we have in the register data for Sweden. However, the gender gap in earnings will for some countries be based on hourly, weekly or monthly wages. Yearly earnings captures the difference in both wages and hours and it is thus possible that gender gaps based on this will differ from gaps calculated on the basis of wages. Furthermore, the outcomes are not always reported for people of different ages, implying that for some countries we will not compare participation and earnings gaps for people of the same age. In addition, outcomes will for some countries be measured for years that differ from our preferred years, because of lack of available data. Moreover, information on earnings is missing for 31 of our 75 groups and for four groups for LFPR. In Table A2 in Appendix A we give an overview of the data sources and the collected data. We should bear in mind when interpreting the results that the source country data is likely to contain some measurement error.

5.2 Descriptive statistics

Table 1 gives descriptive statistics for the sample broken down by cohort, with variable means calculated as an average for all individual-year observations. Noteworthy is that individuals in the 1970s cohort are about four years older on average than individuals in the other two cohorts. This is an artefact of our data availability. More specifically, data is available from 1990 and onwards and the first cohort will include individuals ages 27 and older for the first year of observation in Sweden. For the subsequent years, the youngest persons in the cohort will be a year older. This implies that the age restriction is not consistent

⁴ Geographical distance (as the crow flies) between the centre of each source country's capital and Stockholm was measured using <https://www.google.se/maps>.

over time for the 1970s cohort; however, robustness regressions performed on a sample where the age restriction was set to ages 37 to 54 showed very similar results.

Table 1: Descriptive statistics by cohort

	Cohort 1970-1979	Cohort 1980-1989	Cohort 1990-1999
Yearly real earnings, SEK hundreds	1,085	935	1,004
Labour force participation rate	0.78	0.74	0.67
Age	44.08	39.81	38.75
Years since migration	19.59	12.10	9.07
Share living in a metropolitan area	0.25	0.30	0.27
Share married	0.59	0.57	0.64
Average number of children	0.98	1.14	1.29
Education (shares)			
- Primary school	0.38	0.32	0.27
- High school	0.40	0.42	0.39
- University	0.22	0.26	0.33
Number of years	10	18	8
Number of individual-year observations	739,033	1,780,332	1,153,769

Notes: Sample is restricted to immigrants ages 25-54, older than 16 years at arrival, from any of the 25 groups listed in Table 2. Number of children includes children under age 18 years. Metropolitan area includes the municipalities of Stockholm, Gothenburg and Malmö. Cohort 1970s includes years 1990-1999, cohort 1980s includes years 1990-2007 and cohort 1990s includes years 2000-2007. Real earnings in 1990 values.

Apart from differences in age, it appears that the first cohort has higher LFPR relative to the two more recently arrived cohorts, but earnings is highest in the 1990s cohort. Furthermore, the proportion being married, average number of children and educational level are higher for more recently arrived immigrants.

Table 2 displays the gender gap in LFPR (i.e. male LFPR minus female LFPR) for all immigrant groups, calculated separately for each of the three cohorts. We have missing information on source country gaps for 1970 for four countries. In addition, the number of immigrants from Afghanistan, Somalia and Russia is too small to calculate gaps for the first cohort. The gaps in Sweden are displayed for similar years since migration for the three cohorts and the source country gaps are measured before the first persons in the cohort emigrated. It appears that in Sweden, immigrant men are more likely than immigrant women to be included in the labour force. This pattern holds for all three cohorts, but gender gaps in LFPR tend to vary within cohorts across source countries. For instance, immigrant women from Thailand who immigrated in the 1970s have a LFPR that is about 16 percentage points higher than Thai males from the same cohort. In contrast, females from Greece and Syria who

migrated in the 1970s are between 10 and 13 percentage points less likely to be included in the labour force compared to men from those countries. Noteworthy is the fact that some immigrant groups experience increasing gender gaps in more recently arrived cohorts (for instance, Syrians and Lebanese) while other groups have smallest gender gaps among the latest-arrived immigrants (for example, immigrants from Iceland, Hungary and Finland).

Table 2: Gender gaps in labour force participation rate for cohort-immigrant groups

	Cohort 1970-1979		Cohort 1980-1989		Cohort 1990-1999	
	Sweden (1990)	Source country (1970)	Sweden (2000)	Source country (1980)	Sweden (2007)	Source country (1990)
	(1)	(2)	(3)	(4)	(5)	(6)
Afghanistan			11.24	89.36	26.04	67.10
Chile	1.06	70.76	6.82	60.06	3.03	53.71
China	6.03		-2.75	16.36	1.04	11.34
Denmark	3.08	40.38	3.55	13.23	-8.24	4.86
Ethiopia		35.93	-0.60	34.72	0.80	39.27
Finland	-4.41	27.79	-9.35	10.86	-9.99	5.05
Former Yugoslavia	9.00	46.58	4.88	37.07	6.04	20.40
Germany	6.21	49.46	0.40	41.09	4.84	27.63
Greece	12.75	62.21	15.09	63.10	14.42	62.21
Hungary	-4.65	30.59	-5.13	18.22	-5.67	13.10
Iceland	-2.39	61.76	-2.40	25.97	-3.50	9.40
India	3.53	74.98	0.10	61.34	4.11	56.05
Iran	4.21	89.62	2.19	83.46	4.82	85.70
Iraq	-2.39		8.45	75.87	15.63	78.40
Lebanon	3.53	72.36	19.99	72.36	25.12	54.40
Norway	1.00	62.07	-3.57	25.00	-5.55	11.42
Poland	-0.91	17.90	-2.42	16.31	0.15	15.02
Romania	-2.22		-2.61	15.25	-1.08	17.45
Russia		5.41		4.01	-3.93	4.11
Somalia		56.93	5.20	56.93	18.47	43.50
Syria	10.47	88.20	15.15	87.98	17.11	63.80
Thailand	-17.10	17.18	-1.75	20.36	-6.12	13.10
Turkey	18.40	42.27	16.87	47.81	20.07	50.87
United Kingdom	6.98	44.07	6.19	35.88	7.33	20.77
United States	-1.48	44.60	4.60	29.39	2.26	17.20
<i>Average</i>	<i>2.47</i>	<i>49.57</i>	<i>3.76</i>	<i>41.68</i>	<i>5.09</i>	<i>33.83</i>

Notes: The table displays unadjusted gender gaps calculated as the difference between the share of males and females included in the labour force (employed or unemployed). Source country gaps calculated for individuals aged 25-54, for data-sources and exceptions see Appendix A, table A2. Gaps in Sweden are evaluated at similar years since migration across cohorts (10-20 years for cohort 1970s and cohort 1980s and 8-18 years for cohort 1990s) and the sample is restricted to immigrants aged 25-54, older than 16 years at arrival in Sweden.

The source country gaps are generally positive, implying that more males than females are participating in the labour force. These gaps have on average decreased from about 50 percentage points in 1970 to around 40 percentage points in 1980 and about 34 percentage points in 1990. The gender gap in LFPR is widest for Afghanistan and Syria, where it amounts to nearly 90 percentage points. In Russia, however, it is only around 5 percentage points.

Table 3 displays gender gaps in earnings (i.e. log male earnings minus log female earnings) for all cohort-immigrant groups. Information on source country gaps in earnings is available for only ten countries in the first cohort and for about half the sample in the second. In the analysis we will keep in mind that different results across cohorts might be driven by the countries that are included. It appears that the patterns for gender gaps in earnings are quite different for immigrant groups in Sweden depending on which cohort we consider. On average, the gender gap in earnings was smallest for the cohort arriving in the 1980s; in comparison to the 1970s (1990s) cohort the gender gap in earnings was around 5(3) percentage points lower.

Moreover, there are differences in the gender gap in earnings across Sweden's immigrant groups. For instance, the gender gap in earnings is smaller in the more recent cohorts for immigrants from Greece and Chile, while the opposite pattern holds for Hungary, Norway and the United States. This divergence in gender gaps in earnings across cohort-immigrant groups implies that grouping cohorts of immigrants might result in misleading conclusions about the association between gender gaps in earnings in the source country and in Sweden.

Furthermore, Table 3 shows that, on average, the gender gaps in earnings in the source countries have decreased over time. In 1970 the average gender gap in earnings for the included source countries was around 42 percent, while in 1980 it was about 28 percent and finally in 1990 it was around 26 percent. The gap was particularly low (about 2 percent) in Turkey in 1980 and in China in 1990. Chile, the United Kingdom and the United States have the largest gender gaps in earnings (71, 55 and 52 percent) estimated for 1970.

Table 3: Gender gaps in earnings for cohort-immigrant groups

	Cohort 1970-1979		Cohort 1980-1989		Cohort 1990-1999	
	Sweden (1990)	Source country (1970)	Sweden (2000)	Source country (1980)	Sweden (2007)	Source country (1990)
	(1)	(2)	(3)	(4)	(5)	(6)
Afghanistan			25.85		34.69	
Chile	25.37	70.91	17.74	40.90	13.20	32.07
China	15.24		36.12		22.08	2.18
Denmark	46.48	29.54	31.50	15.00	34.70	16.69
Ethiopia			8.16		19.33	24.39
Finland	18.51	35.11	4.88	28.23	15.95	25.69
Former Yugoslavia	27.26		17.99		24.34	10.65
Germany	33.40	36.22	35.85	31.82	45.63	31.87
Greece	6.23	38.59	34.10	38.83	17.93	24.33
Hungary	9.15		9.71		22.80	29.88
Iceland	32.33		31.41		28.66	18.16
India	18.56	35.58	37.67	16.36	14.96	48.45
Iran	26.94		12.36		14.55	27.59
Iraq	48.66		16.62		17.50	
Lebanon	30.08		21.82		25.14	23.94
Norway	11.26	28.70	31.21	19.98	31.51	14.58
Poland			21.94	30.52	26.35	23.45
Romania			14.03		17.27	24.08
Russia	43.44	35.67		35.67	30.45	31.56
Somalia	14.98		-5.83		16.16	
Syria	3.64		24.92		15.02	
Thailand	27.09		1.25		5.96	44.96
Turkey	46.43		21.27	1.53	21.82	21.06
United Kingdom	35.34	55.15	27.62	37.33	40.37	38.92
United States	13.15	52.09	16.03	50.75	24.67	33.41
<i>Average</i>	<i>24.96</i>	<i>41.76</i>	<i>20.59</i>	<i>28.91</i>	<i>23.24</i>	<i>26.09</i>

Notes: The table displays unadjusted gender gaps calculated as the difference between log male and log female earnings. Source country gaps calculated for individuals ages 25-54. Further notes: See Table 2.

6. Empirical specification

6.1 Culture and gender gaps in labour market outcomes

To investigate whether the observed differences in gender gaps in earnings and LFPR within cohort-immigrant groups are related to culture, we adopt a two-stage estimation procedure.⁵ First we estimate the following equation separately for each cohort-year combination (cohort

⁵ This two-step method was introduced by Borjas (1987) and Borjas and Sueyoshi (1994). Since then, it has been used by Fairlie and Meyer (1996) and Hammarstedt and Shukur (2009) to investigate ethnic differences in self-employment rates and by Antecol (2001, 2003) for ethnic difference in gender wage gaps.

1970s for years 1990 to 1999, cohort 1980s for years 1990 to 2007 and cohort 1990s for years 2000 to 2007):

$$L_i = \beta_0 + \beta_1 X_i + \beta_2 M_i + \beta_3 X_i M_i + \sum_{j=1}^{J-1} \beta_{4j} E_{ij} + \sum_{j=1}^{J-1} \beta_{5j} (E_{ij} M_i) + \varepsilon_i \quad [1]$$

where i indexes the individual and j the immigrant group. L is the log of annual earnings or an indicator variable for labour force participation, X is a vector of individual characteristics (see below), M is a dummy variable which is one for males, and E are dummy variables for immigrant group. The wage regressions are estimated by ordinary least squares and the labour force participation regressions utilize a linear probability model.⁶ The β_{5j} s from the estimations of equation [1] give the deviation from the mean adjusted gender gap for each cohort-immigration group and year. The coefficients show whether a particular immigrant group has a gender gap that is smaller or larger than the average gap among all immigrant groups in the same cohort.

We estimate equation [1] using three specifications. First we estimate gender gaps without controlling for any individual characteristics. We refer to this specification as the *raw*. *Specification 1* includes the following individual characteristics: eight dummy variables for year of arrival, a quartic in age and a dummy indicating residence in metropolitan area (includes the municipalities of Stockholm, Gothenburg and Malmo). *Specification 2* adds a dummy for being married, a variable for number of children and four dummies for educational attainment. The difference between these last two specifications is that the extended specification includes individual characteristics which are likely to be themselves affected by culture. As pointed out by Antecol (2000), this implies that the extended model over-controls for culture and thus might take away some of the variation that we are interested in using in the second stage regression. Therefore specification 1 is our preferred model, but we perform regressions also using specification 2 as a robustness check.

In the next step we estimate the contribution of gender gap in the source country to the variation in the within cohort-immigrant group gender gaps. This step is performed using the regression results from equation [1] with specification 1. In order to identify within cohort-

⁶ Similar results were found using a probit.

immigrant group time patterns we pool the results over years and estimate the following equation for each cohort separately:

$$\hat{\beta}_{5jt}^* = \alpha + \delta_1 S_j + \delta_2 YSM_t + \delta_3 S_j YSM_t + \delta_4 V_j + e_{jt} \quad [2]$$

where $\hat{\beta}_{5jt}^*$ are the deviations from the mean in the $\hat{\beta}_{5jt}$ estimated in equation [1], S is the deviation from the mean in the gender gap in the source country in earnings or LFPR, YSM is a continuous variable for the cohort's years since migration, and t refers to the number of years that have elapsed between the year of migration of cohort c and the year of observation. V is a vector of control variables on source country level (GDP per capita, geographical distance to Sweden and female as share of male enrolment rate in secondary school).⁷ S and V are measured in the year 1970 for the 1970s cohort, in 1980 for the 1980s cohort and in 1990 for the 1990s cohort. The coefficients of interest, δ_1 , shows the influence of a one percentage point increase in the gender gap in the source country on the within cohort-immigrant group gender gap in Sweden and, δ_3 , measures if this association is changing as time since migration increases. We will estimate this equation both with and without the interaction between S and YSM and the control variables in V . Furthermore, especially for earnings it is a major drawback that the number of observations are very few for the 1970s and 1980s cohort. Therefore we will also report results when we estimate gender gaps within immigrant groups, but not distinguishing between cohorts. Equation [1] is then estimated for years between 1990 and 2007 and includes all immigrants in our sample. In equation [2] S is measured in the year 2000 (where data availability is highest).

We will interpret a statistically significant δ_1 as evidence for the fact that culture does matter for gender gaps in earnings and LFPR. As noted by Fernández (2007), the average outcomes in the source countries are likely to depend on the institutional setting, economic environment, and on culture. However, immigrants do not bring with them the institutional and economic environment from their country of origin. As a result, the institutional setting and environment are the same for all immigrants in Sweden. Thus, if source country variables have explanatory power for gender gaps in Sweden, this must be because of the variation in these variables that is due to culture. Still, we will not argue that we measure the causal effect

⁷ The results are robust to including the gender gap in enrollment in primary school instead of secondary school, but these two variables are highly correlated and cannot be included simultaneously.

of culture on gender gaps, since our measure of culture is a rather crude proxy and there are some potential ways in which our estimates can be biased. We need to make a number of assumptions in order for our estimates to be an unbiased estimate of the effect of culture on gender gaps.

To start with, immigrants are not a representative sample of the population in their source country and, as appropriate in any study of immigration, such selection in migration needs to be taken into account (e.g. Borjas, 1987). More specifically, the average immigrant from a country might either be positively or negatively selected, such as having higher income, ability, education than the average person in the source country who does not emigrate. For our estimates to be unbiased we need to assume that there are no systematic differences in the selection of women and men from the same source country. However, we will find an upward bias only if men and women from the same source country are selected differently and if the way in which men and women are selected depends on the size of the gender gap in the source country. So if we are to overrate the impact of culture, women must be more negatively (positively) selected than men in countries with high (low) gender gaps. As a result, the gender gap in Sweden will be higher (lower), because of quality differences between men and women. In general, such selection processes are possible, but not very plausible. We will try to investigate whether selection processes are important by testing the robustness of our results to the reason for migrating. The idea is that refugee migration is less likely to be selective and thus estimations for refugees should be less biased by selection.

Another factor to keep in mind is that immigrants might change their behaviour after emigration because of shocks from language difficulties, discriminatory treatment or absence of a community of other people who share their cultural beliefs.⁸ This implies that outcomes in Sweden are not representative for behaviour in a situation where migration had not taken place and that culture could have a larger or smaller impact than what is indicated by our estimates. However, if men and women from the same source country are affected in the same way by shocks after migration, the estimates will still be accurate. If the impacts of shocks differ both by gender and by the size of the gender gap in the source country, it is

⁸ Fernández (2007) argues that studying second-generation immigrants would imply that culture is less likely to be wrongly estimated because of shocks, since second-generation immigrants are not affected by having immigrated themselves. A drawback is however that the impact of culture might weaken over generations. With the estimation approach in this study there are no or few second-generation immigrants for a large share of the source countries, so studying the second generation is not feasible.

possible that our estimates are upward or downward biased. The impact of culture will be overestimated only if among immigrants from source countries with high (low) gender gaps, women's participation rates or earnings are more negatively (positively) affected by migration shocks than men's.

Furthermore, it is important to keep in mind that other factors influencing both the gender gap in the source country and behaviour on the Swedish labour market cannot be entirely ruled out. For instance, educational differences between men and women in the source country probably affect the gender gap in the source country and are at the same time important for preparedness for the Swedish labour market. By including source country control variables in equation [2] we control for such possible differences across source countries. Apart from controlling for gender gaps in educational attainment in the source country, we also include GDP per capita, to rule out that we capture differences in development, and in geographical distance to Sweden, to test whether we capture geographical rather than cultural differences.

As a robustness test, equation [2] will be estimated also by generalised least squares (GLS). In these estimations we will, instead of pooling across years, estimate yearly regressions with OLS and GLS, since this simplifies the calculation of the weighting matrix for the GLS. This implies that we estimate for each year and cohort a regression with $\hat{\beta}_{5j}^*$ as the dependent variable and including S as the sole independent variable. The reason for using GLS is to take into account that the dependent variable ($\hat{\beta}_{5jt}^*$) is estimated, which results in heteroscedastic disturbance terms (for details see: Borjas, 1987; Borjas and Sueyoshi, 1994). For further details on the GLS estimations please see Appendix B.

In addition, we will calculate the weighted standard deviation (WSD) using the $\hat{\beta}_{5jt}^*$ obtained from equation [1]. This measure is a summary statistic for the total variation in the gender gaps for cohort-immigrant groups in Sweden and we calculate it separately for each year. Comparing the WSDs obtained when equation [1] is altered among our three specifications provides information on whether the additional variables included explain part of the total variation in gender gaps across cohort-immigrant group and whether there remains an

unexplained part that might be related to culture.⁹ The WSD is calculated by the following formula:

$$WSD(\beta_{5t}^*) = \sqrt{\frac{1}{J} \sum_{j=1}^J (\hat{\beta}_{5jt}^*)^2 - \frac{1}{J} \text{tr}(V^*)} \quad [3]$$

where $\hat{\beta}_{5jt}^*$ are the deviations from the mean in the $\hat{\beta}_{5jt}$ estimated in equation [1] and $\text{tr}(V^*)$ is the trace of the variance-covariance matrix for the $\hat{\beta}_{5jt}^*$ s.

6.2 Assimilation of gender gaps

To study whether gender gaps among immigrants tend to assimilate towards the corresponding gender gap among the native population, we estimate the following equation separately for each year between 1990 and 2007 for all native-born individuals in Sweden:

$$L_n = \gamma_0 + \gamma_1 X_n + \gamma_2 M_n + \gamma_3 X_n M_n + \epsilon_n \quad [4]$$

where n indexes native individual and L , X and M are defined similarly as above. Then we calculate the relation between a cohort's gender gap and the native gender gap, using the estimated coefficients from equation [1] and [4]. The average deviation from the native gender gap for a specific cohort is defined as:

$$\overline{dgap_{ct}} = \frac{\sum_{j=1}^J [\hat{\beta}_{2cjt} + \hat{\beta}_{3cjt} + \hat{\beta}_{5cjt}]}{J} - [\hat{\gamma}_{2ny} + \hat{\gamma}_{3ny}] \quad [5]$$

while the deviation from the native gap for a specific immigrant group within a cohort is defined as:

$$dgap_{cjt} = [\hat{\beta}_{2cjt} + \hat{\beta}_{3cjt} + \hat{\beta}_{5cjt}] - [\hat{\gamma}_{2ny} + \hat{\gamma}_{3ny}] \quad [6]$$

where c refers to cohort, j indexes immigrant group, t indexes years since migration and y is the calendar year of observation and the omitted immigrant group in equation [1] above is assigned a value of 0 for the $\hat{\beta}_{5cjt}$ coefficient in the calculations. Our procedure is in line with

⁹ This method is used by Ancontol (2000) for gaps in LFPR within immigrant groups in the United States. For a detailed discussion on the WSD see Krueger and Summers (1988) and Haisken-DeNew and Schmidt (1997).

the previous assimilation literature (e.g. Borjas, 1985) and implies that we assume that time trends are similar for natives and immigrants, this in order to make it possible to identify differences across cohorts and years since immigration simultaneously.

7. Results

7.1 Culture and gender gaps in labour market outcomes

7.1.1 Baseline results

The descriptive results presented in Tables 2 and 3 showed a variation in gender gaps in labour market outcomes across different immigrant groups in Sweden. This variation might be explained by differences in individual characteristics. In order to ascertain whether this is true in our sample, WSDs were calculated from regressions without controlling for individual characteristics (raw) and from regressions using specifications 1 and 2. WSDs were calculated separately for each year and in Table 4 we display the average for all years for each cohort. In addition, in the last column, we display WSDs calculated for gender gaps only within immigrant groups, i.e. not distinguishing between cohorts. The results for the WSDs for earnings and LFPRs in Table 4 indicate a variation in the gender gaps across immigrant groups and that this variation is still present when controlling for individual characteristics. The changes in the WSDs are marginal across specification, but seem to be affected most by adding the control variables that are possibly related to culture in specification 2. For earnings, the WSDs actually increase when using specification 2 (i.e. the variation in earnings gaps across immigrant groups increases). For LFPR, in the richest specification 2 still between 74 and 88 percent of the original variation remains. This pattern supports the idea of a variation in the gender gap across immigrant groups, which is not explained by individual characteristics and is potentially related to culture.

Table 4: Weighted standard deviations for within cohort-immigrant group gender gaps in earnings and LFPR

	Cohort 1970-1979		Cohort 1980-1989		Cohort 1990-1999		All	
	Earnings	LFPR	Earnings	LFPR	Earnings	LFPR	Earnings	LFPR
Unadjusted, raw	10.35	6.73	10.99	8.32	9.33	10.59	17.25	9.14
Adjusted, specification 1	10.18	6.53	10.02	8.04	9.10	10.40	17.40	8.58
Adjusted, specification 2	10.68	5.95	11.51	6.57	11.54	8.19	19.24	6.75
Number of years	10	10	18	18	8	8	18	18
Number of immigrant groups*	19	19	24	24	25	25	25	25

*Notes:** Afghanistan, Ethiopia, Russia and Somalia have too few individuals in cohort 1970-1979 to allow for precise calculations of gender gaps and the same holds for Russia in cohort 1980-1989.

In order to determine whether the variation in gender gaps in labour market outcomes across immigrant groups in Sweden can be explained by differences in cultural norms from their source countries, we estimate equation [2]. As mentioned above, we cannot use all 25 immigrant groups because we lack some data about source country variables. The bottom lines in Tables 5 and 6 report how many immigrant groups we are able to use for each outcome and cohort; Tables 2 and 3 report which immigrant groups have missing information on source country variables. For earnings, it is unfortunate that the number of observations is low for the 1970s and 1980s cohort. We will deal with these missing values at length in the sensitivity analysis in section 7.2.

Table 5 displays the results from estimation of equation [2] for gender gaps LFPR. The results for LFPR are generally very similar across cohorts. There appears to be a positive association between gender gaps in LFPR in the source country at point of migration and gender gaps in LFPR in Sweden within cohort-immigrant groups. For the 1970s cohort, the coefficient for the gender gap in the source country in LFPR is not robust to the inclusion of the interaction term between YSM and the gender gap. In contrast, for the 1980s and 1990s cohort the positive coefficient for the gender gap in the source country remains both when the interaction term and when source country control variables are included.

Table 5: The impact of gender gap in the source country in LFPR on within cohort-immigrant group gender gaps in LFPR

Table 5. The impact of gender gap in the source country in LFPR on within country-migrant group gender gaps in LFPR												
VARIABLES	Cohort 1970-1979			Cohort 1980-1989			Cohort 1990-1999			All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Gender gap in LFPR	0.1596*** (0.0245)	0.1134 (0.1951)	0.1253 (0.1847)	0.2405*** (0.0129)	0.3860*** (0.0482)	0.4133*** (0.0490)	0.3134*** (0.0237)	0.2681* (0.1499)	0.2586* (0.1466)	0.2646*** (0.0159)	0.2831*** (0.0305)	0.2983*** (0.0356)
Years since migration	0.0006 (0.0017)	0.0006 (0.0017)	0.0006 (0.0016)	-0.0005 (0.0006)	-0.0003 (0.0006)	-0.0003 (0.0006)	-0.0004 (0.0023)	-0.0004 (0.0023)	-0.0004 (0.0022)	0.0018*** (0.0006)	0.0025** (0.0010)	0.0025** (0.0010)
Gender gap in LFPR*		0.0019 (0.0080)	0.0019 (0.0076)		-0.0079*** (0.0024)	-0.0079*** (0.0023)		0.0034 (0.0108)	0.0034 (0.0105)		-0.0022 (0.0031)	-0.0022 (0.0030)
Years since migration												
GDP per capita			0.0006 (0.0031)			-0.0019*** (0.0006)			-0.0025*** (0.0005)			-0.0013*** (0.0004)
Distance to Sweden			-0.0062*** (0.0017)			-0.0027*** (0.0009)			-0.0067*** (0.0018)			-0.0035*** (0.0011)
Gender gap in school enrolment			-0.0223 (0.0155)			0.0503*** (0.0137)			0.0208 (0.0268)			0.0379*** (0.0146)
R-squared	0.199	0.199	0.287	0.484	0.498	0.520	0.534	0.535	0.584	0.431	0.432	0.451
Number of observations	190	190	190	432	432	432	200	200	200	450	450	450
Number of years	10	10	10	18	18	18	8	8	8	18	18	18
Number of immigrant groups	19	19	19	24	24	24	25	25	25	25	25	25
Notes: GDP per capita in current 2015 US dollars. Distance to Sweden in kilometres. Gender gap in school enrolment for primary school *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses.												

Notes: GDP per capita in current 2015 US dollars. Distance to Sweden in kilometres. Gender gap in school enrolment for primary school *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses.

In other words, an increase in the gender gap in the source country in LFPR with 10 percentage points implies an increase in the within cohort-immigrant group gender gap in LFPR of between two and four percentage points in columns 4 to 12. For the 1980s cohort, this corresponds to an increase of 0.1 percentage points in the within cohort-immigrant group gap from a one standard deviation increase in the source country gap (column 5). The coefficient for the interaction between source country gap and YSM is statistically significant only for the 1980s cohort. It appears that the positive correlation between gender gap in the source country in LFPR and within immigrant group gender gaps in LFPR is decreasing as time since migration increases, for immigrants who arrived to Sweden during the 1980s. It is noteworthy that the 1980s cohort is the cohort observed for the longest time period (18 years) and it is possible that the other cohorts were not observed for a long enough time in order to conclude whether or not the influence of culture changes with length of residence in Sweden.

In Table 6 the analogous estimates for gender gaps in earnings are displayed. The three first columns show the estimations for the 1970s cohort. From the first two columns it appears that there is a negative and statistically significant association between the gender gap in the source country in earnings and the gender gap in earnings in Sweden within these immigrant groups. However, the coefficient increases substantially when source country controls are included in column three and is no longer statistically significant. Furthermore, columns 3 to 5 display the results for the 1980s cohort. The coefficient for the source country gap is negative and statistically significant in column 4, but increases and becomes insignificant when the interaction term is included in column 5 and the source country controls are added in column 6. Moreover, the results for the 1990s are displayed in columns 7 to 9. For this cohort we find no statistically significant association between source country gaps and corresponding gaps in Sweden in the first two specifications. Including source country controls in column 9 increase the coefficient for the gender gap somewhat and it is positive and statically significant at the 10 per cent level. Finally, the three last columns of Table 5 display the results for estimations of all cohorts jointly, and there appear to be no statistically significant results regardless of specification.

Table 6: The impact of gender gap in the source country in earnings on within cohort-immigrant group gender gaps in earnings

VARIABLES	Cohort 1970-1979			Cohort 1980-1989			Cohort 1990-1999			All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Gender gap in earnings	-0.4158*** (0.0517)	-0.8607* (0.4403)	0.0246 (0.4562)	-0.1660*** (0.0563)	0.1224 (0.2223)	0.1283 (0.2139)	0.0265 (0.0836)	0.6199 (0.5546)	0.7870* (0.4078)	-0.0434 (0.0693)	-0.1248 (0.1685)	-0.0497 (0.1486)
Years since migration	-0.0053* (0.0032)	-0.0054* (0.0032)	-0.0054** (0.0026)	-0.0036** (0.0015)	-0.0037** (0.0015)	-0.0037** (0.0015)	-0.0005 (0.0040)	-0.0005 (0.0040)	-0.0005 (0.0032)	0.0089*** (0.0021)	0.0064* (0.0033)	0.0064** (0.0027)
Gender gap in earnings*		0.0182 (0.0174)	0.0182 (0.0185)		-0.0156 (0.0110)	-0.0156 (0.0105)		-0.0440 (0.0384)	-0.0440 (0.0281)		0.0096 (0.0143)	0.0096 (0.0120)
Years since migration												
GDP per capita			0.0311*** (0.0076)			0.0065*** (0.0014)			0.0016** (0.0008)			0.0020 (0.0012)
Distance to Sweden			-0.0114*** (0.0024)			0.0008 (0.0017)			-0.0166*** (0.0023)			-0.0128*** (0.0035)
Gender gap in school enrolment			-0.2831*** (0.0465)			-0.0532 (0.0442)			0.1291*** (0.0315)			0.1140*** (0.0396)
R-squared	0.322	0.327	0.591	0.071	0.081	0.143	0.001	0.009	0.389	0.047	0.048	0.143
Number of observations	90	90	90	198	198	198	168	168	168	414	414	414
Number of years	10	10	10	18	18	18	8	8	8	18	18	18
Number of immigrant groups	9	9	9	11	11	11	21	21	21	23	23	23

Notes: GDP per capita in current 2015 US dollars. Distance to Sweden in kilometres. Gender gap in school enrolment for primary school. *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses.

7.1.2 Sensitivity checks

We have performed sensitivity tests to check the robustness of our results.¹⁰ To start with, in order to take into account that our model might contain heteroskedasticity, we rerun equation [2] using GLS (for more details on the calculation of the weighting matrix see Appendix B). The coefficients for the gender gap in the source country are very similar in the GLS and OLS, while the standard errors in the GLS are in general lower than when applying OLS. Testing for equality of the coefficients from OLS and GLS regressions show that we cannot reject the null that the coefficients are equal in all cases, implying that we can conclude that OLS and GLS produces quite similar results.¹¹ Thus, possible heteroskedasticity seems to be of minor concern in our estimations.

In Table 4, the WSD estimates showed that the variation in the gender gaps across cohort-immigrant groups changes somewhat across our three specifications. Therefore we estimate equation [2] and [3] using specification 2 instead (i.e. with the inclusion of possible endogenous control variables). For LFPR this has no implications for our estimates, but for earnings the coefficient for the source country gap is now significant only for the 1970s cohort.

Furthermore, in order to make better comparisons of the results across cohorts and investigate whether the results are sensitive to which countries are included, regressions are estimated including only immigrant groups which have no missing information for all periods. This procedure does not change the main conclusions drawn from our results. Moreover, to decrease the number of missing values, equation [2] is specified using the gender gap in the source country calculated for the year 2000 (for which the most data are available). The results for LFPR are robust to this change, with the exception of the first cohort for which the coefficient estimate for the source country gap decreases somewhat. Similarly, for earnings the main change is that the estimate for the 1970s cohort changes and is no longer statistically significant. This supports our belief that it is important to measure culture before or close to when immigration took place, since culture might change with the passage of time.

¹⁰ All regression results from the robustness checks are available from the author upon request.

¹¹ Z-tests were calculated to test equality of OLS and GLS coefficients. Note that the z value is calculated as,

$$z = \frac{b_{ols} - b_{gls}}{\sqrt{SE_{b_{ols}}^2 + SE_{b_{gls}}^2}}.$$

In addition, we have studied whether the impact of culture differs depending on the reasons for immigration. In other words, we wanted to see if the results would be different for countries whose immigrants were most likely to be refugees. If selection into migration constitutes a problem, we should expect refugee migration to be less likely to be selective than, for instance, migration due to work or studies. We study this only for the 1990s cohort, because the inflow of refugees peaked after 1990. We define source countries as refugee countries if the more than 50 per cent of immigrants arriving during the period migrated for humanitarian or security reasons.¹² We do not find any statistically significant differences in the impact of the gender gap in the source country on gender gaps in LFPR or earnings between refugee countries and the other source countries.

A problem with our data for earnings is that in most cases earnings are measured as daily or monthly wages in the source countries, but in Sweden it is measured as yearly income. It is possible that potential measurement error biases the results for gender gaps in earnings. Therefore, we run all regressions using Swedish data for monthly wages, which is available for a subsample of individuals in our total sample.¹³ This has little effect on our results and the conclusions drawn; for the first two cohorts we find a negative association between source country gap and gaps within immigrant groups in Sweden, do not change. Still, it is possible that other measurement problems, like variation across countries in how data are collected and reported, bias our results.

Finally, we have tried to investigate whether selection into labour market participation is a major concern in the earnings estimations. If there is selection into labour market participation it is possible that this is more severe for female immigrants from countries with strong gender norms (i.e. large gender gaps in earnings imply a low probability of women working and thus only the most able, high-earning women work). Such a selection bias would lead to a downward bias of the coefficient for the gender gap in the source country. Following Card and Payne (2002), we control for selection by adding a control function for the fraction of women participating in labour market work in each immigrant group and year. This function

¹² In the data we have information on reasons for migration, divided in the following categories: work, family unification, humanitarian grounds, security needs, studies, and other. About 13 per cent of the observation has missing information on why an individual migrated. The following countries are defined as refugee-countries: Afghanistan, Ethiopia, Former Yugoslavia, Iran, Iraq, Lebanon, Somalia, and Syria.

¹³ We do not make use of the wage data in the main analysis because the sample sizes at immigrant group level get small and we cannot use as many source countries as in the main analysis.

is the Inverse Mills Ratio of the fraction of women participating.¹⁴ The results from the selection regressions point at problems with selection bias for the 1980s cohort. In particular, the estimate for the gender gap in the source country becomes smaller and the coefficient for the included selection term (fraction of women participating by immigrant group and year) is positive and statistically significant for the 1980s cohort. The interpretation of the positive selection coefficient is that immigrant groups with high (low) participation rates of women tend to have large (small) gender gaps in earnings. A plausible explanation for this pattern is that in groups with low female participation rates, only the most able women work and thus women in this group tend to have high earnings (also relative to men). In contrast, in high participation groups almost all women work, including those with lower incomes.

7.2 Assimilation of gender gaps

The regression results provide some evidence that culture is important and that the importance of the culture of the source country decreases as time in Sweden increases. However, it might be more relevant to investigate whether changes occur in relation to natives rather than in relation to the average gap among immigrants. We proceed by estimating equation [4] and calculating gender gaps as specified in equation [5] and [6]. Below we display figures showing the relation between a cohort's mean gender gap, calculated as a deviation from the native gender gap, and years since migration. We display figures using two different specifications for calculations of the gender gaps: the raw gaps calculated without controlling for any individual characteristics and the adjusted gaps calculated controlling for year of arrival, age and residence in metropolitan area. An important factor to keep in mind is that our estimates do not take into account how the assimilation profiles are affected by return migration. If return migration is selective and if the selection differs for men and women from the same source country, this can overstate or underestimate the degree of assimilation. The degree of assimilation will be overestimated if immigrant women from a particular source country with low earnings tend to move back to their country of origin, while among immigrant men from the same source country those with average or high earnings are most likely to move. The same reasoning holds for LFPR. In a similar fashion, assimilation would be underestimated if return migrants are more positively selected among women than among

¹⁴ The control function $-h(\pi_{jt})$, where π_{jt} is the fraction of women participating in each immigrant group in a specific year, is specified as the Inverse Mills Ratio: $\lambda(\pi_{jt}) = \frac{\phi(\pi_{jt})}{\Phi(\pi_{jt})}$. The minus in front of h is added since it simplifies interpretation of the selection term.

men from the same source country. Unfortunately, our data do not contain information on return migration.

7.2.1 Assimilation patterns across cohorts

In figure 1 the gender gaps in LFPR are displayed separately for each cohort and the native gap is indicated by a horizontal line at 0. We do not observe all cohorts at the same point in time (years since migration), but we are able to make comparisons between two cohorts for almost the whole period. It is clear from the patterns of the raw gaps that the two most recently arrived cohorts assimilate towards the native gap. Starting at a gap in LFPR that is about 7 percentage points higher than the gender gap among natives, the distance to the native gap starts to decrease as time spent in Sweden increases. The 1980s cohort reaches the native level after about 14 years in Sweden, but we do not observe the 1990s cohort for a long enough time to conclude on when/if it reaches the native level. For the 1970s cohort, it appears that the raw gender gap in LFPR reaches the native gap earlier than for the 1980s cohort: about 11 years after migration.

The adjusted gaps show a similar pattern as the raw gaps, with some differences. First, the adjusted gaps show larger differences between immigrants and natives. The 1980s and 1990s cohort start at a higher value, a gap corresponding to an about 15 percentage points larger gap than among natives. In addition the catch up of the 1980s cohort takes place earlier and gaps eventually fall below the native level. The same holds for the 1970s cohort, for which the gaps are between 20 and 30 percentage points below the native gender gaps. The large deviation from the native gap for the 1970s cohort is due to the fact that immigrant women have higher adjusted LFPRs than immigrant men in this cohort and thus the average gender gap for immigrants in the 1970s cohort is negative.

Figure 2 displays the gender gaps in earnings for the three immigrant cohorts, expressed as deviations from the native gender gap in earnings. It appears that the raw gender gap in earnings is lower for immigrants than for natives, regardless of which cohort we consider. For the 1980s cohort the gender gap increases towards the native level, whereas for the other two cohorts it is less clear. As regards the adjusted gaps, the 1990s cohort has larger gender gaps in earnings in comparison to natives when we adjust for age and place of residence. The pattern that the gaps for the 1980s cohort increase towards the native level is even clearer in

the adjusted gaps, whereas the 1970s cohort's gap tend to shrink even further below the native gender gap.

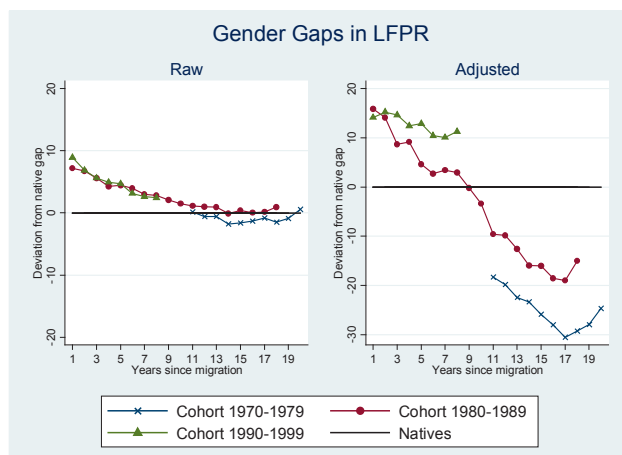


Figure 1: Assimilation in LFPR gender gaps across cohorts
Notes: Gender gaps are displayed as deviation from the native gender gap. 'Raw' refers to a specification without controls and 'Adjusted' includes eight dummy variables for year of arrival, a quartic in age and a dummy indicating residence in any of the three largest cities.

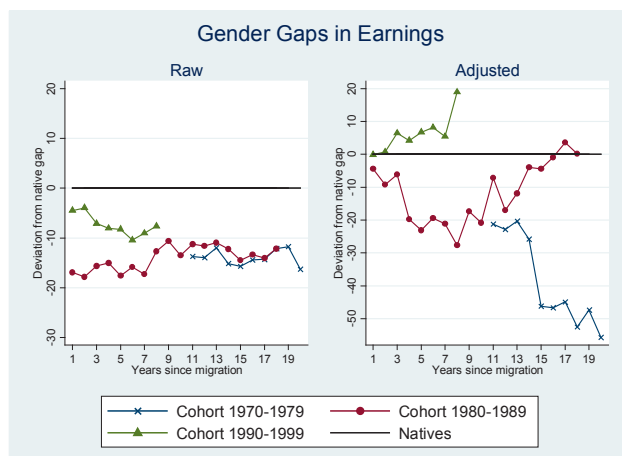


Figure 2: Assimilation in earnings gender gaps across cohorts
Notes: See Figure 1.

7.2.2 Cultural assimilation

So far, we have considered only assimilation patterns across our three cohorts and not in relation to culture. However, our main objective is to study the role of culture and therefore we will attempt to study cultural assimilation also. We investigate the development of within-group gender gaps relative natives for all immigrant groups in the cohort arriving in the

1980s, by subdividing them into four percentile groups based on their value of the gender gap in the source country in 1980. In other words, we want to see whether assimilation patterns appear to be related to disparities in the source country.

Figure 3 shows raw and adjusted gender gaps in LFPR for the four percentile groups separately. Both the raw and adjusted gender gaps in LFPR become more similar across immigrant groups as time in Sweden increases. The immigrant groups with the largest gaps in the source country start nearly 20 percentage points above the native gender gap, but after 18 years in Sweden the difference has decreased to less than 10 percentage points. A similar pattern can be seen for immigrants belonging to the third percentile, with the main difference being that they deviate only by about 10 percentage points from the native gender gap at arrival. Furthermore, it appears that immigrants from countries with small source country gaps tend to have gender gaps in LFPR that are similar to or slightly lower than those of natives.

As regards the adjusted gaps, it emerges that all groups start above the native gender gap in LFPR, reach the native level and finally shrink below it. For percentile one the catch up takes place after about three years, while this happens after five years for percentile two and after ten years for the two highest percentiles. That the immigrant gender gaps in LFPR shrink below the native gap is driven by immigrant women increasing their participation rates as time in Sweden increases.¹⁵ Overall, it appears that a strong culture against participation of women on the labour market is a likely explanation for the initial deviation from the native gender gap in LFPR. However this impact seems to decrease with the passage of time in Sweden.

Figure 4 displays the corresponding figures for raw and adjusted gender gaps in earnings. In comparison to gaps in LFPR, it appears that gender gaps in earnings do not approach the native level. Furthermore it appears that immigrants from countries with large gender disparities in earnings do not experience the largest gaps in Sweden at arrival, as evidenced by the finding that percentile three deviates most from the native gap while the other three percentile groups are quite similar. The adjusted gender gaps follow a u-shaped pattern in

¹⁵ Assimilation profiles separately by gender are available from the author upon request.

relation to native gender gaps, which indicates that factors other than source country gaps are a likely explanation.

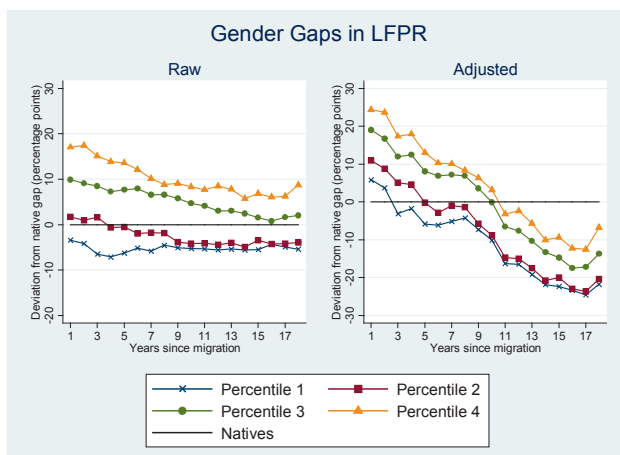


Figure 3: Cultural assimilation in gender gaps in LFPR

Notes: See figure 1. Includes only 1980s cohort. Percentiles are based on the gender gap in the source country in LFPR in 1980. Percentile 1: China, Denmark, Finland, Poland and Romania. Percentile 2: Ethiopia, Hungary, Iceland, Norway, Thailand and the United States. Percentile 3: Chile, Germany, Somalia, Turkey, United Kingdom, Yugoslavia. Percentile 4: Afghanistan Greece, India, Iran, Iraq, Lebanon and Syria.

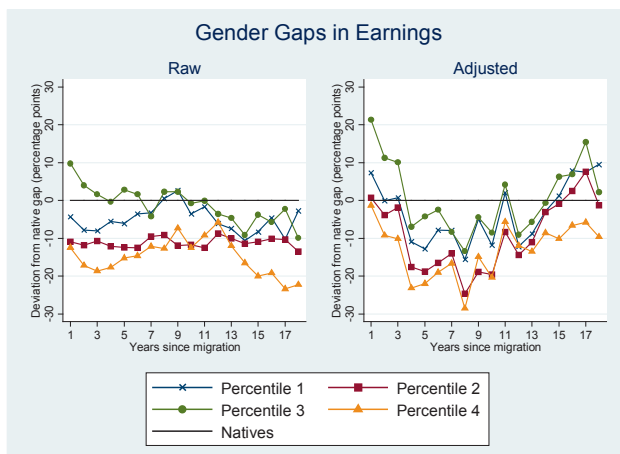


Figure 4: Cultural assimilation in gender gaps in earnings

Notes: See figure 1. Includes only 1980s cohort. Percentiles are based on the gender gap in the source country in earnings in 1980. Percentile 1: Denmark, India and Turkey. Percentile 2: Finland, Norway and Poland. Percentile 3: Russia, UK and Germany. Percentile 4: Chile, Greece and US.

8. Conclusions

The fact that men tend to participate in labour market work in larger numbers and to earn more than women has attracted the attention of researchers, policy makers and media. Several

explanations, such as discrimination, institutional setting, attitudes and social norms, have been posited in the literature as reasons for why the persistence of gender gaps in labour market outcomes. This paper investigates the role of one of these possible explanations -- culture -- which is the totality of differences in social norms, values, attitudes and beliefs about gender across groups with different cultural backgrounds. It investigates whether gender gaps in LFPR and earnings within cohort-immigrant groups in Sweden are explained by gender gap in the source country in these outcomes.

Our results show that gender gap in the source country in LFPR are positively associated with gender gap in LFPR within cohort-immigrant groups in Sweden and this result is robust to a number of robustness tests. In short, a widening of the gender gap in the source country in LFPR with 10 percentage points implies an increase in the within cohort-immigrant group gender gap in LFPR of between 2 and 4 percentage points. For the 1980s cohort, this corresponds to an increase of 0.1 percentage points in the within cohort-immigrant group gap from a one standard deviation increase in the source country gap. A reasonable interpretation of this result is that gender gaps in LFPR are affected by cultural differences in norms and attitudes about gender roles, and these differences are transferred across countries. Exposed to the same institutional setting and labour market conditions, the behaviour of immigrant men and women in Sweden follows the patterns in their source countries. These findings point in the same direction as have previous studies for the United States. In comparison to the United States, the Swedish system with its generous parental leave and subsidized child-care give women a relatively strong incentive to work. Still, in Sweden, culture is strong enough to affect the labour force participation of immigrant women and men in a similar fashion as in the United States.

As regards the time dynamics of culture, we find that the influence of culture on gender gaps is not constant over time. As time in Sweden increases, the more similar the gender gap in LFPR among all immigrant groups will be to the corresponding gender gap among natives. Assimilation patterns are clearest for immigrant groups that have large source country gaps, given that they start up to 20 percentage points above the native gender gap and after 18 years in Sweden they deviate by less than 10 percentage points. When adjusting for individual characteristics the gender gap within all immigrant groups reaches and eventually falls below the gap among natives. Blau, Kahn and Papps (2011) find that upon arrival, immigrant women in the United States work less than native women. In addition, immigrant women

originating from countries with a large gender gap in LFPR tend to deviate most from native women. Over time, women from countries with small gender gaps in LFPR catch up with natives, whereas women from countries with large gender disparities in LFPR do not. Even though their study differs from ours in some aspects, our results are consistent with theirs. However, we find that regardless of the strength of the gender norms in the source country, the within cohort-immigrant gender gap falls below the native gender gap, and this is driven by our observation that immigrant women increasing their labour participation. In that sense, cultural assimilation appears to be stronger in Sweden than in the United States.

Furthermore, as regards gender gaps in earnings, we find that a large gender gap in earnings in an immigrant group's source country appears to result in a lower gender gap within this particular immigrant group relative other immigrant groups on the Swedish labour market. However, the results are not robust to the inclusion of source country control variables and the results from the selection regressions point at problems with selection bias. The coefficient for the source country gap seems to capture that on average, immigrant women originating from countries with large gender disparities in earnings are less likely to work and, thus, those who do work have high earnings relative to men.

We conclude that culture appears to be one of many possible explanations for the prevalence of gender gaps in LFPR among immigrants in Sweden. However, the influence of culture on immigrant men's and women's labour market behaviour appears to decrease with their length of time in their new host country, Sweden. With the Swedish institutional setting in mind, it seems likely that the number of institutions encouraging female labour force participation, such as child care and parental leave system, helps to bring down cultural barriers, especially since cultural assimilation appears to be stronger in Sweden than in the United States, a country characterised by less generous public child-care and parental leave opportunities than those available in Sweden. In order to conclude with certainty whether or not Sweden's institutional setting is a driving force for cultural assimilation, more research on other countries with different institutions and at other levels of economic development is needed. Finally, it would be fruitful for future research to focus more on exploring these interactions between culture and institutions and on how they evolve over time, in order to make more precise policy recommendations aimed at increasing gender equality.

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Appendix A

Table A1: Number of yearly observations by cohort-immigrant group, average over years

	Number of observations		
	Cohort 1970s	Cohort 1980s	Cohort 1990s
Afghanistan		123	587
Chile	1,797	5,782	1,662
China	178	612	1454
Denmark	2,905	2,028	1,678
Ethiopia	281	1,688	1,809
Finland	24,604	9,153	5,112
Former Yugoslavia	4,172	2,622	31,304
Germany	1,431	1,250	1,967
Greece	1,332	752	549
Hungary	1,319	1,180	535
Iceland	286	533	476
India	456	580	614
Iran	798	8,972	4,916
Iraq	167	2,236	8,194
Lebanon	329	1,771	1,993
Norway	2,497	3,489	2,790
Poland	4,361	6,011	3,488
Romania	246	2,014	1,795
Russia			1,606
Somalia		181	2,235
Syria	366	1,166	1,982
Thailand	302	940	2,226
Turkey	1,992	2,743	2,872
UK	1,481	1,595	1,975
US	580	963	1,343
<i>Total</i>	<i>51,877</i>	<i>58,384</i>	<i>85,159</i>

Notes: Cohort 1970s average over years 1990-1999, cohort 1980s average for years 1990-2007 and cohort 1990s average for years 2000-2007.

Table A2: Source country data

	LFPR	Earnings
Afghanistan	1990 ages 15-64 World Bank	2002/2003 daily wage in handicraft Maletta (2008)
Chile	1970, 1980, 1990 ages 25-54 ILO	1969, 1981, 1993 hourly wage Contreras et al. (2005)
China	1982, 1990 ages 15-64 World Bank	1990 annual earnings Zhang et al. (2008)
Denmark	1970, 1979/1981, 1990 ages 25-54 ILO	1970, 1980, 1990 hourly wage in manufacturing ILO
Ethiopia	1977, 1980, 1990 ages 25-54 or 15-64 ILO and World Bank	1990 Appleton et al. (1999)
Finland	1970, 1980, 1990 ages 25-54 ILO	1970, 1980, 1990 hourly or monthly wage in manufacturing ILO
Former Yugoslavia	1971, 1981, 1990 ages 25-49 ILO	1995 monthly wage in manufacturing ILO
Germany	1970, 1980, 1990 ages 25-54 ILO	1970, 1980, 1990 hourly wage in manufacturing ILO
Greece	1971, 1981, 1992 ages 25-54 or 25-64 ILO	1970, 1980, 1990 hourly wage in manufacturing ILO
Hungary	1970, 1980, 1990 ages 25-54 ILO	1986/1992 monthly wage In manufacturing or all industries ILO and Jolliffe and Campos (2005)
Iceland	1975, 1979/1981, 1990 ages 25-54 or 15-64 ILO and World Bank	1990 monthly wage in manufacturing ILO
India	1971, 1981, 1991 ages 15-64 or total population World Bank and Acharya (1996)	1965/1974, 1983, 1988/1993 Monthly or weekly wage in manufacturing ILO and Menon and Van der Muelen Rodgers (2009)
Iran	1972, 1976/1986, 1991 ages 25-54 ILO	1995 monthly wage in manufacturing ILO
Iraq	1977, 1990 ages 25-54 or 15-64 ILO and World Bank	No data available

Table A2 continued

Lebanon	1975,1990 ages 25-54 or 15-64 ILO and World Bank	1995 monthly wage in manufacturing ILO
Norway	1970,1980,1990 ages 25-54 ILO	1970,1980, 1990 hourly or monthly wage in manufacturing ILO
Poland	1970,1978,1988/1995 ages 25-54 ILO	1985,1992 monthly wage Atkinson and Micklewright (1992)
Romania	1977,1992 ages 25-54 ILO	1994 monthly wage Newell and Reilly (2001)
Russia	1989/1992 ages 25-54 ILO	1980,1989/1992 Monthly wage Atkinson and Micklewright (1992) Katz (1997) Newell and Reilly (1996)
Somalia	1990 ages 25-54 or 15-64 ILO and World Bank	No data available
Syria	1970,1979,1990 ages 25-54 or 15-64 ILO and World Bank	No data available
Thailand	1970,1980,1990 ages 25-54 or 25-59 ILO	1991 monthly wage in manufacturing ILO
Turkey	1970,1980,1990 ages 25-54 ILO	1982,1990 daily wage in manufacturing ILO
UK	1971,1981,1990 ages 25-54 ILO	1970,1980, 1990 hourly wage in manufacturing ILO
US	1970,1980,1990 ages 25-54 ILO	1970,1980,1990 hourly wage Blau and Kahn (2000) US Census

Appendix B: Generalized Least Squares estimation

We follow the method proposed by Antecol (2001) for our GLS estimates. Specifying equation [2] as separate yearly regressions instead of one pooled implies that the underlying model that we aim to estimate is

$$\beta_j^* = \delta_1 h_j + v_j \quad [B1]$$

and our estimate of beta is thus

$$\hat{\beta}_j^* = \beta_j^* + e_j \quad [B2]$$

Using the first equation B1 we can rewrite our estimated beta as,

$$\hat{\beta}_j^* = \delta_1 h_j + v_j + e_j \quad [B3]$$

To correct for that, we introduce an additional error term in our estimation we employ GLS and make use of a weighting matrix sigma, specified as

$$\hat{\Omega} = Var(v) + Var(e) = \hat{\sigma}_v^2 I + \hat{V}^{2*} \quad [B4]$$

where the first term is assumed variance matrix for v and the second term is the variance-covariance matrix for the β_{5j} s estimated in our first stage main regression, equation [1] p. 18. The assumed variance matrix for v is obtained by calculating

$$\hat{\sigma}_v^2 = \frac{|\varepsilon \varepsilon' - tr(\hat{V}^{2*})|}{n} \quad [B5]$$

where the first term in the numerator is the sum of the squared residuals obtained from the second stage OLS regression, $\hat{\beta}_{5j}^* = \delta_1 h_j + e_j$, and n is the number of observations in the same second stage regression. The second term in the numerator is the trace of the variance-covariance matrix for the β_{5j} s estimated in our first stage main regression. We then weight our regression and the coefficient, δ_1 , for the gender gap in the source country and its variance. The GLS estimations are calculated as follows

$$\hat{\delta}_{1GLS} = (X'\hat{\Omega}^{-1}X)^{-1}X'\hat{\Omega}^{-1}Y \quad [B6]$$

$$Var(\hat{\delta}_{1GLS}) = s^2(X'\hat{\Omega}^{-1}X)^{-1} \quad [B7]$$

Note that \hat{V}^{2*} and, thus, by definition $\hat{\Omega}$, has the dimension $[j-1, j-1]$ while the regression of equation [A3] is performed using j groups, i.e. j number of observations. In order to get the same dimension of the weighting matrix $\hat{\Omega}$ and our X and Y matrices we instead estimate [A3] excluding the group that we omitted in our original first stage equation [1]. We express all variables as deviations from the omitted group and estimate the model without a constant. This procedure generates the same results as the original when including the omitted group and enables us to compare the OLS and GLS estimates.

IV

All About Balance? A Test of the Jack-of-all-Trades Theory Using Military Enlistment Data

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Abstract

According to the Jack-of-all-trades theory, people with a balanced set of skills are more suitable for self-employment than are those without. In this paper we test this theory using Swedish Military Enlistment data. This data enables us to construct a measure of balance in endowed abilities that, in comparison to measures used in previous research, is less contaminated by endogeneity problems. We measure balance in skills using the result from the tests of cognitive and non-cognitive ability that everyone takes at age 18 or 19. We find clear support for the Jack-of-all-trades theory, in the sense that the likelihood of being or becoming self-employed is higher for individuals whose abilities are balanced. In addition, earnings from self-employment tend to be higher among these individuals.

JEL-classification: J24; J31; L26

Keywords: Ability balance; Cognitive ability; Earnings; Jack-of-all-trades theory; Occupational choice; Non-cognitive ability; Self-employment

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1. Introduction

Researchers and policymakers alike often view self-employment as an important factor in innovation and economic growth. For decades, policies that foster self-employment have been on the agenda in several countries. Among researchers, a large body of literature has been devoted to determinants of self-employment and of self-employment success. Several studies have documented the role of family traditions (e.g. self-employed parents) and access to financial capital (Evans and Jovanovic, 1989; Lentz and Laband, 1990; Holtz-Eakin, Joulfaian and Rosen, 1994; Blanchflower and Oswald, 1998; Fairlie, 1999; Dunn and Holtz-Eakin, 2000; Hout and Rosen, 2000; Sørensen, 2007; Andersson and Hammarstedt 2010, 2011; Lindquist, Sol and Van Praag, 2015).

Besides the importance of financial capital and family traditions there are mixed evidence for how different personal characteristics influence the self-employment decision. Lazear (2005) argues that individuals with a balanced set of competencies across different fields -- Jacks-of-all-Trades -- are better suited to self-employment than those without. According to Lazear (2005), wage-employees can be specialists but self-employment requires a broad set of skills and the self-employed are only as strong as the level of their weakest skill.

This paper tests Lazear's Jack-of-all-Trades theory on data from Sweden. Are people with a balanced set of skills across several fields more likely to become self-employed than those with a less balanced set of skills? Are there differences in self-employment performance between these two groups? Previous researchers have empirically tested Lazear's Jack-of-all-Trades theory by measuring balance in skills with the help of the individual's choices of education and variety of job experience (e.g. Wagner, 2003; Lazear, 2005; Silva, 2007; Stuetzer, Obschonka and Schmitt-Rodermund, 2013). Empirical support for the Jack-of-all-Trades theory has been found by Lazear (2005), Wagner (2003), and Stuetzer, Obschonka and Schmitt-Rodermund (2013). In contrast, Silva (2007) finds that when controlling for individual time-invariant characteristics, balance in skills does not increase the likelihood of becoming self-employed. However, a measure of Jack-of-all-Trades based on education and occupational history may suffer from endogeneity and unclear causality. In short, the choice of education and occupation may be influenced by an individual's anticipated decision to become self-employed and anticipated self-employment earnings.

A solution to this endogeneity problem is to consider balance in endowed skills rather than in skills that are acquired through educational and occupational choices.¹ Hartog, Van Praag and Van der Sluis (2010) use results from five specific ability tests undertaken at between the ages of 15 and 23 to create a measure of balance in abilities. Using this measure, they found empirical support for Lazear's theory. However, a shortcoming of their measure is that ability is not measured among people of the same age and level of education. Since performance on ability tests tend to increase with age and educational level, their balance measure might be biased (e.g. Heckman, Stixrud and Urzua, 2006).

Our paper is the first to test whether endowed skill balance is important for the self-employment decision and self-employment performance. We use a measure based on data from the Swedish Military Enlistment test taken by all 18- or 19-year-old males living in Sweden. We use the balance in an individual's score across four measures of cognitive abilities and a general measure of non-cognitive ability. This measure is unlikely to be endogenous since it is not influenced by an expectation of future self-employment. In addition, age and years of schooling are very similar for the men who are taking the enlistment test. Previous literature has shown that ability measures from the Swedish Military Enlistment do not have to be adjusted for small differences in schooling or age (e.g. Nordin, 2008; Nordin and Rooth, 2009).

We focus on the self-employment decision and on self-employment performance. Our results support Lazear's Jack-of-all-Trades theory, in the sense that the likelihood of being self-employed increases with the ability balance. In addition, our results show that individuals with high cognitive and non-cognitive ability are more likely to be self-employed. Moreover, individuals with a more balanced set of skills are more likely to switch into self-employment and less likely to leave self-employment.

Furthermore, we find evidence that the Jack-of-all-Trades theory holds for performance as self-employed. Self-employment earnings, turnover, profit and number of employees tend to be higher among individuals with a more balanced skill set. The impact of a more balanced ability profile is largest in the bottom and middle of the earnings distribution. In addition, we

¹ Douhan (2009) uses an educational reform conducted in Sweden in the 1960s in order to test the Jack-of-all-Trades theory and finds that the reform decreased self-employment entry among individuals with less balanced abilities.

find that among wage-earners, skill balance is not related to earnings. This regression can be seen as placebo test for whether ability balance captures other omitted individual characteristics, which are rewarded also among the wage-employed. Furthermore, self-employment performance is positively related to both cognitive and non-cognitive skills.

The remainder of the paper is organised as follows. Section 2 describes the theoretical framework of our study. In Section 3 we present the data and some descriptive statistics. Section 4 describes the empirical model. Section 5 explains the results. Section 6 summarises and concludes the paper.

2. Theoretical framework

A large body of literature has been devoted to theoretical explanations of why individuals become self-employed. According to economic theory, the choice between self-employment and paid employment is a utility maximization problem, in which the occupation yielding the higher expected utility is chosen (e.g. Evans and Jovanovic, 1989; Holtz-Eakin, Joulfaian and Rosen, 1994). In the literature, several factors have been posited as being embedded in this choice. Important contributions point at the importance of factors such as attitude towards risk, family tradition and background, liquidity constraints and personal traits (e.g. Kihlstrom and Laffont, 1979, Evans and Jovanovic, 1989; Lentz and Laband, 1990; Holtz-Eakin, Joulfaian and Rosen, 1994; Dunn and Holtz-Eakin, 2000; Blanchflower and Oswald, 1998; Fairlie, 1999, 2002; Hout and Rosen, 2000; Andersson and Hammarstedt, 2011; Lindquist, Sol and Van Praag, 2015). However, in the literature there is no consensus on what should be included in the typical self-employment traits, or ‘entrepreneurial ability’. Even though research suggests that parents transmit a propensity for self-employment to their children, little is known about the components of this ability (e.g. Dunn and Holtz-Eakin, 2000).

What should we expect to be important parts of self-employment ability? Starting from a broad perspective, we will identify three components of this ability: cognitive skills, non-cognitive or psychological factors, and balance in abilities. We will proceed by presenting the theoretical arguments for why these abilities should matter for the self-employment decision and self-employment performance.

2.1 Cognitive ability

Cognitive ability matters for a broad set of economic outcomes (e.g. Cawley, Heckman and Vytlačil, 2001). In a similar fashion, one would expect that earnings and success among the self-employed are positively related to high cognitive ability. However, it is unclear how cognitive ability affects the decision to become self-employed. To start with, people of high ability might opt for self-employment because of the potential for higher earnings. As pointed out by Eren and Sula (2012) whether this is true will depend on how ability is rewarded for wage-earners. If cognitive ability is imperfectly signalled to potential employers or not fully rewarded by employers, it might be more beneficial for capable individuals to be self-employed. In contrast, one could argue that individuals with less cognitive ability will be more prone to become self-employed because they face difficulties on the labour market (i.e. are likely to be laid off or have problems finding a wage-earning job) (Andersson Joona and Wadensjö, 2013). Thus, it is an empirical question to determine how cognitive skills are related to the self-employment decision.

2.2 Non-cognitive ability

The literature on the role of non-cognitive ability for economic outcomes is less extensive than is the literature for cognitive ability. In addition, there is no consensus on the definition of non-cognitive ability, in the sense that it is not clear what it should capture and by which personality traits it is best measured (e.g. Heckman and Rubenstein, 2001). Still, it has been shown that personal traits such as high self-esteem and a feeling of control of one's own life have positive effects on wages and is negatively related to teenage pregnancy and smoking (e.g. Heckman, Stixrud and Urzua, 2006). However, the literature on the role of non-cognitive skills in self-employment is scarce.²

It is possible that individuals with higher non-cognitive ability are better suited for self-employment. Psychological factors such as need for achievement, internal locus of control (the belief that performance depends on own actions), willingness to take risks and, tolerance of ambiguity are arguable more common traits among the self-employed (Amit, Glosten and Mueller, 1993). If individuals behave rationally, observing these traits to a larger degree among the self-employed would imply that individuals possessing these traits are more suited for self-employment. In addition, individuals with these traits might see self-employment as a

² Notable exceptions are Uusitalo, 2001; Hartog, Van Praag, and Van der Sluis, 2010; Eren and Sula, 2012.

more attractive option. It has been shown that self-employment has many non-pecuniary benefits (e.g. Hamilton, 2000) such as greater freedom and a larger control over working conditions and outcomes.

Furthermore, Glaeser, Laibson and Sacerdote (2002) show that individuals will invest more in social capital (i.e. social networks and relations), in occupations where returns to social skills are high. Bosma, Van Praag, Thurik and De Wit (2004) argue that self-employment is one such occupation, since it requires good relations with investors, clients and subcontractors. This would imply that individuals who have invested in or are inherited with much social capital are more likely to become self-employed, since they expect to earn a higher income.

Moreover, the decision to become self-employed will be affected by the returns to non-cognitive ability in wage-employment in a similar way as for cognitive ability. Eren and Sula (2012) argue that it is more reasonable to believe that employers do not fully reward non-cognitive ability. The reason is that non-cognitive ability might be more difficult to signal to potential employers and harder to observe. Thus, it seems reasonable to expect that individuals with high non-cognitive ability are more likely to choose self-employment.

2.3 Balance in abilities

According to Lazear (2005), the self-employed are Jacks-of-all-Trades with competence in many areas. Lazear (2005) argues that owning and running one's own business requires knowledge of many business areas and the ability to evaluate and combine the competencies of others. In Lazear's model, individuals choose to either become a wage-earner, which implies specializing in one skill, or to be self-employed, which implies using a variety of skills. For wage-earners only the skill in which someone has specialized in will affect earnings; for the self-employed, all skills, even the weakest, will affect earnings. The essence of the model is that if the weakest skill is relatively high or the strongest skill is relatively low, people will choose self-employment. Lazear's model therefore predicts that people who are self-employed have a human capital investment strategy which focuses on attaining more balanced skills, unlike wage-earners who will invest in just one skill.

Lazear (2005) argues that the self-employed invest in a balanced skill set by acquiring a more diversified education and/or professional experience, holding many jobs with different

responsibilities. However, other researchers have interpreted the Jack-of-all-Trades theory differently by arguing that skill balance is something that is part of the individual's innate self-employment ability (e.g. Silva, 2007). Furthermore, it is possible that both investments in and endowments of varied skills are important for the self-employment decision and performance (e.g. Stuetzer, Obschonka and Schmitt-Rodermund, 2013). However, it could also be the case that initial endowments create a will to invest in a varied education and job profile, in the sense that anticipated suitability for self-employment creates incentives to apply such an investment strategy. Regardless of whether a more balanced ability set is a result of investments or endowments, the theoretical prediction is that individuals who are more balanced in their abilities should be more likely to be and perform better as self-employed.

3. Data, definitions and descriptive statistics

3.1 The population

Since 1944, young men's general ability and suitability for military training has been evaluated before assignment to compulsory military service in Sweden.³ In this paper we use data provided by the Swedish Military Archives (Krigsarkivet). The data contains information on all Swedes who enlisted between 1969 and 1983 (653,692 individuals). We will impose the following restrictions to our sample. First, since enlistment was not mandatory for women and very few women enlist, we exclude all women from our analysis (130 observations excluded). Second, because of the change in the enlistment test procedure in 1980 we have excluded the years 1980-1983 (166,373 observations excluded). Finally, to ensure that all men undertook the enlistment test at the same age we exclude everyone who enlisted before age 18 or after age 19 (34,094 observations excluded). This leaves us with an enlistment sample of 458,375 men.

The sample of enlisted men is merged with Swedish register data from the data base LISA for the years 1991 to 2005. As we focus on labour market outcomes, we exclude all students or people who were long-term sick. This implies that the number of individuals will vary from year to year. Table A1 in the appendix displays the number of individuals included each year. We follow the sample of enlisted men for 15 years (1991-2005), and in total we have about six million individual-year observations.

³ See Carlstedt (2000) for a description of the Swedish enlistment battery test and its evolution over time.

3.1.1 Register data

The register data is provided by Statistics Sweden and contains yearly information on demographic and labour market variables for all residents in Sweden. Based on the information in the register data we define individuals as self-employed or not self-employed. We define individuals as self-employed if they are registered as self-employed by Statistics Sweden. We include all self-employed, in both limited liability and in private firms. In order to be registered as self-employed, individuals need to have self-employment as their main activity, so their income from self-employment must be their main source of income.⁴ Included in the category of non-self-employed are the wage-employed, unemployed and inactive. We exclude students and disability pensioners from our analysis. In the analysis of the decision to become self-employed, the entire sample of self-employed and non-self-employed individuals will be used, while the analysis of performance is limited to the self-employed. Performance is measured by yearly earnings from self-employment, which includes reported earnings from self-employment and other work-related income. If an individual is classified as self-employed and has wage income, we do not include that income from wage-employment. Individuals in our sample who have very low earnings from self-employment also tend to work for wages; for this reason we will exclude individuals whose self-employment income is less than SEK 32,200 (in 1991).⁵ In addition, we analyse three other performance measures for self-employed: turnover (the company's income from sales net of discounts and taxes), profit (the company's income minus its costs, not including deductions related to interest rates and taxes) and the number of employees.⁶ Furthermore, we have chosen not to compare the earnings of self-employed and wage-earners, since it is difficult to create a comparable measure of earnings for these two groups. The self-employed in Sweden tend to bunch at earnings levels where there are jumps in the marginal tax rate and might therefore have incorrectly reported earnings (e.g. Bastani and Selin, 2014). Because of this bunching the self-employed may earn less than wage-earners. However, we will estimate a separate regression for wage-earners, which will serve as a placebo test for whether ability

⁴ For individuals with income from both wage-employment and self-employment Statistic Sweden defines self-employment as the main activity if income from wage-employment is less than 1.6 times income from self-employment. The reason is that income from self-employment is underestimated in relation to the amount of hours spent on the activity. This is based on the reported income in the month of November, which implies that the total yearly earnings from wage-employment can be more than 1.6 times larger than earnings from self-employment for individuals classified as self-employed.

⁵ This corresponds to one price basic amount (PBA). The PBA is a measure which is adjusted for the overall inflation level and it amounted to Swedish Kronor (SEK) 32,200 in 1991 and SEK 39,400 in 2005 (SEK 1 ≈ USD 0.13 in 2005).

⁶ A drawback with using these performance measures is that they are only included in the data after 1998.

balance captures something else, which has an impact on earnings among those who are not self-employed.

3.1.2 Enlistment data

The battery of tests carried out at the Swedish military enlistment includes evaluations of cognitive and non-cognitive ability, medical status and physical fitness. In this paper we use scores from the cognitive and non-cognitive ability tests. Enlistment was mandatory for all men in Sweden until 2007, and the majority took the test at age 18 or 19. About 93 per cent enlisted at age 18 or 19 in our sample and the share not enlisting at all is about 10 per cent in the period under consideration. In contrast to similar ability tests used earlier in economic literature, an advantage of our enlistment test is that the men taking the test are the same age and have the same amount of education. This implies that our ability measures do not have to be adjusted to accommodate differences in schooling or age. The small variations in schooling and age among men in the Swedish enlistment data do not seem to create endogeneity problems (e.g. Nordin, 2008; Nordin and Rooth, 2009).

The men included in our sample have taken the Swedish Enlistment Battery 67 (SEB67) test, a version which was in use until 1979.⁷ In Table 1 the SEB67 tests are presented alongside the measure we will use for balance in abilities, which is constructed from the scores on the various tests. The part measures cognitive ability in instructions, concept discrimination, paper form board and technical comprehension. In instructions, the task is to find the answer that fulfils some stated conditions and the complexity of the instructions is altered by adding distractive negations, simple numerical operations and/or conditional clauses. The instructions test is meant to measure the ability to make logical inductions. In concept discrimination, the subject's verbal ability is evaluated by answers to questions about the classification of words. The paper form board is a test of spatial visualisation ability and consists of problems where one is to decide which out of four objects will be correctly put together. Finally technical comprehension is an array of technical and physical problems. Each test consists of 25 to 52 questions and the raw test scores are transformed to a grade from 1 to 9.

An overall measure of cognitive ability is constructed from the four subtests and intended to reflect the general intelligence factor, G (for a description see Carroll, 1993). This measure

⁷ The SEB67 is described in detail in Carlstedt (2000) and Rönnlund, Carlstedt, Blomstedt, Nilsson and Weinehall (2013).

also ranges from 1 to 9 and follows a stantine scale, which approximates a normal distribution with a mean of 5 and a standard deviation of 2. Since we have imposed some restrictions upon our sample and excluded some individuals, the mean in our sample is slightly higher at 5.2.

Table 1: Description of enlistment tests and measures of balance in abilities

Test	Description	Mean	Std
<i>Cognitive ability</i>			
1. Instructions	Measures the ability to make logical inductions.	5.2	1.9
2. Concept discrimination	Measures verbal ability by questions about classification of words.	5.2	1.9
3. Paper form board	Measures spatial visualization ability by a paper form board test	5.5	1.9
4. Technical comprehension	Measures technical ability by questions about technical and physical problems.	4.8	1.9
5. General	Measures the general intelligence factor, G. Constructed by tests 1-4.	5.2	1.9
<i>Non-cognitive ability</i>			
6. General	Based on interview with psychologist. Is meant to capture social maturity, psychological energy, intensity and frequency of free-time activities and, emotional stability.	5.1	1.8
<i>Balance in abilities</i>			
7. In all abilities	Constructed by calculation of the negative value of the coefficient of variation in the individual's score on each subtest 1-4 and 6.	-0.2	0.1
8. In cognitive abilities	Constructed by calculation of the negative value of the coefficient of variation in the individual's score on each subtest 1-4.	-0.2	0.1

Apart from the test of cognitive ability, the enlistment procedure also includes a test of non-cognitive ability, based on a 20-25 minute interview with a psychologist. The psychologist is given some background information about the test taker, including his results from the cognitive and physical test taken at enlistment and a questionnaire about his friends, family, and hobbies (Lindqvist and Vestman, 2011). The main purpose of the non-cognitive test is to measure emotional stability, social skills, and ability to cope with stress. The test gives a score from 1 to 9 and builds on an evaluation of four areas: social maturity, psychological energy, intensity and frequency of free-time activities, and emotional stability (Bihagen, Nermo and Stern, 2013). From Table 1 it appears that the mean score on the non-cognitive test in our sample is 5.1 and thus somewhat higher than the mean of 5.0 for the total population of enlisted.

In order to test Lazear's Jack-of-all-Trades theory we construct a measure of balance in abilities. This measure should reward being equally strong in many abilities. In spirit of

Hartog, Van Praag and Van der Sluis (2010) we will use the coefficient of variation (CV)⁸ of the individual's test scores on the five tests, 1 to 4 and 6, listed in Table 1.

$$CV_i = \frac{\text{std}_i(\text{test1}_i, \text{test2}_i, \text{test3}_i, \text{test4}_i, \text{test6}_i)}{\text{mean}_i(\text{test1}_i, \text{test2}_i, \text{test3}_i, \text{test4}_i, \text{test6}_i)}$$

In order to simplify interpretation, we use the negative value of the CV as a measure for balance in abilities. This implies that -CV will be higher when there is less variation in a person's test scores (i.e. the more balanced a person's abilities are, and the higher his average ability). In this way we also construct a variable for the balance in cognitive abilities by calculating the CV only for tests 1 to 4. The most balanced set of abilities yields a balance equal to 0 and the most unbalanced the value -1.2 and the mean in our sample amounts to -0.2. Figure 1 shows the distributions of the constructed measures of balance in abilities and balance in cognitive abilities (negative value of the CV) for self-employed and non-self-employed individuals. All distributions are skewed to the right, meaning that few individuals are very unbalanced in their skills. There are no large differences in distributions between people who are and are not self-employed.

To give an idea of how the CV is related to different test-score profiles, we present some examples. For instance, someone who performs well on all tests by obtaining scores 8-7-8-8-6 will have a -CV of -0.11. In contrast, someone performing poorly on all tests with scores 1-2-3-2-1 earns a -CV of -0.4. Test-takers who are inconsistent in their performance have the lowest CV scores; scores of 1-9-8-2-5 yield a -CV of -0.63. Note that people who earn same score on all tests will have a standard deviation of 0 and thus a CV equal to 0. This implies that high-performing individuals (score 9 on all tests) will have the same CV as low-performing individuals (score 1 on all tests). In order to test whether this affects our results, we have estimated the regressions by omitting individuals with a CV equal to 0 (about 0.4 per cent of the sample for balance in all abilities and 1.8 per cent for balance in cognitive abilities). This did not change the results.

⁸ This is a standard measurement in psychology for measuring variations in an individual's behavior at different points in time (e.g. Fiske and Rice, 1955).

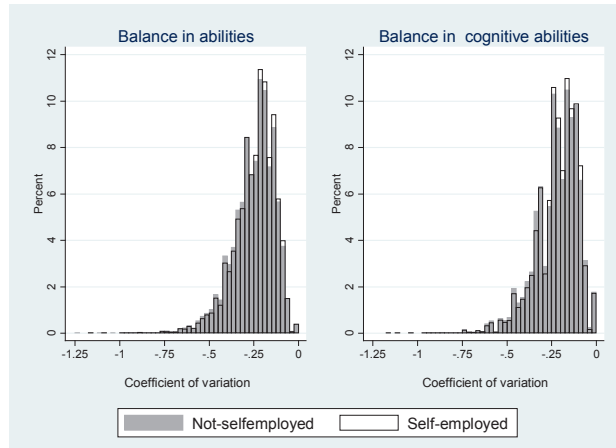


Figure 1: Distribution of measure of ability balance

Notes: Figure displays the negative values of the coefficient of variation. N=655,666 for the self-employed and N=5,592,244 for the not-self-employed.

We use the intra-individual CV as a measure of balance instead of the intra-individual standard deviation in test scores, which might be the first natural choice for a measurement of spread. The motivation for this is that the standard deviation in general tends to depend on the mean. For instance, it could be that high-performing individuals are more likely to do well on all tests; low-performing individuals will be more uneven in their test-performance, a situation which would yield a standard deviation which decreases with the mean. Using the CV is one way to solve this problem, since it adjusts the intra-individual variation by taking the individual's average performance into account.

In our analysis, we will use the test of cognitive ability, the test of non-cognitive ability, and the two constructed measures of balance in abilities. In all cases we create a variable that is the standardized value (mean of 0 and standard deviation of 1) of each test score. We will refer to these four variables as cognitive ability, non-cognitive ability, balance in all abilities, and balance in cognitive abilities. These variables enable us to give a good general description of an individual's ability and balance in abilities. Different ability tests have been used in the economic literature to test whether cognitive and non-cognitive ability affects labour market outcomes (see e.g. Cawley, Heckman and Vytlačil, 2001; Heckman and Rubinstein, 2001; Heckman, Stixrud and Urzua, 2006; Borghans, Duckworth, Heckman and ter Weel, 2008). While cognitive ability is often measured by intelligence tests, which are quite standardized and to a large degree comparable, the measurements of non-cognitive ability tend to vary more. Lindqvist and Vestman (2011) use the Swedish enlistment test of non-cognitive ability

to study the role of non-cognitive ability in earnings and unemployment. They show that high test scores are related to better labour market outcomes and, thus, that this non-cognitive ability is rewarded on the labour market. We believe that emotional stability, social skills, and ability to cope with stress are important abilities also for entrepreneurs, especially since they are solely responsible for their own success.

3.2 Descriptive statistics

Table A1 in the Appendix displays the share of self-employed and total number of observations broken down by year. It emerges that the share of self-employed increases over our time period. In 1991 the share is about 6 per cent, but by 2005 it exceeded 14 per cent.

Table 2 shows the summary statistics separately for people who are and are not self-employed. On average, the self-employed are about one year older and have less education than those who are not self-employed. Furthermore, a larger share of the self-employed is married and they have on average more children. People who are not self-employed are also more likely to reside in a metropolitan area.

Table 2: Descriptive statistics		
	Not self-employed	Self-employed
Age	42.1 (5.2)	43.2 (5.0)
<i>Education</i>		
Primary school or less	20.4 (40.3)	29.5 (45.6)
Secondary school	48.7 (50.0)	51.1 (50.0)
Post-secondary school	30.9 (46.2)	19.4 (39.6)
Married	53.7 (49.9)	59.3 (49.1)
Number of children(at home)	1.2 (1.2)	1.3 (1.2)
Metropolitan area	14.1 (34.8)	11.0 (31.2)
Age at enlistment	18.3 (0.5)	18.4 (0.5)
Number of observations	5,592,244	655,666

Notes: Displayed are sample means and standard deviations within parentheses.

Figure 2 describes how self-employment rates and performance among the self-employed in the sample vary over the test score distributions in cognitive and non-cognitive ability. The earnings of the self-employed are increasing with both cognitive and non-cognitive ability. Furthermore, the likelihood of being self-employed seems to be increasing in relation to non-cognitive ability, but at a decreasing rate. Moreover, the self-employment rate is increasing with higher values of cognitive ability up to the mean around 5 and after that point it is negatively related to the test score.

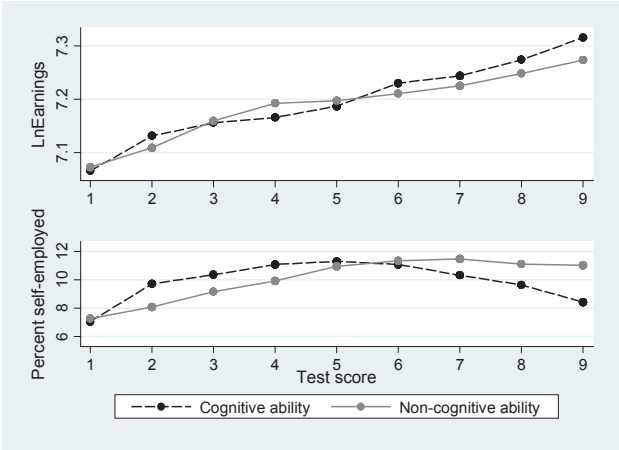


Figure 2: Self-employment rate and performance by ability

In Figure 3, average performance and self-employment rates within each 10th percentile of ability balance is displayed. In terms of performance, it appears that earnings among self-employed are higher for individuals with a more balanced set of abilities, independently of whether we consider all abilities or only cognitive ones. The share of self-employed in our sample increases with balance in abilities up to the 90th percentile, after which it starts to decrease. The pattern for balance in only cognitive abilities is similar, but the share self-employed is decreasing already from the 50th percentile.

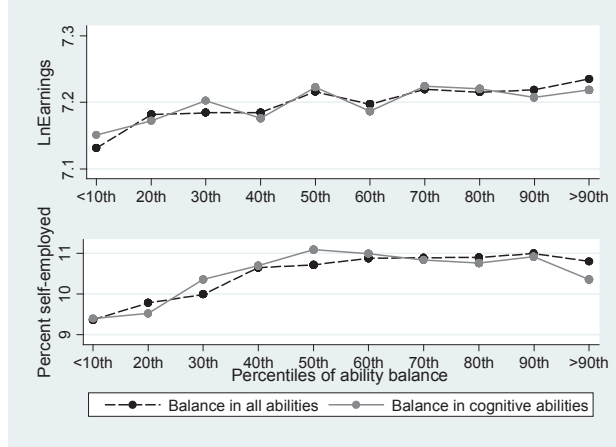


Figure 3: Self-employment rate and performance by balance in abilities

4. Empirical specification

To ascertain whether or not ability affects the decision to be, the probability of switching into, the likelihood of leaving, and the performance as self-employed, we formulate four sets of equations. We begin by estimating the following linear probability model (LPM) by a pooled OLS⁹ for the likelihood of being self-employed in the years 1991 to 2005:

$$SE_{i,t}^* = \alpha + \beta X_{i,t} + \delta A_i + \mu_t + \varepsilon_{i,t} \quad [1]$$

where SE^* is a latent variable taking value one if $SE^* \geq 0$ (denoting self-employment) and value 0 otherwise (implying wage-employed, unemployed or inactive). i indexes the individual and t the year. X is a vector of time-varying individual characteristics (age, age squared, educational level, marital status, number of children, metropolitan area, and county of residence). The vector A includes the overall measure of cognitive ability, the measure of non-cognitive ability, and the measure of balance in abilities. μ is a vector of dummy variables for year. See Table A2 in the Appendix for a description of the included variables.

⁹ We estimate a pooled OLS model with standard errors clustered on the individual. We also estimated equation [1] using (i) a model with random effects, (ii) a logit and (iii) a logit with random effects, all results were in line with our pooled OLS estimates. These results are available from the authors upon request.

We estimate equation [1] using five specifications, altering the included measures of abilities. First we include cognitive ability and non-cognitive ability in the vector A. Second, we study the role of balance in abilities and then include only the variable for balance in abilities in the regression. In addition, we exclude non-cognitive ability from the balance measure and estimate only the impact of balance in cognitive abilities. Finally, we alter the specification by controlling for cognitive and non-cognitive ability in the regressions with the ability balance measures, in order to rule out that the balance measures captures some of the effects from having high cognitive and/or non-cognitive ability. However, it might be that cognitive and/or non-cognitive ability captures some of the variation which ability balance is meant to measure. Introducing all variables in a regression simultaneously would then bias the coefficients. In general, we like to think of a regression in which all three variables are included as the lower bound of the effect, while the regression in which only ability balance is included gives the upper bound.¹⁰

Furthermore, we investigate whether ability affects the probability of switching into self-employment between two years. We estimate again equation [1] with the only change that the dependent variable now is $SW_{i,t,t+1}^*$. SW^* is a latent variable taking value one if $SW^* \geq 0$ (denoting switching, i.e. self-employed in year t+1 and not self-employed in year t) and value 0 otherwise (denoting staying, i.e. not self-employed in year t and t+1). This implies that individuals who are already self-employed in the first year are excluded from the regression.

Moreover, equation [1] is altered by specifying the dependent variable as the likelihood of leaving self-employment between two years. This variable, $EX_{i,t,t+1}^*$, is a latent variable taking a value of 1 if $EX^* \geq 0$ (denoting leaving, i.e. not self-employed in year t+1 and self-employed in year t) and value 0 otherwise (denoting staying, i.e. self-employed in year t and t+1). In these regressions individuals who are not self-employed the first year are excluded.

Lastly, in order to study the role of ability for performance as self-employed we estimate the following pooled OLS for all individuals who were self-employed in any year between 1991 and 2005:

¹⁰ The same way of reasoning would apply also for cognitive and non-cognitive ability. However, estimations where these variables are introduced separately show very similar coefficients for cognitive and non-cognitive ability as when they are entered simultaneously.

$$Y_{i,t} = \alpha + \beta X_{i,t} + \delta A_i + \theta_{i,t} + \mu_t + u_{i,t} \quad [2]$$

where all variables are defined as above, apart from the vector X which also includes years as self-employed and a dummy variable indicating if an individual has income from wage-employment. We also add industry fixed effects θ . The outcome variable for performance Y is specified as (i) the log of annual earnings, (ii) the log of annual turnover, (iii) the log of annual profit and (iv) number of employees in the business. In the earnings regressions, only individuals with earnings above SEK 32,200 (in 1991 prices) will be included. We will also estimate equation [2] using quantile regression techniques in order to test whether the returns to ability varies over the earnings distribution. In addition, we estimate equation [2] separately for wage-earners and test whether the coefficients for cognitive, non-cognitive and ability balance differ from the estimated coefficients for the self-employed. The estimation for wage-earners is meant to serve as a placebo test for whether ability balance captures something else, which also affects earnings among those who are not self-employed.

We argue that the coefficient estimates for ability balance in equations [1] and [2] are less likely to be endogenous in comparison to the measures which have been used so far in this literature (e.g. Wagner, 2003; Lazear, 2005; Silva, 2007; Hartog, Van Praag and Van der Sluis, 2010; Stuetzer, Obschonka and Schmitt-Rodermund, 2013). To start with, in contrast to when work and/or education history is used as a measurement of ability balance, it is unlikely that skills measured at age 18 are affected by an expectation of becoming self-employed. In addition, even if circumstances in childhood can have an impact both on ability at age 18 and on future labour market performance, it is less obvious which factors can simultaneously decide both unevenness in an individual's skills and future performance. We argue that if ability balance captures omitted individual characteristics, we should expect to see a similar impact of ability balance for wage-earners. Secondly, it is important that individuals' abilities be measured when they have had the same amount of schooling and are the same age. The reason is that performance on ability tests increases with age and education and therefore an ability measure relying on test scores for individuals of varying ages and educational levels is likely to be biased (e.g. Heckman, Stixrud and Urzua, 2006). Since the ability tests are collected from people who are of the same age and education we are less concerned about potential bias. This is a clear improvement from previous literature in which balance is measured in a similar way (e.g. Hartog, Van Praag and Van der Sluis, 2010).

Still, it could be that individual differences in age and/or amount of schooling affect abilities at age 18. Around 20 per cent of the non-self-employed and 28 per cent of the self-employed have not continued to secondary school, starting at age 16, and they will have two years less of education. If individuals' test scores at age 18 are affected by these two additional years of education, our regressions should control for whether individuals have had secondary education. In addition, we believe that it is possible (and likely) that individuals with higher ability are more likely to advance to post-secondary education and controlling for this in the regressions implies that we allow some of the effects of ability to run through educational attainment. However, we see no need for adjusting our ability measure for the small level of variation in schooling and age, especially since previous literature has shown that this is not a major concern in the Swedish enlistment data (e.g. Nordin, 2008; Nordin and Rooth, 2009).

Furthermore, it is possible that there is measurement error in the skills which are measured in the enlistment tests. This would be more reasonable to expect for non-cognitive ability. If the non-cognitive skill of a subject is differently evaluated depending on which psychologist they get assigned to, there will be a measurement error in the test result of non-cognitive ability. However, using the same test of non-cognitive ability, Lindqvist and Vestman (2011) show that when correcting for measurement error, the effect of non-cognitive ability increases while the impact from cognitive ability is unaffected.¹¹ Thus, we believe that the coefficient for non-cognitive ability might be downward biased and should be seen as a lower baseline.

5. Results

5.1 Abilities and the self-employment decision

We will start by investigating whether abilities matters for the decisions (i) to be self-employed¹², (ii) to switch to self-employment and, (iii) to leave self-employment. Table 3 displays the results from estimation of equation [1], with the dependent variable specified as being self-employed. It emerges from column (1) that an increase in non-cognitive ability by one standard deviation leads to an about 1.4 percentage point higher probability of being self-

¹¹ They use a correction procedure which makes use of correlation in test scores of identical and fraternal twins. Since we cannot link twins to each other in our data we cannot apply this method to our data. They use data from enlistments between years 1983 and 1993 while we use data from 1969 to 1983. However, the psychological test has remained the same over these years and the measurement error in the tests should be of similar magnitude.

¹² We have also estimated regressions for the intensive margin, i.e. years in self-employment, and these results point in the same direction as the reported results for the extensive margin (i.e. the probability to be self-employed). These results are available from the authors upon request.

employed; a similar increase in cognitive ability is related to an approximately 1 percentage point higher likelihood of self-employment.

Table 3: Pooled OLS estimates for probability of being self-employed

VARIABLES	(1)	(2)	(3)	(4)	(5)
Non-cognitive ability	0.0140*** (0.0004)		0.0134*** (0.0004)		0.0139*** (0.0004)
Cognitive ability	0.0102*** (0.0004)		0.0084*** (0.0005)		0.0078*** (0.0005)
Balance in abilities		0.0109*** (0.0004)	0.0036*** (0.0004)		
Balance in cognitive abilities				0.0097*** (0.0004)	0.0045*** (0.0004)
Observations	6,247,910	6,247,910	6,247,910	6,247,910	6,247,910
R-squared	0.0221	0.0200	0.0222	0.0198	0.0223
Number of individuals	443,044	443,044	443,044	443,044	443,044

Notes: Includes controls for age, age squared, education, marital status, number of children, metropolitan area and region of residence. Predicted probability at sample means=0.1049. Robust standard errors, clustered on individuals, in parentheses. ***p<0.01 **p<0.05 *p<0.1.

Furthermore, in columns (2) to (5) the role of balance in abilities is tested, with and without controlling for cognitive and non-cognitive ability. The results indicate that individuals with a more balanced ability profile are more likely to become self-employed. The coefficients for balance in all abilities and balance in only cognitive abilities are very similar, an increase of one standard deviation in balance in all abilities or balance in cognitive abilities yields an around 1 percentage point higher likelihood of self-employment. When controls for cognitive and non-cognitive ability are included in the regression the magnitude is about half as large. Thus, it appears that the measure of ability balance captures also part of the effect from having high abilities, rather than just having a low spread of those abilities. However, we can conclude from the results in the last four columns that balance in abilities also has an impact of its own.¹³

We continue by studying the probability of switching into self-employment. The regression results from estimation of equation [1] with the dependent variable being switching into self-employment are displayed in Table 4. Overall the directions of the effects are very much in line with the estimates displayed in Table 3, but the magnitudes are in general much smaller.

¹³ A standard deviation increase in ability balance corresponds to comparing an individual with test score profile 9-9-9-4-8 (coefficient of variation equals -0.25 and ability balance equals 0) to an individual with scores 9-8-7-6-8 (coefficient of variation equals -0.13 and ability balance equals 1). These two individuals have similar average level of ability and only differ in the evenness of performance across tests.

The estimated effects of a one standard deviation increase cognitive or non-cognitive ability in column (1) amounts to an around 0.3 percentage point higher likelihood of switching into self-employment from another activity. A more balanced ability profile, both in terms of all abilities and only of cognitive abilities, is related to a higher propensity to make a transition to self-employment. However, the magnitudes of the effects are negligible when comparing individuals with similar levels of non-cognitive and cognitive ability in columns (3) and (5).¹⁴

Table 4: Pooled OLS estimates for probability of switching into self-employment

VARIABLES	(1)	(2)	(3)	(4)	(5)
Non-cognitive ability	0.0029*** (0.0001)		0.0029*** (0.0001)		0.0029*** (0.0001)
Cognitive ability	0.0027*** (0.0001)		0.0026*** (0.0001)		0.0023*** (0.0001)
Balance in abilities		0.0023*** (0.0001)	0.0004*** (0.0001)		
Balance in cognitive abilities				0.0021*** (0.0001)	0.0007*** (0.0001)
Observations	5,229,939	5,229,939	5,229,939	5,229,939	5,229,939
R-squared	0.0109	0.0103	0.0109	0.0103	0.0109
Number of individuals	431,927	431,927	431,927	431,927	431,927

Notes: Includes controls for age, age squared, education, marital status, number of children, metropolitan area and region of residence. Predicted probability at sample means=0.0203. Robust standard errors, clustered on individuals, in parentheses. ***p<0.01 **p<0.05 *p<0.1.

Finally, we estimate equation [1] with the dependent variable specified as the probability of leaving self-employment. The results are displayed in Table 5. In contrast to the previous results, the results in column (1) indicate that the likelihood of leaving self-employment is affected differently by cognitive and non-cognitive ability. A one-standard deviation increase in non-cognitive ability yields a decrease of about 0.2 percentage points in the probability of leaving self-employment, while a similar change in cognitive ability is related to an about 0.3 percentage point higher likelihood of leaving. Moreover, individuals who are more balanced in their abilities are less likely to leave self-employment, with a one-standard deviation increase in ability balance yielding an around 0.3 percentage point lower likelihood of exiting (column 3). The impact of being more balanced in only cognitive abilities is less clear, since the estimate is only significant when controlling for the levels in cognitive and non-cognitive ability in column (5).

¹⁴ We have estimated the probability of switching into self-employment separately for unemployed and wage-employed individuals and the results are almost identical for both groups. These results are available from the authors upon request.

Table 5: Pooled OLS estimates for probability of leaving self-employment

VARIABLES	(1)	(2)	(3)	(4)	(5)
Non-cognitive ability	-0.0019*** (0.0006)		-0.0015*** (0.0006)		-0.0019*** (0.0006)
Cognitive ability	0.0026*** (0.0006)		0.0046*** (0.0007)		0.0033*** (0.0007)
Balance in abilities		-0.0020*** (0.0005)	-0.0037*** (0.0006)		
Balance in cognitive abilities				-0.0002 (0.0005)	-0.0014** (0.0006)
Observations	655,666	655,666	655,666	655,666	655,666
R-squared	0.0124	0.0124	0.0125	0.0124	0.0125
Number of individuals	99,807	99,807	99,807	99,807	99,807

Notes: Includes controls for age, age squared, education, marital status, number of children, metropolitan area and region of residence. Predicted probability at sample means=0.1214. Robust standard errors, clustered on individuals, in parentheses. ***p<0.01 **p<0.05 *p<0.1.

5.2 Abilities and performance as self-employed

We have so far established that high cognitive and non-cognitive ability, in addition to a more balanced set of abilities have positive effects on the likelihood to be self-employed and on the probability of switching into self-employment. In addition, individuals with higher non-cognitive ability and more balanced abilities are less likely to leave self-employment, while more cognitively skilled individuals tend to a higher degree leave self-employment. A natural question to pose is now whether ability is also important for successful self-employment, which would be the case if individuals behave rationally. For this purpose we estimate equation [2] and the regression results are displayed in Table 6. Overall, more capable individuals appear to perform better as self-employed in the sense that they earn more. From column (1) we see that a one-standard deviation increase in non-cognitive ability yields about 2.1 per cent higher earnings, whereas a similar increase in cognitive ability is related to about 1.7 per cent higher earnings. As regards balance in abilities it appears that individuals who are more balanced in their abilities perform better as self-employed, since the results in column (2) shows that a one standard deviation increase in ability balance generates about 1.5 per cent higher earnings or 0.5 per cent when holding cognitive and non-cognitive ability constant in column (3). The results for balance in cognitive abilities are less clear, as the estimate is not robust to the inclusion of cognitive and non-cognitive abilities in column (5).

Furthermore, we have investigated if the results for earnings are heterogeneous depending on industry, by including interactions between the ability variables and industry dummies.¹⁵ These results are not displayed, but available from the authors upon request. Overall, ability balance has the largest impact on earnings for self-employed individuals in retailing. Cognitive ability seems to matter most for earnings among self-employed in health care and in personal and cultural services, whereas the effect of non-cognitive ability is quite similar across industries, but somewhat greater in financial services.

A drawback with measuring self-employment performance by earnings is that self-employed tend to bunch at earnings levels where there are jumps in the marginal tax rate and might therefore have incorrectly reported earnings (e.g. Bastani and Selin, 2014). If the magnitude of under-reporting varies over the ability distribution, it is possible that the returns to ability are misrepresented. In addition, earnings might not be the best way to capture self-employment success, especially since a large share of the sample has low or negative earnings from self-employment. Therefore we use three alternative measures of performance in column (6) to (8), namely the natural logarithm of yearly turnover, the natural logarithm of yearly profit and the number of employees in the company. We present the results for the same specification as in column (3), including ability balance, cognitive and non-cognitive ability. As regards turnover, it emerges from column (6) that all abilities have stronger effects on turnover than on earnings. An increase in non-cognitive ability of a single standard deviation yields an increase of about 10.6 per cent in a company's yearly turnover. In line with the results for earnings, the magnitude of the effect from cognitive ability is only about half as large. The effect of a one standard deviation increase of ability balance is about 1.6 per cent higher turnover. Furthermore, the results for profit in column (7) point in the same direction as for turnover, but the magnitude of the coefficients are somewhat smaller. In column (8) performance is measured by the number of persons employed in the company. In this regression we include also balance in abilities squared, since graphical investigation shows that number employed is non-linearly related to ability balance. This might be because about half of the self-employed have no more than one employee, if any.¹⁶ In contrast to the other

¹⁵ Including ten industries: agriculture, forestry and fishing, manufacturing, electricity, gas and water supply, construction, retailing, financial services, education and research, health care, personal and cultural services, public services and other.

¹⁶ Because of the left censoring of number of employees we estimated also Tobit regressions and the results were in line with the OLS estimations. In the Tobit regression the marginal effect of increasing ability balance by one standard deviation, for companies with at least one employee, amounts to about 1.47 more employees in the company. These results are available from the authors upon request.

performance measures, cognitive ability has the largest impact on the number of employees. A one-standard deviation increase in cognitive (non-cognitive) ability increases the number of employees by about 7 (2) persons. Moreover, a one-standard deviation higher ability balance generates about 2 additional employees. The coefficient for ability balance squared (not displayed) is about 2.1, implying that the effect is much stronger for individuals with a high ability balance.

Table 6: Pooled OLS estimates for performance as self-employed

		LnEarnings				LnTurnover	LnProfit	Number employed	Wage- earners
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Non-cognitive ability	0.0212*** (0.0024)		0.0206*** (0.0024)		0.0212*** (0.0024)	0.1060*** (0.0054)	0.0716*** (0.0050)	2.4844*** (0.8847)	0.0500*** (0.0005)
Cognitive ability	0.0160*** (0.0026)		0.0130*** (0.0030)		0.0155*** (0.0029)	0.0447*** (0.0067)	0.0305*** (0.0062)	7.3953*** (0.9858)	0.0531*** (0.0006)
Balance in abilities		0.0155*** (0.0023)	0.0057** (0.0026)			0.0163*** (0.0059)	0.0114** (0.0054)	1.8892* (1.0078)	0.0007 (0.0005)
Balance in cognitive abilities				0.0097*** (0.0022)	0.0010 (0.0025)				
Observations	353,795	353,795	353,795	353,795	353,795	303,835	266,324	306,841	4,576,763
R-squared	0.1598	0.1586	0.1599	0.1582	0.1598	0.2660	0.0286	0.0547	0.4489
Number of individuals	57,346	57,346	57,346	57,346	57,346	73,444	69,684	74,019	404,085

Notes: Includes controls for age, age squared, education, marital status, years as self-employed, number of children, metropolitan area, region of residence and industry fixed effects. In column (6) balance in abilities squared is included. Individuals with earnings below SEK 32,200 (in 1991 prices) are excluded in columns (1) to (5). Wage-earners with income below SEK 100,000 (in 1991 prices) are excluded in column (9). Robust standard errors, clustered on individuals, in parentheses. ***p<0.01 **p<0.05 *p<0.1.

Finally, equation [2] is estimated for wage-earners in column (9), with the dependent variable specified as the natural logarithm of yearly earnings. We have restricted the sample to individuals whose wage earnings exceed SEK 100,000.¹⁷ The return to cognitive and non-cognitive ability is statistically significantly higher among wage-earners than among the self-employed. However, there is no statistically significant effect from ability balance for wage-earners and the coefficient for the self-employed (in column 3) is statistically significantly higher. This strengthens our belief that ability balance does not capture other omitted individual characteristics.

In Table 6 we considered the effect of balance in abilities on mean earnings, but it is possible that effects vary over the earnings distribution. In order to test whether this is true, we proceed

¹⁷ The results are robust to using a higher threshold than SEK 100,000. However, among low-income earners in retailing there is a small, but statistically significant, impact of having higher ability balance. Excluding wage-earners employed in retailing produces results in line with our baseline, irrespective of earnings restriction. These results are available from the authors upon request.

by estimating quantile regressions. The results from the quantile regressions are displayed in Table 7 and each panel corresponds to separate regressions. From Panel A it emerges that the impact of both cognitive and non-cognitive abilities on earnings varies over the earnings distribution. For non-cognitive ability we find that a one-standard deviation increase in non-cognitive ability increases earnings with about 2.2 per cent at the 10th percentile and around 1.3 per cent at the 90th percentile. Furthermore, a one-standard deviation increase in the overall cognitive ability leads to between 1.4 and 1.5 per cent higher earnings for individuals in the three top percentiles. In contrast, in the two lowest percentiles the coefficients for cognitive ability are smaller and not statistically significant at more than the 10 per cent level. Thus, it appears that for the self-employed the returns to non-cognitive ability decrease as we move up the earnings distribution, while the returns to cognitive ability are the highest among the top-earners.

As regards the role of balance in abilities, presented in Panel B, we find that a more balanced ability profile has the largest positive impact on earnings in the 25th to 50th percentiles of the earnings distribution and the smallest effect at the top of the distribution. Controlling for cognitive and non-cognitive ability in Panel C, results in that the coefficient for balance in abilities only is statistically significant up to the 50th percentile. The estimates for balance in cognitive abilities alone, presented in Panel D, show that the strongest effects on earnings are in the middle of the earnings distribution. In Panel E, when we in addition control for the levels of cognitive and non-cognitive ability, there are no statistically significant effects on earnings from a higher balance in cognitive abilities.

In general, we find that a better balance of skills matters most for low- and middle-income earners. We have also estimated quantile regressions for turnover and profit and these results are in line with the result for earnings.¹⁸ The reason for this result could be that low-performing individuals have less opportunity to hire employees and therefore need to do much of the work themselves. Naturally, this implies that they benefit from a range of skills. On the contrary, the self-employed who earn more might be more inclined to hire people who perform the tasks they are not competent to perform. It seems reasonable to think of the two cases as being the small-business owner and the big corporation entrepreneur.

¹⁸ These results are available from the authors upon request.

Table 7: Quantile regressions for performance as self-employed

	10th percentile	25th percentile	50th percentile	75th percentile	90th percentile
<i>Panel A</i>					
Non-cognitive ability	0.0223*** (0.0034)	0.0251*** (0.0034)	0.0204*** (0.0029)	0.0149*** (0.0028)	0.0128*** (0.0028)
Cognitive ability	0.0054 (0.0037)	0.0087* (0.0036)	0.0154*** (0.0032)	0.0150*** (0.0029)	0.0136*** (0.0029)
<i>Panel B</i>					
Balance in abilities	0.0160*** (0.0032)	0.0186*** (0.0032)	0.0160*** (0.0027)	0.0105*** (0.0025)	0.0044 (0.0025)
<i>Panel C</i>					
Balance in abilities	0.0129*** (0.0038)	0.0125*** (0.0036)	0.0083** (0.0031)	0.0023 (0.0028)	-0.0052 (0.0029)
Non-cognitive ability	0.0203*** (0.0035)	0.0238*** (0.0034)	0.0197*** (0.0029)	0.0145*** (0.0028)	0.0132*** (0.0028)
Cognitive ability	-0.0013 (0.0041)	0.0019 (0.0041)	0.0108** (0.0036)	0.0138*** (0.0033)	0.0166*** (0.0034)
<i>Panel D</i>					
Balance in cognitive abilities	0.0083** (0.0032)	0.0090** (0.0031)	0.0104*** (0.0027)	0.0073** (0.0024)	0.0041 (0.0025)
<i>Panel E</i>					
Balance in cognitive abilities	0.0046 (0.0037)	0.0038 (0.0034)	0.0031 (0.0031)	0.0004 (0.0027)	-0.0037 (0.0028)
Non-cognitive ability	0.0222*** (0.0034)	0.0250*** (0.0033)	0.0203*** (0.0029)	0.0148*** (0.0028)	0.0130*** (0.0028)
Cognitive ability	0.0028 (0.0042)	0.0066 (0.0042)	0.0139*** (0.0035)	0.0148*** (0.0033)	0.0156*** (0.0033)

Note: Includes controls for age, age squared, education, marital status, years as self-employed, number of children, metropolitan area, region of residence and industry fixed effects. Dependent variable is LnEarnings. Individuals with earnings below SEK 32,200 (in 1991 prices) are excluded. Number of observations is 353,795 and number of individuals is 57,346. Robust standard errors, clustered on the individual, in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

5.3 Nonlinearities in the returns to ability

In light of the descriptive patterns emerging from Figures 2 and 3, it seems reasonable to investigate whether the decision to become self-employed and the performance as self-employed is nonlinearly related to abilities. We have done so by including squared terms of cognitive ability, non-cognitive ability, and balance in abilities in the regressions. In Table 8 we display the results for the probability of being and performing as self-employed. The results in column (1) point at a concave relationship between cognitive and non-cognitive ability and the self-employment decision. This implies that a one-standard deviation increase in ability increases the self-employment propensity by about 1 percentage point around the mean (test score of 5) but the impact decreases when evaluated at higher test score values. For balance in abilities, the results in column (2) and (3) do not give strong support for a nonlinear relationship, since the coefficient for balance in abilities squared is only significant when controlling for the levels of cognitive and non-cognitive skills in column (3). As regards performance, the results in columns (4) to (6) reveals that the non-cognitive ability is

concavely related to self-employment earnings, whereas earnings increase linearly with cognitive ability and balance in abilities.

Table 8: Nonlinear returns to ability in the self-employment decision and performance

VARIABLES	Being self-employed			Performance as self-employed		
	(1)	(2)	(3)	(4)	(5)	(6)
Non-cognitive ability	0.0135*** (0.0004)		0.0135*** (0.0004)	0.0195*** (0.0024)		0.0187*** (0.0025)
Non-cognitive ability squared	-0.0019*** (0.0003)			-0.0092*** (0.0020)		
Cognitive ability	0.0099*** (0.0004)		0.0084*** (0.0005)	0.0125*** (0.0026)		0.0102*** (0.0030)
Cognitive ability squared	-0.0046*** (0.0003)			-0.0033 (0.0021)		
Balance in abilities		0.0110*** (0.0005)	0.0029*** (0.0005)		0.0141*** (0.0027)	0.0048 (0.0030)
Balance in abilities squared		0.0001 (0.0002)	-0.0007*** (0.0002)		0.0003 (0.0014)	-0.0007 (0.0014)
Observations	6,247,910	6,247,910	6,247,910	353,795	353,795	353,795
R-squared	0.0225	0.0200	0.0223	0.1562	0.1549	0.1559
Number of individuals	443044	443044	443044	57346	57346	57346

Note: Columns (1) to (3) include controls for age, age squared, education, marital status, number of children, metropolitan area and region of residence. Columns (4) to (6) include in addition years as self-employed and industry fixed effects. Dependent variable for performance is LnEarnings and individuals with earnings below SEK 32,200 (in 1991 prices) are excluded. Robust standard errors, clustered on individuals, in parentheses. ***p<0.01 **p<0.05 *p<0.1.

5.4 Robustness checks¹⁹

We have performed a robustness test by estimating the regressions, omitting individuals with a CV of 0. The reason for doing this is that both high-performing individuals (e.g. score 9 on all tests) and low-performing individuals (e.g. score 1 on all tests) will have a standard deviation equal to 0 and thus a CV which equals 0. It is possible that this has an impact on our results, especially since most individuals with a CV of 0 are found in the group with all test scores equal to 1. However, our results are very robust to this change and the coefficients for the two ability balance measures barely change at all.

Furthermore, we have altered the earnings restriction in several ways. In the baseline, all self-employed with earnings below SEK 32,200 are excluded. The results are robust to excluding individuals with earnings less than SEK 100,000 or including all individuals with positive earnings. Moreover, excluding all individuals whose income from wage-employment is larger than income from self-employment does not alter the results.

¹⁹ These results are available from the authors upon request.

6. Conclusions

To understand why individuals choose to be self-employed and why some are successful in running their own business and others are not is important for creating policies that are conducive to innovation and growth. In this paper we enhance this understanding by investigating how self-employment ability is related to the self-employment decision and self-employment performance. In particular, we test the Jack-of-all-Trades theory developed by Lazear (2005) according to which self-employment requires a broad set of skills and that individuals with a more balanced skill set should be more likely to be self-employed.

The literature shows mixed support for the Jack-of-all-Trades theory (e.g. Wagner, 2003; Lazear, 2005; Silva, 2007; Hartog, Van Praag and Van der Sluis, 2010; Stuetzner, Obschonka and Schmitt-Rodermund, 2013). A problem with the earlier studies is that the estimate of skill balance might be biased because individuals expect to become self-employed and thus invest in a more balanced skill set. Silva (2007) argues that only the balance in skills that individuals are endowed with and not that required through investment in skills, matters for the self-employment decision. Our paper is the first to demonstrate that endowed skill balance is in fact important for both the self-employment decision and self-employment performance. Our results give support for the Jack-of-all-Trades theory, in the sense that the likelihood of being or becoming self-employed increases with a good balance in abilities. Moreover, earnings, turnover, profit and number employees for the self-employed tend to be higher among people with a more balanced skill set. At the same time, we find no evidence that wage-earners benefit from a better balance in abilities. This strengthens our belief that our measure of ability balance does not capture other omitted individual characteristics.

The only previous study that is comparable to ours, by Hartog, Van Praag and Van der Sluis (2010), finds that in the US an increase in ability balance of one standard deviation is related to about 3 per cent higher earnings for the self-employed. However, they find that the probability of being self-employed is not related to ability balance. In general, our estimations point at a smaller impact on earnings, but a larger impact on the self-employment decision of ability balance. It is important to keep in mind that their study is performed using other specific abilities to create the ability balance measure and that individuals are of different ages and educational levels when their abilities are measured.

Although our results support the idea that the self-employed benefit from being Jacks-of-all-Trades, this appears to depend on how successful their business is. It appears that being more balanced in skills matters most for individuals whose performance is low or average. A plausible explanation could be that they cannot afford to hire others and therefore need to “wear many hats” in their business.

Furthermore, by studying how cognitive and non-cognitive abilities affect the self-employment decision and performance we complement the literature on the role of cognitive and non-cognitive skills in explaining economic outcomes. Our results reveal that individuals with high cognitive skills are more likely to be self-employed and to have higher earnings from self-employment. This is in contrast to Eren and Sula (2012), who found that cognitive ability had a negative effect on the likelihood of self-employment in the US. One explanation for these contradictory results could be differences in the countries' wage setting systems. Sweden's compressed wage-system could imply that cognitive ability is not fully rewarded for wage-earners, which could encourage highly cognitive skilled individuals to become self-employed. In contrast, the US labour market is characterised by individualised wages and the returns to cognitive ability are more likely to be high for wage-earners. Furthermore, in line with previous studies, we find that non-cognitive ability increases the likelihood of being self-employed. This could be because non-cognitive skills are not fully observed and rewarded by employers or a consequence of that individuals with specific personal traits and/or high social capital are more suited for self-employment or see self-employment as a more attractive option. Since we find that performance as self-employed is better for individuals with high non-cognitive skills, it seems reasonable to conclude that individuals with high non-cognitive skills are better suited for self-employment.

From a policy perspective, some of these findings have important implications for future formation of policies designed to increase self-employment rates and business survival and to promote economic growth. Our results show that skills that young people possess and in particular the balance of those skills, matter when they choose to be self-employed and how well they perform once self-employed. This motivates policies for skill-building in many areas or that encourage the turning of shortcomings into strengths. In conclusion, self-employment seems to be all about balance.

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Appendix

Table A1: Self-employment rate and number of observations by year

Year	Share self-employed	Number of observations
1991	5.8	422,767
1992	5.6	423,781
1993	9.9	425,984
1994	10.1	423,782
1995	10.4	423,859
1996	10.2	422,355
1997	10.8	419,061
1998	10.9	415,996
1999	10.9	414,987
2000	10.9	413,948
2001	10.9	412,624
2002	11.6	411,194
2003	11.6	409,313
2004	14.1	405,880
2005	14.3	402,379
All years	10.5	6,247,910

Table A2: Description of variables used in regressions

Variable	Definition
<i>Dependent variables</i>	
SE	1 if self-employed, 0 otherwise
SW	1 if switched into self-employment, 0 otherwise
EX	1 if left self-employment, 0 otherwise
Ln(Earnings)	Logarithm of yearly earnings
Ln(Turnover)	Logarithm of net turnover
Ln(Profit)	Logarithm of operating net profit for the year
Number employees	Number of individuals employed in the company
<i>Independent variables</i>	
Age	Continuous
Age squared	Continuous
Secondary school	1 if secondary schooling, 0 otherwise
Post-secondary school	1 if post-secondary schooling, 0 otherwise
Married	1 if married, 0 otherwise
Number of children	Number of children living at home, continuous
Metropolitan area	1 if living in Stockholm, Gothenburg or Malmö, 0 otherwise
County of residence	Dummies for county of residence. In total 24 counties and county of Stockholm is reference
Industry	Dummies for industry. The categories are: Construction/manufacturing, retail trade/communication, financial and industrial services, personal and cultural services and, other (reference).
Years as self-employed, 1 year	1 if one year as self-employed, 0 otherwise
Years as self-employed, 2-5 year	1 if 2-5 years as self-employed, 0 otherwise
Years as self-employed, >5 year	1 if >5 years as self-employed, 0 otherwise
Income from wage-employment	1 if has income from wage-employment, 0 otherwise
Year	Dummies for year. In total 17 years and 2005 is reference
Cognitive ability	Continuous, normalized to mean 0 and standard deviation 1.
Non-cognitive ability	Continuous, normalized to mean 0 and standard deviation 1.
Balance in abilities	Continuous, normalized to mean 0 and standard deviation 1.
Balance in cognitive abilities	Continuous, normalized to mean 0 and standard deviation 1.

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