FIEF Working Paper Series 2001 ISSN 1651-0852

Nr. 169

Immigrants' and Natives' Unemployment-risk: Productivity Differentials or Discrimination?*

by

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Abstract

Studying the unemployment risk during 1992 to 1995 for a sample of employees in 1991, we find that immigrants from the non-European countries run a risk of unemployment that is twice the corresponding risk for the native workers. There exist substantial unemployment-risk differentials taking into account employees' demographic and human capital characteristics, the wage-rate in 1991 and systematic sorting of workers across establishments associated with varying unemployment risks. Exaggerating beyond all reasonable limits, the ability differentials (measured in school grades and IQ-tests) between immigrants and natives fails to explain the differences between immigrants and natives in unemployment risks. Our simulations indicate that the observed unemployment-risk differentials between native and non-European workers correspond to ability differentials that are at least as large as the whole range of IQ-scores. Our conclusion is that discriminatory behavior and stereotype beliefs must be involved. Furthermore, we report results indicating that the existing income-gap between immigrants and natives in Sweden is almost entirely due to unequal employment opportunities.

Keywords: Immigration; Unemployment; Discrimination
JEL classification: .J71; J15; J61; J64

August 15, 2001

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* We are grateful to seminar participants at Trade Union Institute for Economic Research, Swedish Institute for Social Research, Department of Economics at Stockholm and Örebro University. Financial support from the Swedish Council for Work Life Research (RALF) is gratefully acknowledged.

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1 Introduction

Previous Swedish studies on income-convergence patterns of various immigrant groups and natives indicate that the income-gap between immigrants tends to decrease in the first few years in Sweden but thereafter remains at high levels.[1] For the immigrant groups from countries outside Europe, this income-gap settles at around 30 percent. Considering the small wage inequality in Sweden in general and the observed wage differentials between natives and immigrants[2], the huge income gaps must then reflect differences in unemployment-risk.

The main purpose of this paper is to examine whether individual productivity measures can eliminate between-group differences in unemployment-risk. Examining the Swedish Labor Force Surveys for 1987, 1997 and 1999 in Sweden, Arai *et. al.* (2000) report that the odds ratios for being unemployed, comparing various groups of immigrants with natives, range between 2 to 8 implying huge differences in unemployment risks. These odds-ratios remain at very high levels taking into account various demographic and human capital characteristics. These results suggest that the differences in unemployment risks are not explained by differences in indicators of productivity and might be due to discriminatory behavior.[3] A problem has been that the previously available data offer poor possibilities of testing whether the unemployment differentials between the native and immigrant population reflect productivity differentials or not.

We study a unique large sample of employees in 1991, matched with their unemployment records up to 1995, to examine systematic differentials between those who became unemployed and those who did not. In this way we can estimate the impact of various individual characteristics on risks of becoming unemployed. While basically all studies of unemployment use samples of unemployed, this paper is among the very few that estimate risks of

[1] See Ekberg (1983), Ekberg and Gustafsson (1993), Aguilar and Gustafsson (1994), Österberg (2000) and Edin *et al.* (2000). For the U.S. studies, see Chiswick (1977, 1978, 1982), Borjas (1985, 1987, 1992, 1993) and LaLonde and Topel (1994).

[2] See Wadensjö (1992) and le Grand and Szulkin (1999)

[3] For theories of Discrimination see Phelps (1972), Arrow (1972), Aigner and Cain (1977). For overviews see Lundahl and Wadensjö (1984).

becoming unemployed from a sample of employees.[4]

Our results suggest that the major part of the estimated differences in unemployment risks between immigrants and natives remain after controlling for age, gender, marital status, number of children, immigration year, education level, seniority, recent employment history, blue-collar occupation, industry affiliation (two digit level SIC) and the individual's pay-rate in 1991.

Investigating the role of ability, we use upper-secondary school grades as well as pre-enlistment military general IQ-test scores as indicators of ability to learn. The idea is that the ability differentials not reflected in cross-section differentials in wages might yield differential unemployment risks for apparently identical workers as measured in our cross-section of workers.

Upper-secondary school grades are missing for those who have not completed this degree. Moreover these grades are missing for individuals who have completed their education outside Sweden. IQ-test scores are missing for almost all native women and immigrants. As we assign the tenth percentile school grade from the own (region of birth) group distribution, for individuals with missing grades, we exaggerate any possible ability differentials between natives and immigrants. Moreover, assigning the tenth percentile IQ-test score of the own group distribution we exaggerate ability differences between immigrants and natives as well as between native women and men. If native workers are characterized by higher (relevant to the Swedish labor market) ability compared with immigrants, the extremely low IQ-scores and school-grade for immigrants will explain the between-group differentials in unemployment risks.

The tenth-percentile IQ-test score simulation eliminates the ten percent higher unemployment risks for women indicating that this simulation is powerful. When using such a powerful bias against immigrant workers, results imply that the major part of the observed unemployment risk-differential between natives and immigrants remains unexplained even though group differentials are exaggerated beyond all reasonable limits. Our simulations indicate that the observed unemployment-risk differentials between

[4]See also le Grand (2000).

native and Non-European workers correspond to ability differentials that are at least as large as the whole range of IQ-scores.

The message of these findings is that discriminatory behavior is involved. Prejudices and stereotype beliefs about immigrant workers lead to higher risks of jobs-loss and more difficult transition to re-employment leading to the outcome that apparently similar workers run radically different risks of unemployment due to their region of origin.

The gap in unemployment-risk between immigrants and natives narrows rapidly in the years after immigration but is rather constant after seven or eight years of stay in Sweden. The convergence pattern in unemployment risks observed for immigrants from outside Europe mirrors the income-convergence pattern reported by previous studies. As compared with non-European immigrants, the Nordic and other European immigrants are characterized by a lower unemployment-risk gap. This gap narrows rapidly in the beginning and contrary to non-Europeans, they do catch up to natives, but only for those who remain in Sweden more than 20 years.

Estimating within immigration year, between group differentials in wages, our results are as follows. The Nordic immigrants catch up at once and earn the same wage as natives or even more. For the immigrants from Europe there is a small gap of approximately three percent. There are no clear between cohort patterns in the wage gap for these groups. For the non-European group, we find a wage difference of seven percent that varies somewhat across various cohorts. Concerning the income-convergence pattern for different immigrant groups, the major source of income inequality is the substantially higher unemployment risks for immigrant workers.

The remainder of the paper is as follows. The next section describes the data and the empirical set-up. General findings are reported in Section 3. Section 4 deals with the role of ability. Section 5 report results on convergence in unemloyment risk and wages. The paper is concluded in Section 6.

2 Data and empirical setup

The origin of the data is the 1991 Swedish Establishment Survey (APU) linked with a large number of administrative registers. The APU establishments are the workplace of a representative sample of the working population as sampled in the 1991 round of the Swedish Level of Living Surveys (LNU).[5] The establishments in the APU are used as the frame for matching adminstrative records on all individuals who have been working in these establishments during the years 1987, 1991 or 1995 are sampled. In this paper, we use data on all individuals who worked during 1991 at the APU establishments. This constitutes a random sample consisting of more than 500.000 workers. For a detailed description of data and variables see Appendix A.

The sample used in our estimations consists of employees between the ages of 18 and 60 from both the private and public establishments in 1991. We limit the sample to individuals not older than 60 since we aim to estimate the risk of becoming unemployed during the period 1992-1995. In this way none of the individuals in our sample is older than 65 years (mandatory age of retirement) in 1995. We have information on the unemployment history of the individuals during 1992-1995 and a large number of variables related to individual's unemployment risks. We study the impact of individual characteristics on the risk of becoming unemployed by logit estimations based on variations of the following model.

$$P(U_{i,1992-1995} = 1 | U_{i,1991} = 0) = f(\mathbf{D}_i, \mathbf{X}_i, \mathbf{E}_i, \mathbf{HC}_i, \mathbf{Z}_i) \qquad (1)$$

Our dependent variable is a dummy variable that measures whether an individual i has been registered as unemployed during the period 1992-1995, given that she is employed in 1991. Using this variable we can estimate the risk of becoming unemployed given that the individual has a job in 1991.

The vector $\mathbf{D}_i$ is the set of region-of-birth dummies. The estimates for the elements of this vector, represent between group

[5] See Fritzell and Lundberg (1994) for description of the LNU-data.

differentials in unemployment risks. Native-born individuals are compared to immigrants from the Nordic countries, other European countries or countries outside Europe.

The vector $\mathbf{X}_i$ includes dummies for age intervals, marital status, number of children and a female dummy intended to capture possible systematic demographic differences in labor market attachment. The impact of sectoral and establishment level unemployment shocks are captured by 79 industry dummies as well as the fraction of employees at the same establishement who became unemployed in 1992-1995, in $\mathbf{E}_i$.

The human capital variables are represented by $\mathbf{HC}_i$. The human capital measures are the highest attained educational level classified in 7 levels, seniority at the establishment level and recent labor market experience using five employed/non-employed dummies for 1986-1990.

Workers with immigrant background might have on average lower seniority. This is tied to difficulties in obtaining and keeping employment. The Employment Protection Law (LAS) implying seniority rule for lay-offs might thus lead to higher lay-off risks for these workers. LAS is subject to negotiation between the employer and the labor union. We aim to examine whether the seniority rule of *last in first out* contributes to an explanation of between-group differentials in unemployment risks. These rules as such, as well as their implementation, might create unequal opportunities for individuals with immigrant background. Using the employment register and the organization identity number of establishments we can track individuals back to 1986 and construct a variable for the number of years employed at the current establishment in 1991. In this way worker seniority in 1991 is expressed in years up to 5 years and then more than 5 years. For the class of seniority above 5, we assigned average seniority from 1991 Level of Living Surveys for individuals with seniority greater than 5 years.[6]

The most important control variable for human capital and perceived productivity in general is the wage rate. The wage for the workers are computed as the monthly full-time equivalent pretax wage based on our various earnings sources.

[6]This does not alter the results on the other variables, but permits us to interpret the results in terms of years of seniority.

The idea is that the between group differences in unemployment risks can be explained by demographic and human capital measures. However, we use rather crude measures of productivity and any systematic ability differences across groups that we have not explicitly accounted for, will be captured by the group dummies in $\mathbf{D}_i$. In order to examine whether individuals associated with different regions of birth receive differentiated treatment in the labor market, we have to assure that we have accounted for any possible between group productivity differentials. This is not an easy task, but the very rich information in our data enables us to examine the possible role of ability differentials in explaining the between group differences. Various variables measuring productivity differentials other than the standard variables included in $\mathbf{HC}_i$ are denoted by $\mathbf{Z}_i$.

Apart from the wage rate that should measure productivity related ability, we use several explicit indicators of ability. Upper secondary total mean grades, IQ-test scores from the pre-military service admission tests[7] and the monthly wage in full time equivalence are our principal variables accounting for productivity differentials. School grades are missing for a large number of immigrants and the military IQ-test scores (ranging between 1 and 9) are available, except for a few foreign-born workers, only for native men. We use simulations where we aim to estimate lower bounds for between group unemployment-risks differentials assuming low productivity for the foreign born workers. The missing IQ-tests scores and school grades are set to the tenth percentile of the own region-of-birth group value which we consider to be lower than an absolute minimum. Notice that this implies extremely low grades that with today's values in the Swedish education system would normally not permit an individual to enter university. These low grades are imputed for immigrants with missing secondary high-school grades which partly cover immigrants with foreign university degrees. On the other hand, assigning the own-group tenth percentile grade for natives with missing grades also refers to individuals that have not completed high school.[8] This does not correspond to any reasonable belief, but is rather used

[7] These are general IQ-tests applicable to men as well as women.

[8] Missing values for natives can also be due to foreign high-school education.

as a means of examining whether unobserved ability differentials could be responsible for differential unemployment risks. Notice that IQ-scores and school grades in the middle of the distribution might not say much about the individuals' ability related to the ability of keeping or finding a job. What is essential here is that extremely low IQ-scores and school grades most likely indicate that any other relevant ability measure score is also low.

Assuming extremely large between-group differentials in ability, we introduce a bias against the disadvantaged groups and if we still do not succeed in explaining between-group differentials, unobserved ability differentials might then be ruled out as an explanation of the observed between group differentials in unemployment risks.

Another factor which might influence workers' unemployment risk is the individual's human capital specific to Sweden. This is everything that Swedes are assumed, on average, to know and recent immigrants not to know. Proficiency in the Swedish language is a frequent example. The difference in Sweden-specific human capital between natives and recent immigrants might decrease with the duration of stay in Sweden. Estimating within immigration year models can yield information whether differences in unemployment risks between natives and immigrants vary across various cohorts of immigrants.

The data contain information on the individuals last official immigration year to Sweden. We use this variable to define the duration of stay in Sweden. The resulting measure, however, has some shortcomings that should be mentioned. The time in Sweden for the Nordic and other European immigrants is underestimated since these individuals due to their facility of moving across the borders might have been living in Sweden several times before the last registered immigration date. For the non-European citizens, this underestimation might be balanced by a possible source of overestimation. Some of these workers might have spent some time outside Sweden without having officially emigrated and then re-immigrated to Sweden. This might be the case since being formally registered in Sweden is associated with advantages that facilitate returning to Sweden. This type of advantage is less evident for the Nordic and other European immigrants. One thing

is sure, we underestimate the stay time in Sweden for the Nordic and other European immigrants while for the non-European group we can hope that the biases cancel each other out.

Cross-section estimates of the pattern of convergence comparing various cohorts of individuals might under or overestimate the rate of income convergence between natives and immigrants if the emigration of immigrants is systematically related to their productive ability. For the non-European immigrants, however, such bias is not likely due to the fact that only a tiny fraction of these immigrants emigrate from Sweden. Our assimilation results for the non-European group is robust for this bias, while the direction of bias for the Nordic and European immigrants is unknown.[9] However, the errors in the immigration year variable cannot harm our analysis, since we also use explicit measures of human capital, the wage rate specially that must control for human capital differentials including differentials in Sweden-specific human capital.

3 Basic Empirical Findings

Results of our basic models are reported in Table 1. We experimented with various specifications departing from the specification given in equation (1). The message of the results is clear: there are significant and huge differences in risks of ending up in unemployment during the period 1992-1995. All group differences for comparable workers are significant at conventional levels. The ranking in terms of risks of unemployment is as expected: Non-European, European, Nordic and Natives. The unemployment risk is close to twice as large for the Non-European group compared with the natives. The European and Nordic workers, run around 25 and 10 percent higher risk of ending up in unemployment, compared to natives. Considering the longer unemployment duration and higher unemployment frequencies of immigrants, the real between-group differences in unemployment are even higher. (see table A.2).

[9] Edin *et al.*(2000) study this problem finding that emigration of non-OECD immigrants is not affected by this type of selection. For other immigrants, they do not present clear evidence indicating whether high or low ability individuals tend to emigrate from Sweden.

Results in Table 1 disclose that the group differentials do not reflect differences in the age structure of immigrants compared with natives, on the contrary, the group differentials increase when dummies for age groups are included. The estimates for the age groups are as expected, indicating that the youngest workers are associated with the highest unemployment risks.

The employment history measuring recent labor market experience as well as seniority in the establishment contribute very little in explaining the observed differences. Including these variables in our estimations however, leads to underestimation of the differences if employment history and seniority themselves are results of unequal treatment of different groups.

The Swedish labor protection legislation imposes seniority rules for lay-offs. For this reason we are interested in knowing whether the between-group differentials reflect possible lower seniority of immigrant workers. The labor laws also protect employees with permanent contracts to a greater extent than workers on temporary contracts. Immigrants tend to be on temporary contracts more often than the natives and thus might run a higher risk of lay-off.[10] The number of years at the current establishment is negatively correlated with the likelihood of being temporarily employed. This is due to the fact that the employers' possibilities of hiring workers on temporary contracts for longer periods is restricted by the Swedish labor law. The seniority variable has a very strong effect, but large differences in unemployment risks still remain between groups within the same seniority class. Differential risks in unemployment can therefore not be due to the labor legislation law. [11] Neither can temporary contracts be responsible for the observed differences. If this were the case, the seniority variable would reduce the group differentials to a larger extent.

Female workers have at least 10 percent higher odds of becoming unemployed compared with men (see Table 2). Notice that results in column (7) in Table 2, refer to gender differences in unemployment risks, controlling for wages.

[10] See Arai *et al.* (2000).

[11] Notice that the employer and the labor unions have the possibility to negotiate on the *last in, first out* rule and find other rankings for lay-offs.

Table 1. Logit estimates of unemployment risks. Odds ratio, standard errors in parenthesis.

	(1)	(2)	(3)	(4)	(5)	(6)
NON-EUROPEAN	1.951*	1.779*	1.865*	2.122*	1.758*	1.759*
	(.043)	(.040)	(.043)	(.049)	(.040)	(.040)
EUROPEAN	.964	1.020	1.037	1.291*	.906*	1.002
	(.019)	(.021)	(.021)	(.027)	(.018)	(.021)
NORDIC	.978	1.048*	1.076*	1.254*	.876*	.939*
	(.015)	(.016)	(.016)	(.020)	(.013)	(.014)
Age 27-35[a]				.435*		
				(.004)		
Age 36-44[a]				.252*		
				(.002)		
Age 45-55[a]				.189*		
				(.002)		
Age 56-60[a]				.268*		
				(.003)		
Seniority		.930*				
		(.000)				
Employed 1986			.441*			
			(.004)			
Employed 1987			.958*			
			(.006)			
Employed 1988			.653*			
			(.009)			
Employed 1989			.578*			
			(.010)			
Employed 1990			.420*			
			(.008)			
White collar workers[b]					.404*	
					(.020)	
Own firm[b]					.765*	
					(.034)	
Unclassified workers[b]					1.454*	
					(.020)	
Wages 1991						.999*
						(.000)
Log Likelihood	-272829	-264329	-265054	-258279	-263425	-258822
N	541,627	541,627	541,627	541,627	541,627	541,627

Notes
i) * indicates significance at 1 percent level.
a) Age dummies with individuals aged 18 to 26 as a reference category.
b) Socio-economic level dummies with blue collar workers as reference group.

Since women have lower wage rates, this variable, being correlated to the female dummy, captures the high unemployment risk. This higher risk might be due to down-sizing in the public sector during the early nineties. This is confirmed by the 10 percent higher risks of unemployment associated with the public sector dummy. Running a model including an interaction variable for female and public sector leads to an odds ratio for the female variable that is equal to one and insignificant.[12]

The pattern of job-loss risks and ending up in unemployment seems to be extremely robust for taking into account important demographic and human capital variables (see Table 2). The higher attained education level has an expected effect on unemployment risks, indicating that a higher education level implies lower risks. The Swedish economy was hit by a deep recession but different sectors where hit differently. The public sector and the manufacturing industry lost far more jobs than other sectors. The sorting of immigrants' into different industries does not seem to be an explanation of the observed differential unemployment risks. The same is true when including the fraction of individuals at the establishment who became unemployed as well as when including the fraction of immigrant workers at the establishment. This implies that general sorting mechanisms and establishment level adverse shocks are not explanations behind observed unemployment differentials between immigrants and natives.

The most striking result is that the wage variable does little in reducing the estimates for the different groups (see Table 1 and 2). If anything, wages should be considered as a good measure of individual productivity. In a sense, the wage variable reflects what the employer actually observes and perceives as productivity and therefore is a good measure of determinants of lay-off risk as compared to workers' true productivity that might be even higher than the wage but not perceived due to imperfect information on the part of employers. Immigrant workers might receive lower prices for their productivity-related characteristics. This is confirmed by previous studies reporting non-negligible unexplained wage differentials between immigrants and natives.[13] Immigrants earn less given their observed characteristics and, given this lower pay, also run a substantially higher risk of ending up in unemployment.

[12]Results of these estimations are available from the authors on request.

[13]See Wadensjö (1992) and le Grand & Szulkin (1999)

Table 2. Logit estimates of unemployment risks. Odds ratio, standard errors in parenthesis.

	(7)	(8)	(9)	(10)	(11)	(12)
NON-EUROPEAN	1.692*	2.246*	2.108*	2.023*	1.929*	2.230*
	(.040)	(.052)	(.050)	(.048)	(.047)	(.059)
EUROPEAN	1.254*	1.340*	1.264*	1.170*	1.219*	1.320*
	(.027)	(.028)	(.027)	(.025)	(.026)	(.031)
NORDIC	1.196*	1.230*	1.102*	1.137*	1.088*	1.128*
	(.019)	(.019)	(.018)	(.018)	(.018)	(.020)
Age 27-35	.654*	.493*	.471*	.505*	.763*	.765*
	(.006)	(.003)	(.004)	(.005)	(.008)	(.009)
Age 36-44	.479*	.314*	.271*	.314*	.555*	.571*
	(.005)	(.003)	(.002)	(.003)	(.006)	(.008)
Age 45-55	.390*	.232*	.188*	.233*	.404*	.417*
	(.004)	(.002)	(.002)	(.002)	(.005)	(.006)
Age 56-60	.557*	.325*	.244*	.323	.565*	.624*
	(.008)	(.003)	(.003)	(.004)	(.010)	(.011)
Female	.808*	1.143*	1.152*	1.282*	1.228*	1.290*
	(.006)	(.008)	(.008)	(.011)	(.010)	(.012)
Prim. Sch. $= 9$			.935*		1.014	1.032
			(.016)		(.018)	(.020)
Second. Sch < 3			.734*		.820*	.822*
			(.010)		(.012)	(.013)
Second. Sch ≥ 3			.758*		.818*	.869*
			(.012)		(.014)	(.016)
College < 3			.386*		.460*	.464*
			(.006)		(.008)	(.009)
University			.344*		.363*	.395*
			(.005)		(.007)	(.008)
Seniority	.950*				.947*	.951*
	(.000)				(.000)	(.000)
Number of children		.960*			.957*	.943*)
		(.004)			(.004)	(.004)
Married		.703*			.756*	.747*
		(.006)			(.006)	(.007)
Wages 1991[b]	.999*					
	(.000)					
Empl. History	YES	NO	NO	NO	YES	YES
78 Industry dummies	NO	NO	NO	YES	YES	YES
3 Occupational groups	NO	NO	NO	YES	YES	YES
Frac. of unempl.92-95	NO	NO	NO	NO	NO	YES
Frac. of Immigrants	NO	NO	NO	NO	NO	YES
Log Likelihood	-245273	-257295	-253097	-247552	-239518	-210635
N	541,627	541,627	541,627	541,627	541,627	541,627

Notes

i) * indicates significance at 1 percent level. The reference category for education level dummies is Elementary school or less. Industry dummies are based on three digit SIC, 79 industries. Missing SIC codes are classified as a separate dummy. See also notes to Table 1.

These results mean that individuals with similar demographic and human capital characteristics, employment history and with the same wage rate, within the same industry have substantially different risks of job-loss and becoming unemployed. It is easy to imagine that discrimination is involved as the main explanation for these differences. It might be argued that given all these controls, due to the relatively compressed wage structure in Sweden, differences in ability not included in these models translate not to wage differentials but rather to differential risks of unemployment. This argument implies that a (small or large) part of the observed group differences are due to unobserved ability. The next section is devoted to an examination of this hypothesis.

4 Does ability matter?

The question we analyze here is how large ability differentials are required to explain the group differentials? By ability here we simply mean ability to produce and contribute in production.

High school grades can be considered a good measure of individuals' ability to learn. The Swedish school mean grades for the period under study range between 1.00 and 5.00. Mean school grades for those whom data are available, imply that non-Europeans have a slightly lower mean grade than natives (3.15 compared to 3.31). The between group differences in grades are nevertheless statistically insignificant. The school degrees for the foreign-born individuals concern young workers who have completed their studies in Sweden. The large number of missing values hinders us in using this variable.[14]

Mainly two groups have missing data on high school grades. A first group consists of those who have not attained this degree. Basically all education obtained in Sweden is registered in our data. This implies that basically all natives that have missing grades have compulsory or elementary school as the highest attained education level. For the immigrant group, on the other

[14]Predicting school grades and thus imputing for missing values is rather inappropriate, due to lack of relevant predictors. However, we run a simple model predicting the mean school grades. These values for predicted school grades perform poorly in explaining the between-group differentials. The same is true for grades in the Swedish language subject. Vilhelmsson (2000) using data on young immigrants and natives arrive at the conclusion that the higher unemployment risk for young immigrants in Sweden cannot be explained by a number of possible determinants of unemployment including detailed data on school mean grades and grades in the Swedish language.

hand, grades from high school degrees obtained outside Sweden are systematically missing.

To investigate the role of ability to learn, we estimated a model including only observations where data is available (column 13 in Table 3). Results indicate that school grades have a strong effect on the probability of unemployment. To examine whether omitted ability to learn can explain our observed between group differentials, we assigned the tenth percentile school grades from the own-group distribution for individuals with missing high-school grades. This is a way to systematically underestimate the learning ability of the immigrants to see if there can be any truth in the belief that observed unemployment differentials reflect ability differentials. By exaggerating ability differences, we assure that any reasonable ability differentials falls within the range of the difference we have examined.

Assigning the 10th percentile own-group mean grade for individuals with missing degree leads to two types of underestimations. First, it is not obvious that natives not having attained higher education than compulsory school would obtain such low grades as 2.5 if they had pursued their education. These workers are assigned a higher grade than an immigrant that might have high school or even a university degree. Another source of underestimation is that immigrants with attained non-Swedish education corresponding to high school or higher, are assigned the low mean grade of 2.3 - 2.4.

This implies that this simulation is based on an assumption of huge differences in ability reflecting high school grades between natives and immigrants. This simulation serves as a means of testing whether such an extreme difference in ability to obtain high degrees could explain the observed between-group unemployment-risk differentials. The findings reported in Table 3 imply that ability measured as high school degrees fails to explain the immigrants' higher unemployment risks as compared to natives, despite the exaggerated between-group grade differentials. We also experimented with assigning mean own-group school grades for the native workers while immigrants were assigned 10th percentile grade from their own region-of-birth group. Results here reduced the between group differentials further, but the non-European immigrants, still had more than 50 percent higher odds of falling into unemployment.

Table 3. Logit estimates of unemployment risks. Odds ratio, standard errors in parenthesis.

	(13)	(14)[a]	(15)	(16)	(17)
NON-EUROPEAN	1.736*	1.678*	2.160*	1.909*	1.619*
	(.100)	(.134)	(.050)	(.044)	(.039)
EUROPEAN	1.262*	1.360*	1.301*	1.209*	1.124*
	(.070)	(.027)	(.026)	(.025)	(.024)
NORDIC	1.152*	1.079	1.249*	1.169*	1.099*
	(.043)	(.055)	(.019)	(.019)	(.017)
Actual Mean grades	.997*				
	(.000)				
Actual IQ-test scores		.878*			
		(.003)			
Mean grades				.997*	
				(.000)	
IQ-test scores					.894*
					(.002)
Age 27-35	.396*	.447*	.432*	.424*	.425*
	(.004)	(.005)	(.004)	(.004)	(.004)
Age 36-44	.256*	.279*	.249*	.213*	.236*
	(.005)	(.006)	(.002)	(.002)	(.002)
Age 45-55	.283*		.187*	.155*	.168*
	(.017)		(.002)	(.001)	(.001)
Age 56-60	.286*		.266*	.219*	.239*
	(.044)		(.003)	(.003)	(.003)
Female	1.349*	1.218	1.124*	1.156*	.967*
	(.014)	(.008)	(.007)	(.008)	(.007)
Log Likelihood	-104128	-240640	-258142	-257066	-257441
N	189,654	116,418	541,627	541,627	541,627

Notes

i) * indicates significance at 1 percent level. See also notes to Table 1 and 2. We also ran all these specifications including human capital and demographic variables as well as industry and occupation dummies. Results are essentially unchanged introducing these controls.

a) Age dummy variables for 44-60 are dropped due to collinearity.

Another experiment was to exaggerate ability differentials between the native men on the one hand and women and immigrants on the other. We use IQ-test scores from pre-military enlisting tests that are constructed in a general way and according to descriptions of these tests are applicable to men as well as to women. These tests are available mainly for Swedish men. For some immigrants, we observe actual test-scores. Again, assigning the 10th percentile test scores from the own-group distribution for those with missing scores (mainly immigrants and women) and adding this variable to our estimations, we obtain the following results. First, the results in column 14 in Table 3 confirm that observed IQ-scores have the predicted effect. Using the observed IQ-scores and the simulated values for immigrants and women with missing scores, it turns out that the IQ-test score variable has a strong effect and is highly significant (column 17, Table 3). The higher unemployment risk for women almost disappear, indicating that the exaggeration of between-group differentials function as a powerful instrument. The interpretation is that if differences in unemployment risks between men and women stem from IQ differences, it would imply an unrealistic pattern, namely that the average women IQ would be at the 10 percentile of the mens IQ distribution. Our results imply that the between-group differences in unemployment are too large to be explained with any reasonable ability differentials between natives and immigrants. We also experimented with assigning average IQ-scores to all men (and in another setup all natives), while immigrants were assigned the 10th percentile score. These experiments returned essentially the same results in that they fail to explain the between-group unemployment-risk differentials.

A question that may arise is how large IQ-gaps are required to purge the unemployment-risk differentials. In order to purge the unemployment differentials in the estimation, it doesn't help much to set the IQ-test scores for immigrants to zero. To obtain an insignificant coefficient we need to go beyond the range of the IQ-test scores. Our simulations indicate that in a model with no human capital controls, we have to assign a test-score of -4 to obtain an odds ratio of one, i.e. no systematic differences. When we control for human capital variables, even -4 is not enough and we have to go to a value of -11. The message of these simulations is that the observed unemployment differentials between natives and Non-Europeans can be translated to ability differentials that are as large as the range of the test-scores and when comparing na-

tives and non-European immigrants with comparable education, unemployment differentials correspond to ability differentials that are 1.5 times the range.

Our conclusion is that the remaining candidate for explaining the observed pattern above is discriminatory behavior and stereotype beliefs. These results indicate the existence of substantial discrimination in the Swedish labor market.[15]

5 Convergence in unemployment-risk and Wages

Results reported above suggest that there are significant between-group differences in unemployment risks that we do not succeed in explaining by various individual characteristics, controlling for industry affiliation and occupation. These differences in unemployment risks reflect average differences between various groups. Another dimension is the variation of within immigrant-group differentials across different cohorts. Unemployment risks might vary across individuals with various duration of stay in Sweden. Two issues come to mind when considering the evolvement of unemployment risks for individuals over time. First, individuals might accumulate Sweden-specific human capital and thus decrease the likelihood of losing their jobs and becoming unemployed. Second, immigrants might face decreasing discrimination as they stay longer in Sweden. Running within immigration-year regressions and estimating the odds-ratio for becoming unemployed for the various immigrant groups compared to natives yields indications about the process of convergence with respect to unemployment risks. These measures, nonetheless, capture cohort quality differences as well. Controlling for quality differences among individuals using the set of variables above, removes between group differences in worker quality across immigration cohorts.

Odds-ratios from within immigration-year logit estimations explaining the risk of becoming unemployed sometime between 1991 and 1995 are plotted in Figures 1-3. We use two models, the first concerns raw-differentials in unemployment risks estimated in a model with only group dummies and the second, also uses controls for human capital and demographic characteristics. There seems

[15]Based on a sample of unemployed in 1998, Arai *et. al.* (1999) report results indicating that there are no systematic differences between immigrants and natives with respect to attitudes towards work and search behavior. They also report that more than 2/3 of unemployed natives and immigrants believe that having dark hair and skin as well as foreign names influences chances of obtaining a job to some, high or very high degree.

to exist a slight narrowing of unemployment-risk gaps between immigrants and natives as immigrants stay longer in Sweden. This is especially true for the Nordic and other European immigrant groups (Figure 1 and 2). Considering immigrants from outside Europe, the narrowing of unemployment risks occurs mainly in the first seven or eight years. After that basically nothing changes. Another difference between immigrants from Europe and outside Europe is that non-Europeans converge to an unemployment risk that is almost double as high as that for natives. The European and Nordic immigrants catch up but only after more than twenty years.

We also studied wage differentials between immigrants and natives, for various immigration cohorts. The wage differentials for different Nordic and European cohorts are plotted in Figures 4 and 5. The overall pattern is that these immigrants catch up immediately if they are employed and they might also earn more than natives. The within group differentials between cohorts are very small and often not statistically different from each other. The earliest cohorts seem to be slightly different from the other cohorts. The earliest Nordic immigrants' lower wages are explained by their lower level of education while the earliest European cohorts higher wages are explained by their higher level of education.

Results plotted in Figure 6 show the wage-gap differences between various non-European cohorts compared to natives. Two things differ in comparison to the Nordic and European immigrants. The non-European immigrant group earns systematically lower wages as compared to natives. This wage gap is however rather invariable with respect to duration of stay in Sweden. There seem to be a slight and slow wage convergence ranging between 5 to 10 percent lower wages than natives.

The earlier income convergence studies conclusion about variation in different immigrant groups assimilation rate is almost entirely due to variations in employment opportunities. An important implication of our results is that the observed income-convergence pattern for immigrants pointing at a rapid convergence during the first years and a remaining huge income gap thereafter perfectly reflects the unemployment-risk differences reported here. The basic message here is that the main hinder to convergence is due to difficulties in finding and keeping employment.

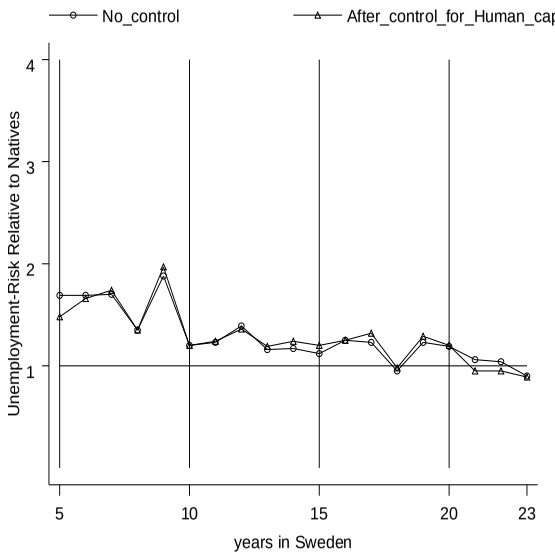

Figure 1. Unemployment, Nordic immigrants.

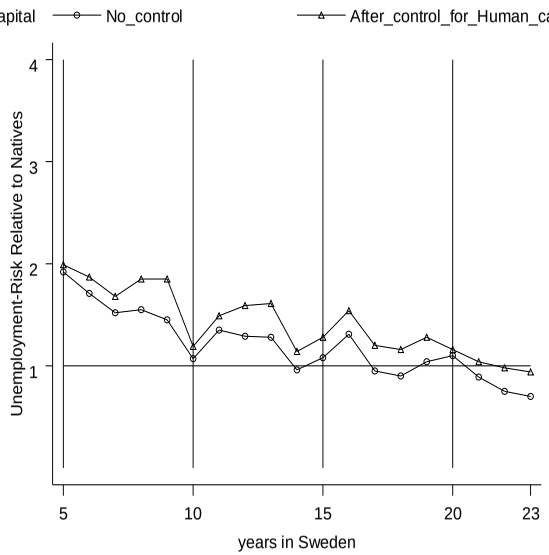

Figure 2. Unemployment, European immigrants.

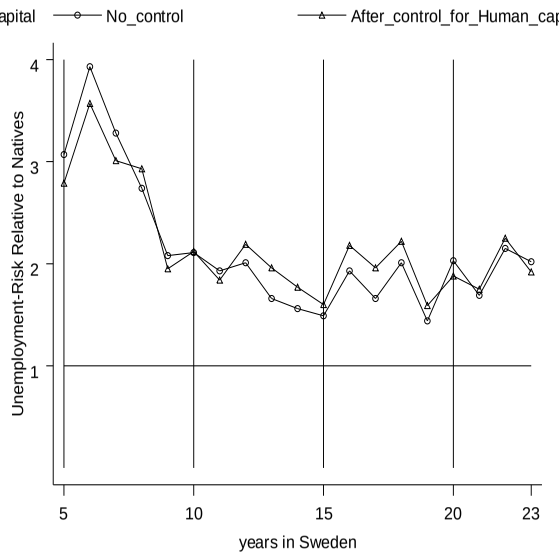

Figure 3. Unemployment, Non-European immigrants.

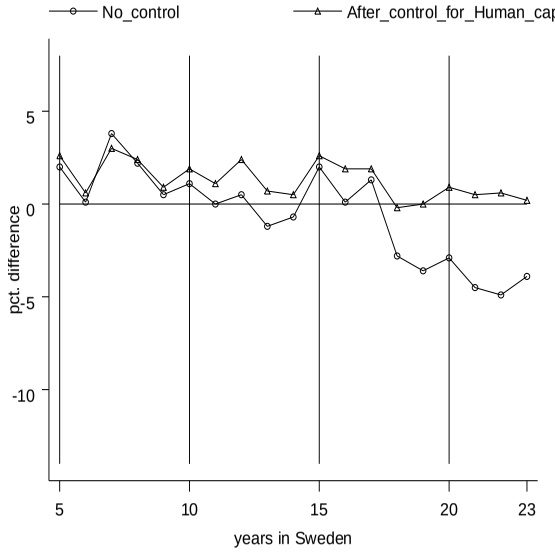

Figure 4. Wages, Nodic immigrants.

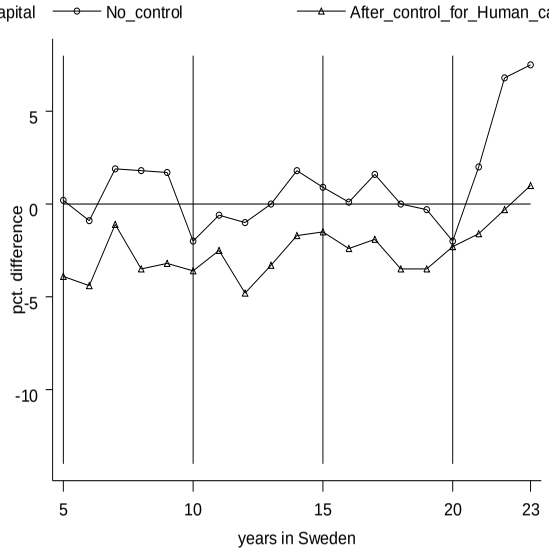

Figure 5. Wages, European immigrants.

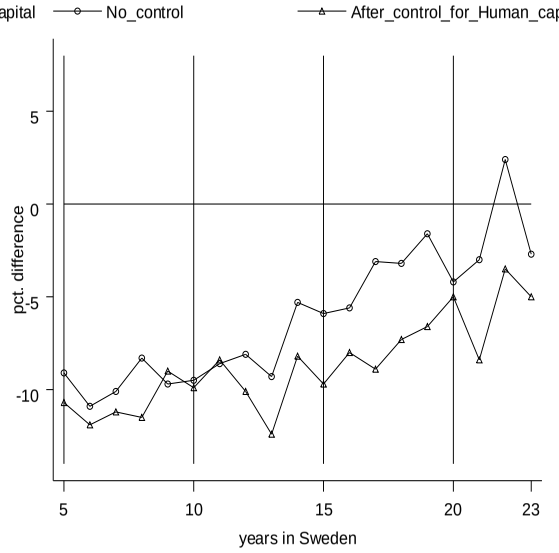

Figure 6. Wages, Non-European immigrants.

6 Conclusions

We reported results indicating huge differentials in unemployment risks between natives and immigrant workers that cannot be due to group differentials in demographic composition or differences in human capital variables such as level of education, recent labor market experience and seniority at the establishment level. These between group differentials exist within industries, within establishments with the similar share of immigrant workers, and within establishments with similar rate of unemployment associated with their employees, for blue- and white collar workers and for individuals with the same wage rate. These results rule out cross-section productivity differentials and the general sorting of immigrant workers across industries and establishments with systematic different job-security as explanations of the unemployment-risk gap between immigrants and natives.

Existing large between group differences in unemployment risks for individuals with the same seniority at the establishment level imply that the seniority lay-off rule of *last in first out* is not responsible for the observed differentiated outcome. The probability of being on a temporary contract is negatively related to seniority due to legal duration limitations in temporary contracts. Therefore, our observed risk differences do not reflect systematic differences in contract forms for native and immigrant workers.

Allowing for the possibility that cross-section productivity differences do not capture all relevant factors determining individual unemployment risks, we examine the role of potential omitted ability. This is performed by means of a biased-test. We introduce a negative bias against immigrant workers by assigning within-group tenth percentile high-school and IQ-scores for almost all immigrants. Such a bias exaggerates ability differentials between native and immigrant workers beyond all reasonable limits. Even after introducing such an extreme bias against immigrants, the major part of the higher unemployment risks remains unexplained. These results suggest that these differentials reflect discriminatory treatment based on prejudices and stereotype beliefs about individuals born in different parts of the world.

The European and Nordic immigrants' wages catch up quickly with the natives, indicating no significant cohort differences with respect to wages. As for unemployment risks, there is some evidence of convergence and these groups catch up but only after more than 20 years in Sweden. The wage differentials between var-

ious non-European immigrant cohorts and natives is on average 7%, varying between 4 percent for the earliest cohorts, and 12 percent for recent cohorts. We find that the main cohort differences in unemployment risks, within the non-European immigrants, are between those who have stayed in Sweden less than 7-8 years, and those who have stayed longer - up to at least 22 years. This simply means that employment chances of non-European immigrants converge somewhat to the chances of natives within the first 7 years but that no convergence takes place thereafter. An important implication of our results is that the observed income-convergence pattern for immigrants pointing at a rapid convergence during the first years and a remaining huge income gap thereafter perfectly reflects the unemployment-risk differences reported here. The basic message here is that the main hinder to convergence is due to difficulties in finding and keeping employment.

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Appendix A.1: Description of the variables

Individual outcome variables:
Unemployment risk: If the individual has been unemployed sometime during 1992-95 according to the National Labor Market Board's (AMS) Event Database (Händelsedatabasen) containing individual records of all individuals who have registered as unemployed at the labor offices. Registering as unemployed is a necessary condition for being eligible for unemployment benefits as well as having the possibility of participating in labor market programs.
Log wage: Monthly pre-tax fulltime equivalent wage in 1991 based on the Swedish Trade Union Confederation (LO) and the Swedish Employers' Confederation (SAF) wage data and supplemented with the income registers.
Log labor earnings: Log yearly labor earnings in 1991 according to the Income and Assets register (Inkomst- och förmögenhetsregistret).

Region of Birth Dummies:
Sweden (reference), **Nordic**, **European** and **Non-European** (including Turkey) based on information in the Total Population Register (RTB).

Demography variables:
Female and **Age Dummies**. Age refers to age in 1991 and the reference in the estimations is $18 \leq \text{Age} < 26$. **Married** and **Number of children** (in the individual's care) are from the Population and Housing Census in 1990 (FoB90).

Human Capital:
Education level Dummies are based on the 2 digit level of the Swedish Education Nomenclature (SUN-codes) from the Swedish Education Register (Utbildningsregistret). These are *Elementary School* (less than 9 years), *Compulsory School*, *Upper Secondary School*<3 (at most 2 years), *Upper Secondary School* ≥ 3 (long Upper Secondary School (3-4 years)),*College* (Shorter University Education) and *University*.
Seniority is the number of years at the establishment based on tracing the individual back to 1986 in the Employment Register (Sysselsättningsregistret). The varible is left censored at 5,5 years. Individuals having more than 6 years of seniority are given the mean senority in Sweden according to the Level of Living Survey i.e. 16 years.
Employed Year variables indicate that the individual was employed in november of that year according to the Employment Register.

Ability Measures:
Mean grades: Mean grades if the individual attended Upper Secondary School, missing if not or if having foreign Upper Secondary education.
IQ-test scores: The actual IQ-test score for those who attended the general pre-enlisting IQ-test. Scores range between 1 and 9. These data are from the Pre-Military Enlisting Register (Inskrivningsregistret) provided by the National Service Administration (Pliktverket).

Time in Sweden:
Immigration year: Individual's last immigration year (immigration before 1968 is registered as immigration in 1968) from the Total Population Register (Registret över totalbefolkning (RTB)).

Industry and Occupational Groups:
79 Industry dummies based on the 3-digit SIC (SNI69). **Blue-collar** (reference), **White-collar worker** and **Own firm** (if working at own firm) according to the Population and Housing Census of 1990 (FoB90). These refer to occupation calssifications in 1990 and not necessarily to the current employment. Individuals with missing codes are coded as **Unclassified**.

Appendix A.2. Sample Means

Table A Sample Means

	ALL	Natives	Nordic	European	Non-European
Unemployed 92-95[a]	.202	.201	.197	.195	.329
	(.40)	(.40)	(.39)	(.39)	(.47)
Unempl. Cases[a]	5.12	5.08	5.37	5.21	5.91
	(4.53)	(4.51)	(4.80)	(4.65)	(4.64)
Unempl. Duration[a]	138.90	136.06	156.67	177.61	160.56
	(201.48)	(196.76)	(223.50)	(254.96)	(240.16)
Age	39	38	42	43	38
	(10)	(11)	(10)	(09)	(9)
Female	.56	.56	.60	.50	.41
	(.49)	(.49)	(.49)	(.48)	(.49)
Elementary Sch. < 9	.08	.07	.20	.14	.12
	(.27)	(.28)	(.40)	(.34)	(.32)
Compulsory Sch. $= 9$	.08	.08	.11	.09	.11
	(.27)	(.27)	(.31)	(.28)	(.31)
Upper Sec. Sch < 3	.37	.37	.37	.28	.30
	(.48)	(.48)	(.47)	(.44)	(.45)
Upper Sec. Sch. ≥ 3	.11	.11	.09	.15	.11
	(.32)	(.32)	(.29)	(.37)	(.32)
College < 3	.19	.20	.13	.14	.14
	(.38)	(.39)	(.33)	(.33)	(.34)
University	.17	.17	.10	.20	.22
	(.36)	(.36)	(.29)	(.39)	(.40)
Seniority	3.59	3.59	3.83	3.83	3.11
	(1.83)	(1.83)	(1.85)	(1.79)	(1.81)
Wages	14,606	14,626	14,226	15,109	13,822
	(4,810)	(4,815)	(4,315)	(5,509)	(4,551)
Employed 1986	.91	.91	.96	.95	.86
	(.27)	(.27)	(.18)	(.20)	(.34)
Employed 1987	.96	.96	.98	.99	.98
	(.44)	(.39)	(.31)	(.38)	(.73)
Employed 1988	.95	.95	.97	.97	.92
	(.20)	(.21)	(.15)	(.16)	(.25)
Employed 1989	.96	.96	.97	.98	.94
	(.18)	(.19)	(.14)	(.15)	(.23)
Employed 1990	.97	.97	.98	.98	.96
	(.15)	(.17)	(.14)	(.15)	(.20)
N	541,672	489,593	27,453	15,449	9,177

Table A.2. Continued.

	ALL	Natives	Nordic	European	Non-European
Missing mean grades	.65	.63	.86	.89	.85
Observed mean grades	3.31	3.31	3.21	3.23	3.15
Mean grade replacing missing with own-group					
1th percentile	2.30	2.36	1.93	1.77	1.90
	(.81)	(.82)	(.56)	(.55)	(.57)
5th percentile	2.60	2.64	2.29	2.13	2.16
	(.63)	(.64)	(.43)	(.44)	(.47)
10th percentile	2.77	2.80	2.51	2.45	2.41
	(.54)	(.55)	(.36)	(.35)	(.39)
25th percentile	3.01	3.03	2.81	2.80	2.73
	(.44)	(.44)	(.28)	(.27)	(.30)
Missing IQ-test score	.78	.77	.92	.94	.92
	(.40)	(.41)	(.26)	(.22)	(.25)
Observed IQ-test scores	5.45	5.48	4.72	4.90	3.57
	(1.98)	(1.97)	(1.94)	(2.12)	(2.29)
Mean IQ-scores replacing missing with own-group					
1th percentile	1.95	2.03	1.28	1.19	1.19
	(2.04)	(2.11)	(1.12)	(.97)	(.91)
5th percentile	2.70	2.80	2.20	1.19	1.19
	(1.72)	(1.74)	(1.89)	(.97)	(.91)
10th percentile	3.42	3.57	2.20	2.14	1.19
	(1.45)	(1.40)	(.89)	(.79)	(.90)
25th percentile	4.16	4.34	3.13	2.14	1.19
	(1.25)	(1.13)	(.70)	(.79)	(.91)
N	541,672	489,593	27,453	15,449	9,177

Notes

a) Unemployment events and durations defined for the period 1992-1995

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