Why educational attainment is lower among children of immigrants in Denmark: A dynamic analysis of educational progression

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Abstract

Recent studies show that the educational attainment of children of immigrants in Denmark is much lower than the educational attainment of native Danish children. The purpose of this paper is to determine at what stages of their educational careers ethnic minority youth fall behind their native Danish peers and the magnitude of intergenerational transmission. Separate analyses are undertaken for children of immigrants in the aggregate and for the two largest ethnic minority groups; the Turks and the Pakistanis. A dynamic discrete model of educational progression from grade school to either completion of a vocational upper secondary education or enrollment in a qualifying education upon graduation from an academic upper secondary education is formulated and estimated, controlling for individual, family background, and neighborhood characteristics as well as unobserved heterogeneity. The analyses show that high dropout rates particularly from vocational upper secondary educations are an important reason for the observed differences in educational attainment. Interestingly, family background and neighborhood characteristics do not significantly affect dropout rates from vocational upper secondary educations for any of the ethnic minority groups. Other main findings are that intergenerational transmission is most important early in the child's educational career and that the magnitude of the transmission is greater for native Danes than for ethnic minorities. Finally, simulations show that behavioral differences in educational choices exist among ethnic minority groups and between ethnic minority groups and native Danes. Weak family background is identified as another important reason for the particularly low educational attainment of the Turks.

3.1. Introduction

Over the coming decades, the share of retired people to people in the labor force in Denmark is projected to increase by 12 percentage points to 37 percent in 2030 (Kongsø and Groes 2002). Because the social welfare system is organized as a redistribution of income by taxation from people currently in the labor force to retired people and other recipients of public transfers and not as in many other countries as an individual insurance system, this change in population structure could put the Danish welfare state under pressure. In addition to policies already being implemented to increase the labor force, strengthening the integration of immigrants and their children is necessary to reduce the financial burden in the future. Projections show that the number of immigrants and their children will almost double over the next 20 years and ethnic minorities from less developed countries for whom the unemployment rate is particularly high will account for 60 percent of all immigrants and their children (Tænketanken 2002). Inadequate educational attainment and inadequate Danish language skills in conjunction with the structure of the labor market with a high minimum wage and few unskilled jobs are considered the main reasons for the low employment rate among ethnic minorities. Consequently, increasing the educational attainment of ethnic minorities, particularly from less developed counties, is one of the most important social goals in Denmark.

In this paper, a dynamic discrete model of educational progression from grade school to a qualifying education[1] is developed and estimated. The main objectives are to identify at which stages in the educational system ethnic minority children face barriers to educational progression and to investigate how family background, neighborhood and individual characteristics affect educational choices of native Danes and ethnic minorities.

The model is inspired by Cameron and Heckman (2001) who analyze schooling attainment as the outcome of decisions made at each age and each grade from feasible person-specific choice sets. Many school systems, including the Danish school system, contain parallel branches of study at the upper secondary and tertiary level. Hence students do not only face the decision to continue at the next higher grade level, but also which branch to choose. By modeling educational choices as a sequence of age-and-grade-specific multinomial decisions, the Cameron-Heckman model is able to accommodate both the institutional structure of the educational system, the effect of interruptions such as dropping out on educational attainment, and to control for dynamic selection bias.

[1] The Danish educational system consists of nine years of compulsory grade school, followed by upper secondary education, and finally a choice of advanced tertiary educations. The upper secondary level is divided into one vocational and one academic track. A qualifying education provides qualifications for specific occupations in the labor market. Qualifying educations include vocational upper secondary educations and advanced tertiary educations. Academic upper secondary educations are not considered a qualifying education because they qualify for further study not for any particular occupation.

Colding (2004) applies this very comprehensive model to analyzing educational progression of ethnic minorities and native Danes. She concludes that the model, due to the generality of the specification, demands fairly large data sets to be useful in empirical research. Consequently, a more parsimonious version of the Cameron-Heckman model, similar to the one applied by Breen and Jonsson (2000) to a large Swedish data set, is developed in this paper.

Breen and Jonsson (2000) disregard the age dimension and model educational transitions from different grade levels. Their results show that social background effects on transition probabilities vary according to the particular choice made at a given transition point, and that the probabilities of making particular choices vary depending on the educational pathways that students follow. In countries where the educational system contains parallel branches, a model of educational transitions that can take into account the institutional structure of the school system is thus better able to explain why educational choices differ according to social background, sex, ethnicity, and other exogenous variables. Such a model is also more appropriate for identifying at which transitions the effects of explanatory variables are greatest.

A number of Danish studies of educational choices of ethnic minorities exist (Hummelgaard et al. 1998, Larsen 2000, Schmidt and Jakobsen 2000, Mehlbye et al. 2000, Ministry of Education 2001, Rosholm et al. 2002, Jakobsen and Smith 2003, Jakobsen and Rosholm 2003, Colding 2004, Colding and Husted 2003, Højmark Jensen 2003). One of the main findings is that ethnic minorities are less likely to complete a qualifying education compared to native Danes. Rosholm et al. (2002) find that the magnitude of intergenerational mobility is the same for ethnic minority and native Danish youth. An undesirable result they conclude because ethnic minority children generally come from more disadvantaged backgrounds and it would thus be beneficial if their intergenerational mobility was greater than the one of native Danes.

Most of the existing statistical analyses focus on educational attainment of immigrants[2] rather than of children of immigrants who are born in Denmark. Using bivariate analyses, Colding and Husted (2003) show that children of immigrants and immigrants who arrive in Denmark before school age from less developed countries start an upper secondary education at almost the same rate as native Danes, but the dropout rate is much higher, particularly from vocational upper secondary educations. Immigrants who arrive in Denmark during school age (age 6-12) are less likely to start an upper secondary education and their dropout rate is even higher. The study also corroborates two main findings in the Danish

[2] According to Statistics Denmark‘s definition, an immigrant is a person born abroad to parents who are both foreign citizens or are born abroad. If information is only available for one parent she must be a foreign citizen or born abroad. If there is no information about either parent, but the person is born abroad, she is also categorized as an immigrant.

literature, namely, that substantial differences exist between the sexes and between children of different countries of origin. The main problem then seems to be that ethnic minority children do not complete the upper secondary educations they start; dropout rates from vocational upper secondary educations are of particular concern.

Research on the causes of dropping out has focused on a wide range of related factors including family background, particularly socioeconomic status; ethnicity; academic preparedness; teen pregnancies and early marriages; drug use; labor market conditions; peer effects; residential mobility and single parenthood; extracurricular activities; and gender (Johnes and McNabb 2004, DesJardin et al. 2002, Cameron and Heckman 2001, Lillard and DeCicca 2001, Montmarquette et al. 2001, Eide and Showalter 2001, Monk et al. 2000, Eckstein and Wolpin 1999, Rees and Mocan 1997, McNeal 1995, Ensminger and Slusarcick 1992, Rumberger et al. 1990, Upchurch and McCarthy 1990, Mensch and Kandel 1988, Anderson and Latts 1965). The focus of this predominantly American literature has been on high school dropouts, including dummy variables to account for ethnic differences among Whites and Blacks, Hispanics and Asians (see Haveman and Wolfe (1995) for a review).

Two quantitative studies have investigated dropout decisions from qualifying educations among a sample of immigrants in Denmark. Jakobsen and Smith (2003) find that inadequate Danish language proficiency significantly affects the probability of dropping out, but they find no significant effects of parental background variables. They use a binary probit model without controlling for dynamic selection bias and therefore point out that their findings must be taken with reservations. However, using a competing risk duration model controlling for sample selection and unobserved heterogeneity to analyze the time patterns of dropout rates Jakobsen and Rosholm (2003) do not find significant effects of parental background variables on dropout rates either.

Vocational upper secondary educations consist partly of time spent at vocational schools and partly of an apprenticeship with an employer. According to Mehlbye et al. (2000) and Schmidt and Jakobsen (2000), discrimination by employers is another important reason ethnic minority children have high dropout rates from vocational upper secondary educations as they are unable to find an apprenticeship and thus unable to complete their education. In addition, careers guidance officers at vocational schools argue that ethnic minority children write too few applications and lack the social network necessary to find an apprenticeship (Højmark Jensen 2003).

The dynamic statistical model developed in this paper is estimated using administrative individual-level panel data from statistical registers at Statistics Denmark. Information is available on all immigrants and their children and on 10 percent of the native Danish population from 1984 to 2001. The analyses focus on children of immigrants and children of

native Danes because both ethnic groups spend most of their childhood in Denmark and thus attend Danish grade school which should provide similar prerequisites in terms of educational preparedness and Danish language proficiency necessary for further educational progression. Separate analyses are also undertaken for children from the two largest ethnic minority groups; the Turks and the Pakistanis.

The paper is organized as follows. The Danish educational system and the administrative panel data sets used are described in section 2 and 3, respectively. In section 4, the model of the educational system used in the paper is described and bivariate analyses of educational progression of native Danes, children of immigrants in the aggregate, Turks and Pakistanis are discussed. The explanatory variables and hypotheses of their effects on educational choices are discussed in section 5. The econometric model is specified in section 6, marginal effects and simulations based on model estimates are presented in section 7. Finally, the paper concludes in section 8.

3.2. The educational system

The Danish educational system consists of nine years of compulsory grade school, followed by an optional 10^{th} year of grade school, upper secondary school, and finally advanced educations. The upper secondary level is divided into one vocational and one academic track. Academic upper secondary schools qualify the student for entry into advanced educations at the tertiary level, but do not qualify the student for any particular job category. Qualifying educations that provide the student with formal qualifications of direct use in the labor market thus include vocational upper secondary educations and advanced educations.

To comply with the nine years of compulsory education, about 86 percent of children in Denmark attend public schools and the remaining 14 percent attend private schools. Public grade schools are comprehensive schools managed by the municipalities. Following the Danish constitution, there is no tuition fee in public schools and books are free. The share of children attending private schools has been increasing over the past few years. These schools are heavily subsidized by the state which finances about 80 percent of their total costs.

There are approximately 85 different vocational upper secondary educations, ranging from clerical education to training in such skills as carpentry, plumbing and car mechanics. In 1998, 33.4 percent of native Danes and 39.7 percent of children of immigrants started a vocational upper secondary education upon completion of grade school (Colding and Husted 2003). These educations consist partly of time spent at vocational schools and partly of an apprenticeship with an employer and take between two to four years. Vocational upper secondary educations are financed and managed by the state.

About 54.6 percent of native Danes and 42.2 percent of children of immigrants started an academic upper secondary education upon completion of grade school in 1998 (*ibid.*). The share of girls is much larger than the share of boys and the difference between the two has been increasing over the past decade. Some upper secondary schools are financed and managed by the counties while others are financed and managed by the state.[3]

Tertiary level educations are usually divided into three groups according to the duration of the education. Short advanced degrees take one to three years and typically aim at a specific field such as technicians, engineers and computer scientists. Medium advanced degrees take three to four years and cover a great variety of professions, including grade school teachers, nurses, journalists and social workers. Long advanced degrees take five to six years and are research based degrees undertaken at universities. With a few exceptions admission to advanced educations is restricted to students who have completed an academic upper secondary education and depends on the student's grade point average.[4] Most advanced educations are financed by the state, but the universities enjoy a high degree of autonomy, particularly with regard to the contents of the programs. Tuition in advanced education is free.

In addition to the educations described above are the Civil Service educations such as the police, the national transportation service and the national mail service. Furthermore, educations within the armed forces and in the private sector such as banking, insurance and shipping can be pursued.

Previously, there was a sharp divide between the branches of the educational system. Only a small proportion of children, primarily those with university educated parents, went to academic upper secondary school and subsequently pursued a university degree. Over the past 30 years, however, academic upper secondary school has become more accessible and consequently a larger share of the population now chooses an academic upper secondary education over vocational and other educations.

One reason academic studies have become more accessible is that the state has to a large extent taken over the financial responsibility for students above the legal age of 18. The fundamental principle is that everyone 18 years of age and older is entitled to economic support from the government if she attends an eligible educational program and is personally eligible. The support is provided by the State Educational Grants and Loans Scheme, managed by the Danish Students' Grant and Loans. The grant is sufficient to cover living expenses and study related expenses, including books. The grants and loans

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[3] A few private high schools exist in Denmark. These are highly subsidized by the state which finances nearly 90% of their costs.

[4] One exception for example is that a few vocational upper secondary educations qualify the student to pursue selected engineering programs.

scheme is the only source of economic support of any significance for students in Denmark, as universities and other education institutions play no direct role in the financial support of students, and parental support is limited.

In 2001, 298,100 students received student grants, of these 116,500 attended upper secondary educations while 181,600 were enrolled in advanced educations. The total amount disbursed was DKK 10.5 billion[5] which accounted for 0.77 percent of Denmark's GDP.

3.2.1 A model of the educational system

In this paper, the educational system is modeled as shown in figure 3.1. Individuals are followed from they leave grade school. The model does not differentiate between individuals who leave grade school after 9th grade or 10th grade. Educational choices available at this time are to start either a vocational or an academic upper secondary education or to leave the school system. Students who start a vocational upper secondary education can complete the education, they can change to and complete an academic upper secondary education or they can drop out of the educational system. Similarly, students who start an academic upper secondary education can complete the education, they can change to and complete a vocational upper secondary education or they can drop out of the educational system. Upon completion of an upper secondary education, the student can start a qualifying education.

Students with an academic upper secondary education most often continue their educational careers in an advanced education, but it has also become increasingly common for students in clerical vocational educations to take a supplementary one-year academic upper secondary education to increase their chances of finding an apprenticeship. In the model, these students will complete an academic upper secondary education after starting a vocational upper secondary education, and subsequently enroll in a vocational upper secondary education again at the tertiary level. Most students who complete a vocational upper secondary education leave the educational system to join the labor market, but a few continue in the educational system. Students in a qualifying education may either graduate or drop out.

[5] This amount is equivalent to about 1.4 billion US$.

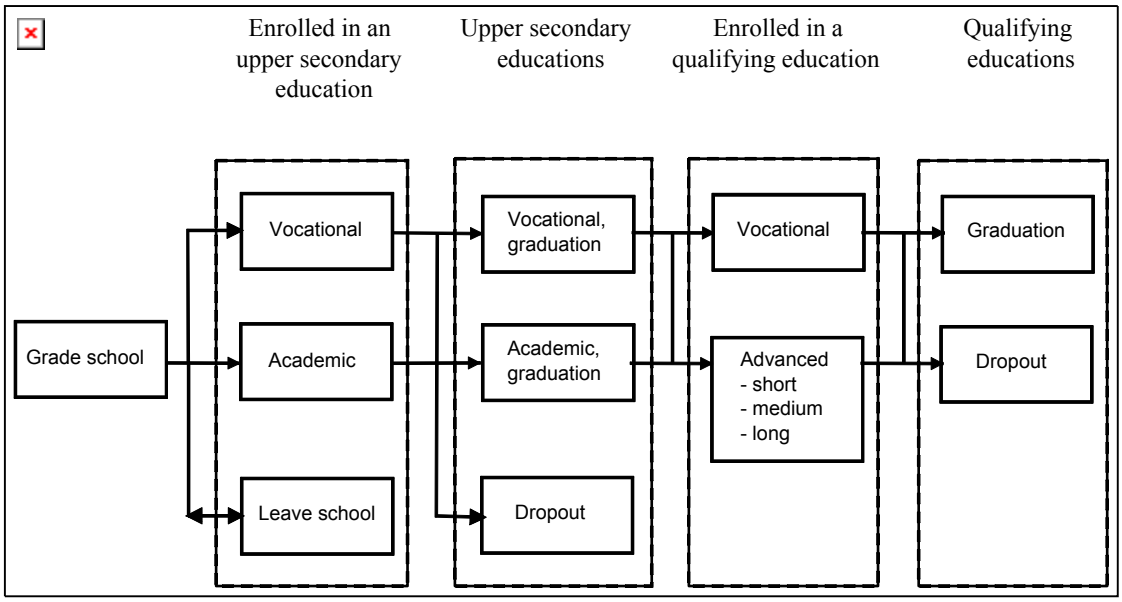

Figure 3.1. Model of the educational system

3.3. Data

In 1968, social security numbers were introduced in Denmark and since then a large number of public authorities and public and private institutions and organizations have submitted individual level data to Statistics Denmark. Using this wealth of information, the Institute of Local Government Studies – Denmark (AKF) has established two panel data sets. One is a census of all immigrants and their children, the other is a 10 percent sample of the entire Danish population aged 15 and above. Both the census and the 10 percent sample are updated annually and currently cover the period 1984-2001. Information is available on a wide variety of topics, including demography, housing and change of address, labor market attachment, educational enrollment and attainment, income and wealth, social benefits, and health. The analytical unit in both data sets is the individual and not the household but for ethnic minorities, household information can be readily computed from the census. For native Danes, parental information is available in a separate data set for selected cohorts of children.

Unlike survey data, administrative data from statistical registers are not susceptible to errors in reporting due to memory issues, self presentation concerns or comprehension. Another advantage is that attrition only occurs at death or emigration. On the downside, however, administrative data do not provide the kinds of information available from clarifying behavioral questions in surveys such as reasons for dropping out of school, Danish

language proficiency and religious affiliation. Unfortunately, information about a student's grade point average from grade school is not available either.

3.3.1 Sample characteristics

The samples used for native Danes and children of immigrants include children from they are 15 years old and as long as they are present in the data. The population of children of immigrants is very young. In 2000, the total number of children of immigrants from the two largest ethnic minority groups in Denmark, Turkey and Pakistan, was 19,734 and 7,567, respectively. About 80 percent of the Turks and 65 percent of the Pakistanis were 15 years or younger and almost no children were above the age of 25. Consequently, it is not possible to follow all individuals to age 30 when most people have completed their qualifying education. The sample is unbalanced. The fact that many individuals' educational careers are censored must be taken into account when modeling their educational choices as further discussed in section 4.

The samples have been reduced in the following ways. First, only children who are enrolled in grade school at age 15 are included because it is important for the analysis of subsequent educational decisions at the upper secondary level to model the path leading up to the decision.[6] Second, children who are not present in the data set in two or more consecutive years are only included in the analysis up until the year they leave the data set, even if information is available for later years. The reason is that information about the individual's educational behavior abroad is not available in the data and it is thus not possible to analyze her educational progression. If the individual is only away one year, it is assumed that the educational attainment is the same upon her return as the year before she left. Third, the individual has to be present in the data at least two years after completion of grade school to be included in the analyses as will be further discussed in section 4.

In addition, the sample of ethnic minorities is limited to individuals born in Denmark to immigrant parents.[7] Most of these individuals have lived all their life in Denmark and have attended Danish schools. Their educational choices can thus more readily be compared to those of children of native Danes. Secondly, the analyses of children of immigrants in the aggregate include individuals from so-called less developed countries which include countries outside Europe, North America, Japan, Australia and New Zealand. According to the

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[6] The share of children who have already started an upper secondary education at age 15 is 2 percent for native Danes, less than 1 percent for the Turks, 4 percent for the Pakistanis, and 3.4 percent for the children of immigrants in the aggregate. In addition, 2 percent of the native Danes did not have information about educational enrollment at age 15. These individuals were also dropped from the analysis as were the 6.4, 8.1 and 6.7 percent of the Turks, the Pakistanis and the children of immigrants in the aggregate without educational information at age 15, respectively.

[7] This is Statistics Denmark's definition of a so-called second-generation immigrant. See footnote 2 for a definition of an immigrant.

definition, Turkey, Cyprus as well as some countries of the former Soviet Union are also categorized as less developed.[8] Third, analyses are undertaken separately for children of immigrants from Turkey and Pakistan. Previous analyses (Colding and Husted 2003, Ministry of Education 2001, Hummelgaard et al. 1998) suggest that educational attainment vary greatly by country of origin and that the educational attainment of Turkish and Pakistani children is very different. Turkey and Pakistan are the largest ethnic minority groups that have been in Denmark the longest, consequently, the sample size of children is large enough for separate statistical analyses of educational progression for these two groups. Finally, although information is available on 10 percent of the native Danish population, only two percent were used in the statistical analyses to reduce computational costs.

3.3.2 The dependent variable

Two variables describing educational status are used to compute an educational history for each individual: one is highest completed education, the other is current enrollment. Both refer to the educational status as of October 1 the previous calendar year; hence for an individual who was 15 years old on January 1, 1999, the education variables give information about enrollment status and educational attainment as of October 1, 1998. The variables provide detailed information about the educations in question. For example, it is possible to differentiate between different fields of vocational upper secondary education and advanced educations. However, in this paper, the analyses focus on the educational attainment level and the branch rather than the specific field of upper secondary education chosen.

3.4. Descriptive analysis of educational progression

In this section, the pathways through the educational system chosen by native Danes, children of immigrants in the aggregate and by children of Turkish and Pakistani immigrants who left grade school from 1984 on are described. Transition probabilities are calculated for all of the educational choices indicated in figure 3.1 above.

3.4.1 Simplifying assumptions

A number of simplifying assumptions are imposed on the educational model to define the origin and destination states. First, upon completion of grade school, the individual will start an upper secondary education or leave the school system. An individual will be categorized as having left the school system if she has not started an upper secondary educa-

[8] These are: Azerbaijan, Uzbekistan, Kazakhstan, Turkmenistan, Kyrgyzstan, Tajikistan, Georgia and Armenia.

tion within three years of completing grade school. Most people who start an upper secondary education do so within this timeframe. Another reason for imposing a timeframe is the skewed age distribution of children of immigrants. To be able to analyze subsequent educational decisions, it is necessary to focus the attention on individuals who start an upper secondary education shortly after completion of grade school.

Second, individuals are categorized as dropouts if they one year are enrolled in an education and the following two consecutive years have left the educational system without having completed the education they were enrolled in to start with. Consequently, changing branch of study is not included in the definition of dropouts because as long as the individual completes an education, it is considered less of a concern whether she changes branch of study along the way or takes a one year sabbatical. Many students change their field of study in the first year or two after enrollment. If a dropout subsequently starts an upper secondary education and is present in the data long enough to determine whether she completes the education, the individual will contribute two spells to the analyses of completion and dropping out of upper secondary school.

Third, to accommodate sabbaticals and students changing studies, individuals are categorized as having completed their upper secondary education if they graduate within the prescribed duration of their education plus two years. For example, most academic upper secondary educations have a prescribed duration of three years, consequently an individual who starts an academic upper secondary education is categorized as having completed the education if she graduates within five years. If the individual does not complete the upper secondary education within the prescribed duration of the study plus two years and does not drop out she is categorized as belonging to the so-called residual group.

Fourth, individuals who complete an upper secondary education can choose between starting a qualifying education, i.e. a vocational upper secondary education or an advanced education, and leaving the educational system. An individual is categorized as having left the educational system if she does not start a qualifying education within two years. This restriction is imposed because of the age structure of ethnic minorities, but may be inexpedient for the analysis of native Danes, many of whom spend more than two years working and traveling before starting a qualifying education. The share of native Danes who start a qualifying education is therefore likely to be substantially underestimated. Finally, individuals are categorized as having completed their qualifying education if they graduate within the prescribed duration of the study plus two years. The definitions of dropout and the residual group are as described above.

In all transitions analyzed, individuals who are not present for the duration of the timeframe within which the destination states are defined are categorized as censored. For example, if an individual is not present in the data for two consecutive years following com-

pletion of grade school, she is categorized as censored. In the descriptive analysis, such individuals are included in the analysis if they are observed to make a transition. In the statistical analysis, individuals are only included in the analysis of transitions for which they are not censored.

3.4.2 Descriptive analysis of educational progression

To describe the educational progression of native Danes and ethnic minorities, transition probabilities are computed for each educational decision included in the model. In table 3.1, probabilities for transitions from grade school to upper secondary educations or leaving school are shown. About 87 percent of native Danes start an upper secondary education within three years of completing grade school, of these a little more than half choose the academic branch. The distribution is similar for children of immigrants in the aggregate (referred to in the tables as ethnic minorities), but covers large differences between individuals from different countries of origin as illustrated by the Turks and the Pakistanis. The share of Pakistanis who starts an upper secondary education is about the same as for native Danes, but the Pakistanis are more likely to choose the academic branch. In contrast, the Turks are much less likely to start an upper secondary education and unlike the Pakistanis and the native Danes, a larger share of those who do start chooses a vocational upper secondary education.

Table 3.1
Transitions from grade school by ethnic group

	Upper secondary educations				
	All	Academic	Vocational	Leave school	
	%	%	%	%	N
Grade school					
ethnic minorities	84.6	46.8	37.8	15.4	8,065
Pakistanis	85.5	50.7	34.7	14.5	1,413
Turks	70.4	31.1	39.2	29.6	1,664
native Danes	86.8	45.5	41.3	13.2	79,632

The dropout rate is much higher among ethnic minorities than among native Danes (see table 3.2). About one third of the ethnic minority students who start an upper secondary education drop out compared to one fifth of the native Danes. However, large differences in the dropout rate between the two branches of upper secondary education exist. About 60 percent of each of the three ethnic minority groups studied drop out of their vocational upper secondary education compared to 12-16 percent of the individuals who start an aca-

demic upper secondary education. It is interesting to note, that the dropout rate from vocational upper secondary educations is almost the same for all ethnic minority groups, whereas the dropout rate is higher for Turks and lower for Pakistanis from academic upper secondary educations. The dropout rates are much lower among native Danes, still as many as 32 percent drop out of a vocational upper secondary education.

Table 3.2
Completion and dropout from upper secondary educations by ethnic group

	Completed upper secondary educations					
	All	Academic	Vocational	Dropout	Residual	
	%	%	%	%	%	N
Upper secondary educations, all						
ethnic minorities	65.9	52.9	13.0	31.9	2.2	4,075
Pakistanis	66.5	56.9	9.5	30.5	3.1	1,100
Turks	60.2	43.3	16.9	38.3	1.5	1,005
native Danes	78.6	47.3	31.3	20.2	1.2	72,526
Academic						
ethnic minorities	83.7	82.5	1.2	13.4	2.9	2,387
Pakistanis	84.2	83.0	1.2	12.4	3.4	683
Turks	81.9	81.1	0.8	15.6	2.5	487
native Danes	89.7	87.7	2.0	8.8	1.6	36,966
Vocational						
ethnic minorities	40.8	11.0	29.7	58.0	1.2	1,688
Pakistanis	37.4	14.1	23.3	60.0	2.6	417
Turks	39.8	7.7	32.0	59.7	0.6	518
native Danes	67.0	5.3	61.7	32.1	0.9	35,560

The table also shows that only a few individuals who start an academic upper secondary education complete a vocational upper secondary education while about 14 and 8 percent of the Pakistanis and Turks, respectively, change branch from a vocational to an academic upper secondary education. The latter group of individuals is likely to include more academically inclined and motivated individuals as well as individuals who have a better understanding of the Danish educational system; for some fields of vocational upper secondary education, completing a supplementary academic upper secondary education increases the chances of finding an apprenticeship markedly.

Table 3.3 shows that about 70 percent (20.6+48.8) of the native Danes who complete an academic upper secondary education continue in the educational system within the time-

frame of the model compared to about 86 percent of the Pakistanis. This surprisingly large difference is at least partly a result of the definition of the destination states that only allows two years of sabbatical before starting a qualifying education as discussed above. The result may also be due to sample selection because only the more gifted students from the ethnic minority groups complete an academic upper secondary education while the group of native Danes is more mixed in terms of ability. Gifted and motivated individuals are more likely to know what profession they want to pursue and to complete their qualifying education at an early age. Only about 49 percent of the native Danes who complete an academic upper secondary education, start an advanced education compared to almost 74 percent of the Pakistanis and 64 percent of the Turks. However, many more native Danes start a vocational upper secondary education. Among individuals, who start an advanced education, more ethnic minorities choose a short advanced education and fewer choose a long advanced education.

Table 3.3
Transitions from upper secondary educations to qualifying educations by ethnic group

	Qualifying education						
	Vocational	Advanced, all	Short	Medium	Long	Residual	
	%	%	%	%	%	%	N
Upper secondary educations							
ethnic minorities	13.1	57.0	11.5	13.2	32.3	29.9	2,189
Pakistanis	13.2	66.6	12.7	17.0	36.8	20.2	628
Turks	13.4	49.9	8.5	14.3	27.1	36.7	469
native Danes	15.1	32.2	5.0	9.1	18.1	52.8	51,365
Academic							
ethnic minorities	12.6	67.9	13.3	15.7	38.9	19.5	1,811
Pakistanis	12.4	73.9	13.9	18.7	41.3	13.7	555
Turks	12.9	64.0	11.0	18.1	34.9	23.1	364
native Danes	20.6	48.8	5.5	13.8	29.4	30.7	31,395
Vocational							
ethnic minorities	15.6	5.0	3.2	1.3	0.5	79.4	378
Pakistanis	19.2	11.0	4.1	4.1	2.7	69.9	73
Turks	15.2	1.0	-	1.0	-	83.8	105
native Danes	6.4	6.0	4.1	1.8	0.2	87.5	19,970

A vocational upper secondary education is both an upper secondary education and a qualifying education. Hence fewer individuals who complete a vocational upper secondary education are expected to start a qualifying education. It is therefore surprising that almost one third (19.2+11.0) of the Pakistanis do so. Some vocational upper secondary educations qualify students for admission into selected engineering programs. Engineering is a popular field among the Pakistanis which may explain that as many as 11 percent start an advanced education. A much larger share of the three ethnic minority groups starts a second vocational upper secondary education (15-19 percent) compared to native Danes (6 percent). Finally, the table shows that the number of ethnic minorities who completes a vocational upper secondary education and is present in the data long enough to determine whether they start another qualifying education is very small (73 for the Pakistanis and 105 for the Turks).

Table 3.4 presents probabilities for the last set of transitions in the model. The sample sizes for ethnic minorities are very small and the probabilities can therefore only be indicative at best. The dropout rates from advanced educations are smaller for native Danes than for ethnic minorities for whom the dropout rate is highest from long advanced educations. Between 41-57 percent of individuals who start a long advanced education do not complete the education within the timeframe of the model. This may reflect that many students change studies, have children and take sabbaticals and thus postpone completion of the education. Also, student grants are only available to an individual for the prescribed duration of a study plus one year. Hence if a student takes longer than this to complete an education, she will most likely have to work to support herself, typically postponing completion further.

Table 3.4
Completion and dropout from qualifying educations by ethnic group

	Completed qualifying education							
	Ad-vanced, all	Short	Me-dium	Long	Voca-tional	Drop-out	Residual	
	%	%	%	%	%	%	%	N
Advanced, all								
ethnic minorities	32.5	18.1	9.1	5.3	4.3	27.5	35.8	397
Pakistanis	32.5	19.2	9.2	4.2	5.8	31.7	30.0	120
Turks	40.4	19.2	13.5	7.7	3.8	26.9	28.8	52
native Danes	50.6	17.1	23.6	9.9	2.9	13.4	33.1	9,765
Short								
ethnic minorities	62.4	62.4	-	-	2.0	25.7	9.9	101
Pakistanis	57.1	57.1	-	-	-	28.6	14.3	35
Turks	72.7	72.7	-	-	-	27.3	-	11
native Danes	77.6	77.4	0.2	-	2.4	14.7	5.3	1,930
Medium								
ethnic minorities	46.3	4.9	41.5	-	7.3	20.7	25.6	82
Pakistanis	38.7	3.2	35.5	-	12.9	19.4	29.0	31
Turks	57.1	7.1	50.0	-	7.1	7.1	28.6	14
native Danes	78.2	1.9	76.2	0.0	2.4	10.2	9.2	2,774
Long								
ethnic minorities	13.1	2.3	0.9	9.8	4.2	30.8	51.9	214
Pakistanis	13.0	3.7	-	9.3	5.6	40.7	40.7	54
Turks	18.5	3.7	-	14.8	3.7	37.0	40.7	27
native Danes	25.1	2.4	3.6	19.1	3.3	14.7	56.9	5,061
Vocational								
ethnic minorities	0.6	0.6	-	-	83.9	13.7	1.9	161
Pakistanis	2.1	2.1	-	-	77.1	20.8	-	48
Turks	-	-	-	-	95.5	4.5	-	22
native Danes	1.3	1.0	0.4	-	86.4	9.0	3.3	6,127

For all ethnic groups, a larger share of women than men continues in upper secondary school upon completion of grade school although the differences are quite small (see table 3.5). However, substantial gender differences in the choice of branch of upper secondary education exist. The share of women choosing academic upper secondary school is much larger than the share of men, except among the Pakistanis where about 60 percent of those who start an upper secondary education of both sexes choose this branch. The gender difference in the share choosing an academic over a vocational upper secondary education is largest among native Danes.

Table 3.5
The share starting and the share dropping out of upper secondary educations by ethnic group and sex

	Starting upper secondary educations			Dropout rates from upper secondary educations	
	All	Academic	Vocational	Academic	Vocational
	%	%	%	%	%
Men					
ethnic minorities	83.1	42.4	40.7	16.0	65.9
Pakistanis	84.7	51.6	33.2	13.6	66.8
Turks	67.8	26.6	41.2	16.3	72.5
native Danes	86.1	37.7	48.4	8.3	28.9
Women					
ethnic minorities	86.1	51.4	34.7	11.1	49.0
Pakistanis	86.4	49.8	36.7	11.0	52.7
Turks	73.0	35.8	37.2	15.1	46.5
native Danes	87.5	53.6	33.9	9.1	36.4

Table 3.5 also shows that the dropout rate is lower among native Danes of both sexes, but the difference between native Danish men and ethnic minority men is much larger than the difference between the women. It is interesting to note that among ethnic minorities the dropout rate is lower for women than men whereas the opposite is true for native Danes.

High dropout rates from vocational upper secondary educations seem to be the key concern for all ethnic groups and both sexes. Still, native Danes perform better than ethnic minorities, and females perform better than males among the ethnic minorities. One explanation for these observed differences may be the choice of field. Table 3.6 shows that the concentration among ethnic minorities in a few fields is greater than among native Danes.

Table 3.6
Enrollment in vocational educations by sex, field and ethnic group

	Ethnic minorities	Pakistani	Turks	Native Danes
	%	%	%	%
Men				
Building and construction	9.5	10.7	7.6	23.3
Commercial and clerical trades	60.7	67.3	63.4	23.1
Iron and metal	20.3	17.3	22.1	33.9
Food and home economics	4.7	1.9	2.3	7.5
Health care	1.1	0.5	1.1	0.4
Others	3.8	2.3	3.4	11.8
All	100.0	100.0	100.0	100.0
Women				
Building and construction	0.3	-	-	2.5
Commercial and clerical trades	73.4	80.8	74.6	59.7
Iron and metal	0.3	-	-	1.9
Food and home economics	1.4	1.5	-	12.8
Health care	17.5	11.8	19.9	8.9
Others	7.2	5.9	5.5	14.2
All	100.0	100.0	100.0	100.0

Note: The category "others" includes transport, agriculture and fishing, service, and printing and publishing.

Ethnic minority men primarily choose commercial and clerical trades, iron and metal, and building and construction, while ethnic minority women almost exclusively choose commercial and clerical trades and health care. Assuming discrimination in the labor market, a high concentration in a few fields may make it more difficult for ethnic minorities to find an apprenticeship because they compete with each other over a limited number of apprenticeships open to ethnic minorities. Hence the concentration can help explain the difference in dropout rates between ethnic minorities and native Danes. However, the concentration among women is greater than among men, but their dropout rate is lower. The reason is that women choose fields where the market for apprenticeships is larger and more open to ethnic minorities and in the case of the health care field, students are in some cases guaranteed an apprenticeship once they are admitted into the study.

3.5. Explanatory variables

Table 3.7 presents the means and standard deviations of the explanatory variables used in the statistical analyses. Most of the variables are computed the year the child was 15 years old which is the first year data are available for native Danes. Parental background variables are included separately for the mother and the father to account for the empirical evidence that suggests that increasing resources in the hands of mothers benefit her children more than increasing resources in the hands of fathers (Haveman and Wolfe 1995, Smith and Haddad 2000). Recent studies by Behrman and Rosenzweig (2002) and Plug (2004), however, show that the association between mother's, but not father's, and child's schooling disappears when they control for unmeasured ability and assortative mating. By including both mother's and father's characteristics, the models control for assortative mating.

The table shows that parental background characteristics are more favorable for native Danes. The average number of years of schooling of Danish mothers and fathers is 11 and 12 years, respectively. Parental education is lowest for the Turks. The table also shows that the income level of both parents is much higher for native Danes.

The human capital of the parents is usually included in studies of children's educational attainment to control for the child's learning environment in the home. Education can also be interpreted as a measure of permanent income. The income level of the family in which the child grows up is included as a measure of the level of economic resources devoted to the child by the parents although income may convey little about the actual allocation of financial resources to children and fails to capture other economic resources important to educational attainment of children such as parental time allocation. For example, a high income may have adverse effects on children's educational attainment if parents work long hours and spend little time with their children.

Table 3.7

Means and standard deviations of explanatory variables by ethnic group

	Children of immigrants (N=7,216)		Pakistanis (N=1,412)		Turks (N=1,664)		Native Danes (N=15,883)	
	Mean	Std.	Mean	Std	Mean	Std	Mean	Std
Mother's characteristics								
Educational attainment (years)*	7.69	4.79	7.82	4.49	5.31	4.20	11.06	3.11
Missing educational information (%)	65.15	47.65	65.16	47.66	70.79	45.48	2.65	16.06
Gross income (DKK)**	130,204	73,575	110,277	79,423	129,111	60,478	178,151	100,633
Work experience (years)	4.90	4.56	3.72	3.49	4.90	3.53	10.41	6.71
Duration of stay in Denmark (years)	17.79	4.61	17.00	4.25	17.17	4.11	-	-
Mother missing (%)	1.77	13.20	1.70	12.93	1.32	11.43	1.43	11.87
Father's characteristics								
Educational attainment (years)*	9.64	3.92	10.21	3.29	7.54	3.65	11.90	3.34
Missing educational information (%)	58.37	49.30	54.89	49.78	64.60	47.83	7.69	26.65
Gross income (DKK)**	180,894	122,471	170,732	102,700	162,403	86,395	314,468	304,445
Work experience (years)	10.94	6.29	11.15	5.88	10.99	5.32	15.56	8.39
Duration of stay in Denmark (years)	19.97	4.78	18.98	3.20	19.36	4.15	-	-
Father missing (%)	5.61	23.02	5.45	22.71	2.94	16.91	5.93	23.62
Family structure								
Nuclear family (%)	82.95	37.61	87.18	33.44	87.44	33.15	70.86	45.44
Number of siblings (#)	3.93	1.56	4.40	1.44	3.78	1.36	2.42	1.02
Neighborhood								
Child lived in disadvantaged neighborhood at age 15 (%)	14.20	34.91	11.54	31.97	17.43	37.95	1.27	11.21
Share of minorities in 9th grade (%)	22.45	22.63	22.66	22.57	16.80	17.43	1.70	4.69
Missing information about grade school (%)	1.59	12.52	1.49	12.11	0.30	5.48	8.30	27.59
Characteristics of child								
Female (%)	48.88	49.99	45.40	49.81	48.80	50.00	48.65	49.98
Age of child when leaving grade school (years)	16.72	0.66	16.83	0.71	16.83	0.65	16.71	0.59
Change of branch of education (%)								
- from academic to vocational	4.00	20.00	4.00	19.00	4.00	20.00	3.00	16.00
- from vocational to academic	17.00	38.00	20.00	40.00	12.00	32.00	4.00	20.00

* Parents with missing educational information are excluded from the computation of the means and standard deviations of educational attainment.

** 1 US$ = 7 DKK. The explanatory variables for gross income included in the analyses are log (gross income of mother) and log(gross income of father).

Information about educational attainment is unavailable for between 50-70 percent of the parents of ethnic minorities. The reason is that only information about education obtained in Denmark is available in the register data used. A survey was conducted in 1999 to collect information about immigrants' education from their home countries to replace the missing educational data.[9] The response rate was very low. Unfortunately, the response rate was particularly low for immigrants from Turkey (30.1 percent) and Pakistan (38.8 percent). Statistics Denmark has imputed the values for the people who did not reply based on country of origin, age at immigration, current age and sex. Since most of these variables are used either directly or indirectly as explanatory variables in the statistical analyses, imputed values of educational attainment are not used to avoid collinearity. Instead dummy variables are included to control for the effect of missing parental educational information.

Work experience and the duration of stay in Denmark by immigrant parents are included in the analyses as measures of their level of integration. Presumably, parents who have spent more time in Denmark have a better understanding of the workings of Danish society, including the educational system, and are thus better able to guide their children's educational choices over time. However, because the unemployment rate is very high among immigrants and the unemployed may have little contact with native Danes, time spent in Denmark may not adequately control for parental integration. Therefore, work experience of the parents in Denmark is included in the analyses. Parental work experience is expected to positively affect the educational attainment of their children.

The Turkish and the Pakistani mothers and fathers have on average spent 17 and 19 years in Denmark, respectively. However, the work experience of the mothers is only 4-5 years compared to 10 years for native Danish mothers. The difference n work experience between ethnic minorities and native Danes is smaller among fathers. Since mothers are expected to be particularly important for the educational attainment of their children, the low labor market participation of ethnic minority women may be an important social problem not only in the short run, but also in the long run. Work experience may also control for parental education for individuals with missing educational information.

Two variables controlling for family structure are included in the analyses; one is whether the child lived with both biological parents at age 15, the other is the number of children in the family. The table shows that the share of native Danish children who live with both biological parents is much smaller than is the case among ethnic minorities and that the average sibship size is larger among ethnic minorities.

[9] A total of 152,181 immigrants received the questionnaire, of which 49.7 percent returned valid replies. The questionnaire was sent to people who on January 1, 1999 were 18-59 years old, were 16 years or older when they immigrated to Denmark, and who did not have a qualifying education from a Danish educational institution.

In their review of determinants of children's attainment, Haveman and Wolfe (1995) find that growing up in a one parent family or experiencing divorce or marital separation is negatively related to the level of schooling attained and in most cases is statistically significant. Empirical evidence is also strong that family size matters. Different hypotheses have been put forth in the literature as to why sibship size affects children's outcomes.[10]

The theory most emphasized in the economics literature is the quantity-quality model (Becker and Lewis 1973, Willis 1973, Becker and Tomes 1976) which takes into account the non-random assignment of sibship sizes. In the model, couples make simultaneous decisions about fertility and investments in their children's human capital depending on market prices and/or heterogeneous preferences by the parents. This implies that the variable for sibship size is endogenous. However, since there are no convincing instruments for sibship size in the data used and since the focus of the paper is not to estimate the quantity-quality tradeoff, the standard approach in empirical studies of consumer behavior, i.e. conditioning on the present structure of the household, is followed here (Garg and Morduch 1998).[11]

A dummy variable for whether or not the child lived in a disadvantaged neighborhood at age 15 is included. Estimates of neighborhood effects should, however, be interpreted with caution for two main reasons (Haveman and Wolfe 1995, Ginther et al. 2000). First, data are usually available for a unit of analysis larger than the "true" neighborhood such as census tracks. Second, parental choice of neighborhood is likely to depend on family economic resources as well as preferences. Hence it is difficult to separate the independent effects of family and neighborhood on children's educational attainment.

In this paper, housing projects are ranked by an index computed from a number of indicators of socioeconomic status, including the share of residents that are ethnic minorities, the unemployment rate, the share of residents who receive early-retirement benefits, the share of single-parent households, and the average disposable income. Disadvantaged neighborhoods are defined as the 20 percent of the housing projects that score worst on the index (Hummelgaard et al. 1997). Almost 12 percent of the Pakistanis and 17 percent of the Turks live in disadvantaged neighborhoods compared to about one percent of the native Danes.

Ginther et al. (2000) conclude that the more closely the neighborhood factor is tied to the outcome under study the more likely the neighborhood variable is to be significant, and to remain significant as the number of family background variables is increased. In their

[10] See Conley (2003) for a summary of the two main sociological hypotheses; the dilution and the confluence model.

[11] In fact, most explanatory variables included in analyses of educational attainment express parental preferences, including parental income and work experience, and are therefore potentially endogenous. However, it is not the objective of this paper to investigate these issues.

schooling models, they find that the effect of a variable for racial diversity in the neighborhood which serves as a proxy for the racial composition of neighborhood schools is robust. Therefore, a variable of the share of ethnic minorities from developing countries enrolled in 9th grade at the child's grade school the year the index child attended 9th grade is also included in the analyses.

Unfortunately, information about the child's grade point average from grade school is not available for the cohorts of children under study. However, the variable for the concentration of ethnic minorities in 9th grade may also partly control for academic preparedness. The assumption is that the higher the concentration of ethnic minorities in school, the more likely children of immigrants are to associate with peers in the language of their home country and the weaker Danish language proficiency they are likely to have which negatively affects learning. In addition, inadequate Danish language proficiency among students will negatively affect the quality of the instruction and thus their academic preparedness. The average share of ethnic minorities in 9th grade is over 22 percent for Pakistanis, almost 17 percent for Turks and only about two percent for native Danes.

Finally, an indicator variable for the sex of the child, an indicator variable for whether or not the child changes branch of upper secondary education, and a time-varying variable for the age of the child are included. Cameron and Heckman (2001) and Colding (2004) find that age matters for educational choices. The table shows that relatively many Pakistanis change from a vocational upper secondary education to an academic upper secondary education.

3.6. The model

The dynamic discrete choice model formulated and estimated in this paper is based on a model developed by Cameron and Heckman (2001). The point of departure for their work was the recognition that schooling attainment at any age is the outcome of previous schooling decisions and that particularly for minority groups and low-income Whites, high school graduates are select members of the source population, making it particularly important to control for educational selectivity when analyzing causal effects of family background on educational attainment of these groups. Cameron and Heckman (*ibid.*) therefore extend the econometric models previously used in the literature on the economics of schooling attainment analyzing the entire set of age-specific schooling decisions from age 15 through age 24, controlling for unobserved heterogeneity. Their methodology enables them to separate out age-by-age influences of variables such as family income in a general way and they are able to include time-varying explanatory variables. However, the generality of the model specification comes at the cost of potential inefficiency (Colding 2004). Therefore, a

more parsimonious version of the model, disregarding the age dimension, is formulated in this paper.[12]

The descriptive analysis identified two primary reasons why educational attainment is lower among ethnic minorities than among native Danes; low transition rates from grade school to an upper secondary education for the Turks; and high dropout rates from upper secondary school, particularly from vocational upper secondary educations for all ethnic minority groups. Consequently, the statistical analyses focus on the transition to and from upper secondary educations. This focus is further supported by the fact that the number of ethnic minority children at the tertiary educational level is relatively small. The model estimated is depicted in figure 3.2.

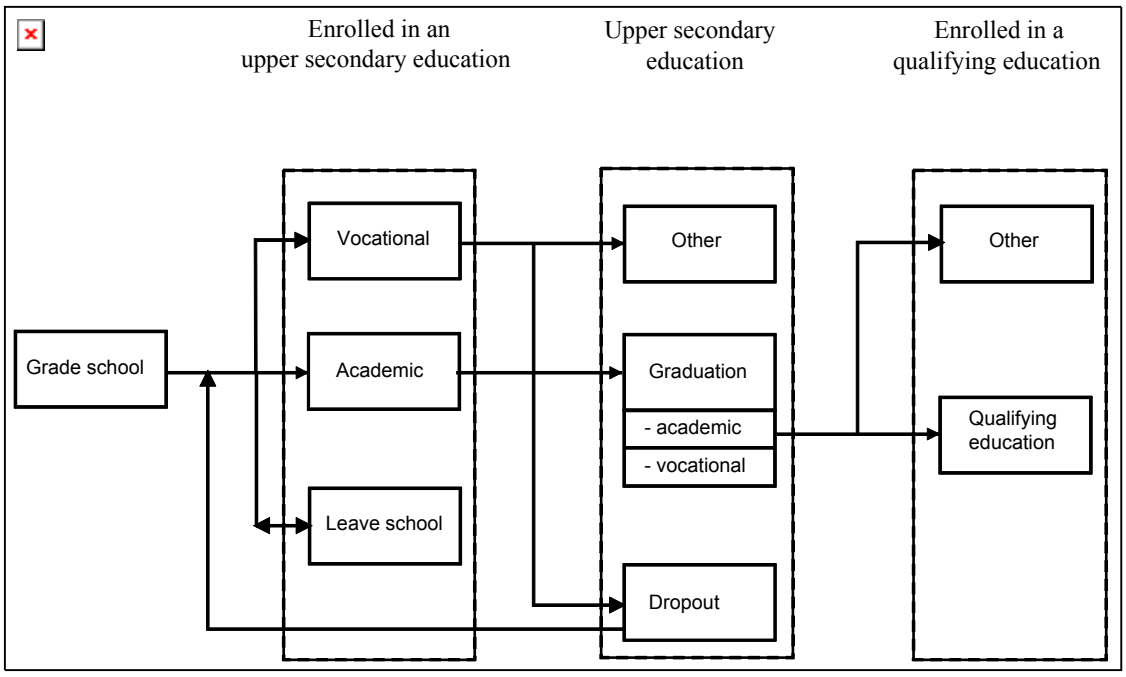

Figure 3.2. Estimated model of the Danish educational system

Schooling transitions are modeled from an individual completes grade school until she either completes a qualifying education at the upper secondary level, i.e. a vocational upper secondary education, or enrolls in a qualifying education upon graduation from an academic upper secondary education. If a child who is categorized as having left school subsequently enters an upper secondary education and is present in the data long enough to determine whether she completes the education, this record is included in the analysis.

[12] Breen and Jonsson (2000) apply a similar model of educational transitions from different grade levels to a large Swedish data set.

However, a transition probability from the state "leave school" is not estimated. By modeling the transition from grade school, the model controls for educational selectivity which is particularly important for the Turks since many Turks leave the school system already upon completion of grade school.

The destination states for individuals who start either a vocational upper secondary education or an academic upper secondary education are: to graduate; to drop out; or the residual category other which includes individuals who have not completed their education within the timeframe of the model (see section 4.1). The category "graduation" does not distinguish between the branches of upper secondary education hence an individual who starts an academic upper secondary education may complete either an academic upper secondary education or a vocational upper secondary education. However, a dummy variable for whether the individual has changed branch is included in the estimation.

Individuals who complete a vocational upper secondary education have acquired skills that qualify them for specific job categories. Therefore, only the decision to start a qualifying education by individuals who complete an academic upper secondary education is modeled. Due to the limited number of ethnic minority youth at this level it is not possible to differentiate between vocational upper secondary educations and advanced educations or between different advanced educations.

3.6.1 The likelihood function

To account for unobserved heterogeneity a finite mixture model with two types is used. This low dimensionality has been found in many studies of mixture models (Heckman and Singer 1984, Cameron and Heckman 2001). The two types can be thought of as representing one group of highly motivated and/or gifted children and one group of less motivated and/or less gifted children. The log likelihood function for the model estimated in this paper is:

$$ll = \ln\left\{\pi_1 \exp\left(\sum_{j=1}^{O}\left(\sum_{k=1}^{D_j} d_{jk}\left(Z\beta_{jk} + \alpha_{jk} v\eta_1 - \ln\sum_{\tilde{k}=1}^{D}\exp\left(Z\beta_{j\tilde{k}} + \alpha_{j\tilde{k}} v\eta_1\right)\right)\right)\right) + \right.$$
$$\left. \pi_2 \exp\left(\sum_{j=1}^{O}\left(\sum_{k=1}^{D_j} d_{jk}\left(Z\beta_{jk} + \alpha_{jk} v\eta_2 - \ln\sum_{\tilde{k}=1}^{D}\exp\left(Z\beta_{j\tilde{k}} + \alpha_{j\tilde{k}} v\eta_2\right)\right)\right)\right)\right\}$$

where Z is a vector of explanatory variables and $d_{jk} = 1$ if an individual chooses a particular transition and $d_{jk} = 0$ otherwise. Each transition probability is parameterized by a separate coefficient vector (both β_{jk} and α_{jk}) for each origin state j in the set O of origin states, and each destination k in the D_j choice set available to an individual with educa-

tional attainment *j*, as well as an unobserved heterogeneity component η governed by the distribution $F(\eta)$. Then β_{jk} and α_{jk} are the estimated parameters and the mass point, respectively. Setting $\eta_1 = 1$ and $\eta_2 = 0$, the probability, π_1, associated with η_1, is estimated (as is $\pi_2 = 1 - \pi_1$, the probability associated with η_2). To obtain a prespecified variance for η, η is multiplied by a constant *v*. The constant *v* is chosen so that $Var(v\eta) = 1$, a normalization needed to identify the factor structure and slope coefficients (Cameron and Heckman 2001).[13]

The probability of any educational career path may then be computed as the product of predicted probabilities. The predicted probability that a particular destination $\tilde{k}$ is chosen by an individual with educational attainment $\tilde{j}$ is computed based on the estimated coefficient vector by integrating out η using the distribution of $F(\eta)$ as follows:

$$\Pr\left(d_{\tilde{j}\tilde{k}} = 1 \middle| Z, \eta\right) = \pi_1 \frac{\exp\left(Z'\beta_{\tilde{j}\tilde{k}} + \alpha_{\tilde{j}\tilde{k}} v\eta_1\right)}{\sum_{k \in D_{\tilde{j}}} \exp\left(Z'\beta_{\tilde{j}k} + \alpha_{\tilde{j}\tilde{k}} v\eta_1\right)} + \pi_2 \frac{\exp\left(Z'\beta_{\tilde{j}\tilde{k}} + \alpha_{\tilde{j}\tilde{k}} v\eta_2\right)}{\sum_{k \in D_{\tilde{j}}} \exp\left(Z'\beta_{\tilde{j}k} + \alpha_{\tilde{j}\tilde{k}} v\eta_2\right)}$$

where $D_{\tilde{j}}$ is the choice set available to the individual with educational attainment $\tilde{j}$.

As is common in multinomial logit models, it is necessary to normalize one benchmark state to zero for each choice set ($\beta_{j\bar{k}} = 0$ and $\alpha_{j\bar{k}} = 0$ for benchmark state $\bar{k}$ for each *j*). The benchmark chosen is the option in each choice set that most individuals choose. Finally, multinomial models are susceptible to collinearity within group, which most often occurs with discrete explanatory variables. The problem arises when all individuals choosing a given destination state have the same value of the dummy variable. If there is no variation in the explanatory variable, it is collinear with the intercept and the parameters cannot be estimated.

For example, in a number of transitions in the models estimated in this paper, both parents were present for all individuals, and consequently, the dummy variables for whether information was available about the father and the mother were zero for all. In fact, numerical estimation problems also arose when only a few individuals had missing information about the father and/or mother. To account for this problem, including the numerical one, the slope parameter, β_{jk}, for dummy variables was set to zero if less than five people differed from the majority value of the variable.

For rare events, i.e. transitions with less than 50 observations, only the intercepts and not the slope parameters in β_{jk} are estimated. Factor loadings for these parameters (α_{jk}) are also set to zero. This decouples rare transitions from the heterogeneity distribution while at the same time accounting for all of the observed sample paths. The number of

[13] See Colding (2004) for a detailed discussion of the econometric model.

observations (50) was chosen as two times the number of parameters to be estimated in the model. Cameron and Heckman (2001) handle rare events the same way.[14]

3.6.2 Model fit

The model is not available in any standard statistical package. For the purpose of this paper, the model was coded in GAUSS.[15] Several specifications of the statistical model were estimated and compared. Different sets of explanatory variables were included in different functional forms and different numbers of transitions were modeled. The final specification for each of the four ethnic groups studied was chosen based on convergence and model fit. The log-likelihood function value, the number of estimated parameters, the pseudo R^2, and the probability associated with the factor loading of the final models are presented in table 3.8.[16]

Table 3.8
Log-likelihood function values, total number of estimated parameters, pseudo R^2, and the probability associated with the factor loading by ethnic group

	Log-likelihood function value	Number of estimated parameters	Pseudo-R^2	π_1 *
Children of immigrants	-9,181.4	145	0.065	0.8361
Pakistanis	-1,742.9	86	0.074	0.9209
Turks	-2,181.2	95	0.054	-
Native Danes	-23,695.9	138	0.084	0.6170

* π_1 is the probability associated with the factor loading.

The number of parameters estimated for the Pakistanis is the lowest because the transition to a qualifying education for students who complete an academic upper secondary education is excluded from the model. Otherwise unobserved heterogeneity could not be identified empirically. For the Turks, the full model is estimated, but unobserved heterogeneity is not included because it could not be identified, even in a reduced model. Small sample sizes are most likely a reason why unobserved heterogeneity cannot be identified empirically.

The value of π_1 for the Pakistanis shows that most of the individuals, 92 percent of the population, are categorized as type one, which also helps explain why identification of the

[14] The number of transitions subject to this restriction is two for the Turks, two for the Pakistanis, one for the children of immigrants, and zero for the native Danes.

[15] See Colding (2004) for a description of the code for the more general Cameron-Heckman model. The structure of the code for the simpler model used in this paper is similar to the code for the more general model.

[16] The estimated parameter values and standard errors of the models are available from the author on request.

unobserved heterogeneity is difficult. For children of immigrants and native Danes, the full model with unobserved heterogeneity is estimated. About 84 and 62 percent of the populations are categorized as type one, respectively. Finally, the pseudo R^2 varies between 0.054 and 0.084.

Table 3.9 shows that the models predict the transition probabilities of each of the ethnic groups well. In most cases, the actual sample outcomes and the predicted outcomes are identical in the first two significant digits. However, the standard deviations are quite large for some of the transitions for children of immigrants and the Pakistanis. The reason is that the standard errors of the estimated parameters associated with the constant and the mass point are very high in these transitions.

Table 3.9

Actual and predicted transition probabilities by ethnic group (standard deviation in parenthesis)

	Native Danes		Children of immigrants		Pakistanis		Turks	
	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted
From grade school to				Percentage				
Academic upper secondary	46.0	46.0 (0.41)	46.1	46.1 (11.73)	50.8	50.8 (41.23)	31.1	31.1 (1.11)
Vocational upper secondary	41.0	41.0 (0.45)	36.6	36.6 (9.83)	34.7	34.7 (23.03)	39.2	39.2 (1.16)
Leave school	13.0	13.0 (0.35)	17.2	17.2 (21.40)	14.5	14.5 (36.37)	29.6	29.6 (1.03)
From academic upper secondary to								
Graduation	89.2	88.5 (1.76)	82.1	81.9 (38.18)	84.0	82.2 (44.76)	79.5	79.5 (2.69)
Other	1.7	2.1 (1.46)	4.2	4.6 (2.40)	4.3	4.1 (2.43)	4.0	4.0 (1.37)
Dropout	9.1	9.3 (1.05)	13.8	13.5 (42.76)	11.8	13.6 (45.93)	16.4	16.4 (2.24)
From vocational upper secondary to								
Graduation	65.6	59.5 (3.65)	41.9	38.5 (3.03)	36.8	36.8 (36.98)	37.7	37.7 (3.06)
Other	1.0	2.6 (4.76)	2.3	2.1 (0.51)	4.6	4.6 (5.45)	1.4	1.4 (1.00)
Dropout	33.4	37.9 (3.47)	55.8	59.4 (3.17)	58.6	58.6 (41.88)	60.9	60.9 (2.99)
From completed academic upper secondary school to								
Qualifying education	67.5	65.9 (1.18)	76.0	75.6 (9.70)	-	-	68.6	68.6 (2.69)
Other	32.5	34.1 (1.18)	24.0	24.4 (9.70)	-	-	31.4	31.4 (2.69)

Note: Standard deviations (in parenthesis) are calculated using 500 random draws from the distribution of the underlying estimated parameters.

3.7. Results

Marginal effects of family background characteristics and characteristics of the neighborhood and the index child are computed to determine which background characteristics significantly affect the decision to start an upper secondary education, the choice of branch, and the decision to drop out of the upper secondary education chosen. Although each explanatory variable is included in the analyses to control for specific causalities, the variables included are likely correlated as discussed in section 5, which implies that the joint effect of a change in family background variables provides a more easily interpretable measure of the aggregate marginal effect on educational decisions. Aggregate marginal effects are therefore also computed. Finally, the estimated models are used to simulate the educational choices and educational attainment of ethnic minorities if their family background were equal to the one of an average native Dane. If the observed differences in educational choices and attainment persist when background characteristics are identical to an average native Dane then behavioral differences in education, as expressed in the estimated parameters, exist between native Danes and ethnic minorities.

3.7.1 Marginal effects of individual explanatory variables on transitions from grade school

Marginal effects of family background characteristics and characteristics of the neighborhood and the index child on the decision to start an upper secondary education are presented in table 3.10.[17] For native Danes, most of the explanatory variables are significant and have the expected effect on the decision to start an upper secondary education or not and on the choice of branch of upper secondary education. For example, an increase in parental educational attainment reduces the probability of leaving school after grade school and increases the probability of choosing an academic upper secondary education. Furthermore, the effect of the educational attainment of the mother on the choice of branch is larger than of the father.

[17] For continuous variables, the marginal effects show the percentage point change in the probability of choosing a specific destination when the explanatory variable is increased by one standard deviation. For dummy variables, the marginal effects show the percentage point change in the probability of choosing a specific destination for a discrete change of the dummy variable's value (zero-one). Hence the size of the marginal effects is not readily comparable between the two types of variables.

Growing up in a disadvantaged neighborhood significantly increases the probability of leaving school after grade school, but does not significantly affect the choice of branch while the share of ethnic minorities in 9th grade significantly increases the probability of leaving school and significantly reduces the probability of choosing an academic upper secondary education.[18] Girls are significantly less likely to leave school and are more likely to choose an academic upper secondary education than boys.

[18] The magnitudes of the two neighborhood effects are not directly comparable. See footnote 17.

Table 3.10

The predicted probability for transitions from grade school and marginal effects of individual explanatory variables by ethnic group

	Native Danes			Children of immigrants		
	Academic	Vocational	Leave school	Academic	Vocational	Leave school
	percentage					
Predicted transition probability	46.00	40.97	13.03	46.15	36.61	17.25
Characteristics of the mother	percentage points					
Education of mother	14.7298 **	-11.1505 **	-3.5793 **	1.3800 **	-1.2267 **	-0.1533
Gross income of mother	-0.0028	0.0413	-0.0385	0.2417 **	-0.0137	-0.2279 **
Work experience of mother	4.6804 **	-3.3072 **	-1.3731 **	-0.0125	0.1952	-0.1828
Duration of stay in Denmark of mother	-	-	-	2.9428 **	0.3540	-3.2968 **
Characteristics of the father						
Education of father	11.3122 **	-6.9886 **	-4.3236 **	2.6971 **	-1.4663 **	-1.2308
Gross income of father	0.8803 **	-0.4948 **	-0.3856 **	-0.0838	0.3849 *	-0.3011
Work experience of father	-1.7804 **	2.3941 **	-0.6137	2.1979 **	-0.0098	-2.1881 **
Duration of stay in Denmark of father	-	-	-	1.3566	-0.0655	-1.2911
Family structure						
Nuclear family	9.0048 **	-0.4656	-8.5392 **	9.1526 **	-2.0028	-7.1498 **
Number of children in household	-1.2854	-1.9441 **	3.2295 **	-24.0571 **	10.1774 *	13.8797 **
Neighborhood						
Disadvantaged neighborhood	-4.8332	-2.2054	7.0386 **	-1.3577	0.5641	0.7936
Share of ethnic minorities in 9th grade	-0.0139 **	-0.0007	0.0146 **	-0.2974 *	0.4136 **	-0.1162
Characteristics of child						
Female	16.1841 **	-13.9352 **	-2.2489 **	10.3247 **	-5.8989 **	-4.4258 **
Country of origin, Turkey	-	-	-	-18.4958 **	8.3255 **	10.1702 **
Country of origin, Pakistan	-	-	-	1.5472	-0.1434	-1.4039

Table 3.10
continued

	Pakistani			Turks		
	Academic	Vocational	Leave school	Academic	Vocational	Leave school
	percentage					
Predicted transition probability	50.79	34.70	14.51	31.13	39.24	29.63
Characteristics of mother	percentage points					
Education of mother	2.0824 **	-1.4792 **	-0.6032	0.1116	-0.0584	-0.0532
Gross income of mother	-0.0074	0.0759	-0.0685	0.0194	0.1955	-0.2150
Work experience of mother	0.9748 *	-0.0744	-0.9004	1.3141 **	-0.3436	-0.9705 *
Duration of stay in Denmark of mother	6.5398 **	-1.7618	-4.7781 *	0.6559	-0.5329	-0.1230
Characteristics of father						
Education of father	2.0475 **	-1.1440	-0.9034	2.0803 **	-0.8367	-1.2436 **
Gross income of father	-1.0415 **	1.5587 **	-0.5172	0.1645	0.1107	-0.2751
Work experience of father	6.0611 **	-6.2697 **	0.2086	3.8330 **	2.3432	-6.1762 **
Duration of stay in Denmark of father	-1.7105	2.2780	-0.5675	-1.4483	-2.8314	4.2797 *
Family structure						
Nuclear family	5.5538 *	2.8486	-8.4024 **	6.7999	-6.7476	-0.0523
Number of children in household	-31.8903 **	13.1344 **	18.7559 **	-9.0134 **	-2.9110	11.9244 **
Neighborhood						
Disadvantaged neighborhood	1.0216	1.5860	-2.6076	-0.9709	-1.4027	2.3736
Share of ethnic minorities in 9th grade	-0.6543 **	0.4025 **	0.2518	-0.2487	0.3349	-0.0862
Characteristics of child						
Female	-0.5559	2.9918 *	-2.4359	9.3493 **	-3.6768	-5.6724 **

Note: * and ** imply significance at the 10 and the 5 percent level, respectively. Standard deviations are calculated using 500 random draws from the distribution of the underlying estimated parameters.

However, the effects of maternal income and paternal work experience on the choice of branch are contrary to expectations. Both maternal income and paternal work experience negatively affect the decision to choose an academic upper secondary education and positively affect the decision to choose a vocational upper secondary education. Only the effects of paternal work experience are statistically significant. As discussed above, if high income is an indicator for long working hours and the mother's presence in the home is particularly important for her children's outcomes, then the negative effect of maternal income on the probability of choosing an academic upper secondary education may simply reflect the effect of long working hours. Similarly, if fathers with a vocational education have more work experience than fathers with an academic upper secondary education, but the same educational attainment measured in years, then work experience may control for whether or not the father has a vocational education. This would explain the observed results. Fathers with an academic upper secondary education as their highest completed education will most likely have lower work experience for two main reasons. One, it is more difficult to find employment for individuals without a qualifying education, and two, individuals with an academic upper secondary education may have spent some time pursuing an advanced tertiary education. The years spent studying would reduce their work experience proportionately.

Most of the explanatory variables also have the expected effects for ethnic minorities, but the significant effects vary between groups. For children of immigrants in the aggregate, parental educational attainment affects the choice of branch, but not the decision to leave school. The effect of paternal education is larger than the effect of maternal education. The duration of stay of the parents also has the expected effects, but only the variable for the mother is significant. In contrast to the native Danes, living in a disadvantaged neighborhood does not significantly affect educational choices whereas the share of ethnic minorities in the index child's 9^{th} grade school does affect the choice of branch. The indicator variable "country of origin, Turkey" shows that the Turks are significantly less likely to continue in upper secondary school and to choose the academic branch than other children of immigrants.

Living in a disadvantaged neighborhood does not significantly affect children from the two largest ethnic groups, the Pakistanis and the Turks, either, but interestingly the direction of the effects is opposite for the two groups with the Pakistanis benefiting from living in disadvantaged neighborhoods. However, the variable for the share of ethnic minorities in 9^{th} grade has the expected effects on the Pakistanis and the effects are significant for the choice of branch. In contrast to all other ethnic groups, Pakistani girls are significantly more likely than boys to start a vocational upper secondary education. The number of sib-

lings has the expected effect on all groups by increasing the likelihood that the index child leaves school, but the effect on choice of branch is ambiguous.

A few variables have unexpected effects on the Pakistanis and the Turks, two of which as statistically significant. Paternal gross income decreases the probability that Pakistani children choose an academic upper secondary education and increases the probability that they choose a vocational upper secondary education. For the Turks, the duration of stay in Denmark by the father increases the probability that the index child leaves school although the effect is only significant at the 10 percent level.

3.7.2 Marginal effects of individual explanatory variables on dropping out

The marginal effects of family background characteristics and characteristics of the neighborhood and the index child on the decision to drop out of an academic and a vocational upper secondary education are presented in tables 3.11 and 3.12, respectively. Only two variables significantly affect the decision to drop out of an academic upper secondary education for all four ethnic groups; age at the start of the study and changing branch of study (see table 3.11). For all ethnic groups, the dropout rate is higher the older the student is when she starts her education and if she changes branch from an academic to a vocational upper secondary education. These are also the only significant variables for the Turks. Only two additional variables are significant for the native Danes for whom paternal income and living in a nuclear family significantly reduces the probability of dropping out.

In contrast, a larger number of variables affect dropout rates for children of immigrants, including income and work experience of both parents as well as duration of stay in Denmark of the father and educational attainment of the mother. Women are significantly less likely and the Turks are significantly more likely to drop out of academic upper secondary educations and increasing the share of ethnic minorities in 9th grade and the number of siblings in the household significantly increases the dropout rate of children of immigrants.

The direction of the effects of some of the parental background variables for the Pakistanis is unexpected. For example, increasing income and duration of stay of the mother increases the dropout rate as do educational attainment and income of the father. Only the effect of the duration of stay of the mother, however, is significant at the five percent level. Interestingly and in contrast to all the other ethnic groups studied, increasing the number of siblings reduces the dropout rate for the Pakistanis whereas the share of ethnic minorities in 9th grade has the expected positive effect.

Table 3.11

Predicted probabilities of dropping out of academic upper secondary educations and marginal effects of individual explanatory variables by ethnic group

	Native Danes	Children of immigrants	Pakistanis	Turks
	percentage			
Predicted transition probability	9.35	13.43	13.70	16.45
	percentage points			
Characteristics of mother				
Education	-1.1569	-0.7978 *	-1.2951 **	0.1513
Gross income	-0.0218	-0.1668 **	0.0118	-0.2806
Work experience	-0.6988	0.8821 **	-0.4063	-0.5721
Duration of stay in Denmark	-	-0.0468	2.5654 **	-2.1510
Characteristics of father				
Education	-0.1090	0.1654	0.7728	0.6272
Gross income	-0.4002 **	-0.4420 **	0.1796 *	-0.3846
Work experience	-0.4303	-1.2949 *	-0.4629	1.4883
Duration of stay in Denmark	-	-2.0929 **	-5.9698 **	2.6949
Family structure				
Nuclear family	-6.1640 **	-1.1850	-2.7918	-7.6126
Number of children in household	-0.1754	4.1713 **	-7.9640 *	-3.0225
Neighborhood				
Disadvantaged neighborhood	5.6034	-1.6976	0.7145	0.0000
Share of ethnic minorities in 9th grade	0.0067	0.3275 **	0.3766 **	0.3305
Characteristics of child				
Female	0.7311	-5.0105 **	1.6266	1.8083
Age when starting education	40.6376 **	60.6478 **	96.5570 **	72.0745 *
Country of origin, Turkey	-	6.1216 **	-	-
Country of origin, Pakistan	-	0.9183	-	-
Change of study	9.5504 **	21.6489 **	39.0538 **	36.5564 **

Note: * and ** imply significance at the 10 and the 5 percent level, respectively. Standard deviations are calculated using 500 random draws from the distribution of the underlying estimated parameters.

The marginal effects for the decision to drop out of a vocational upper secondary education are presented in table 3.12. Ethnic minority women are significantly less likely to drop out of a vocational upper secondary education than men whereas the opposite is true for native Danes. The reason is most likely as discussed above that ethnic minority women choose a few selected fields of vocational study with lower dropout rates whereas the concentration of native Danish women in particular fields is less pronounced.

Maternal educational attainment reduces dropout as expected, but the effect is only significant for the Turks and the Pakistanis. Contrary to expectations paternal educational attainment increases the dropout rate for all three ethnic minority groups and the effect is significant for children of immigrants and the Pakistanis. Paternal education is significant and has the expected effect on native Danes. Paternal work experience reduces dropout significantly for children of immigrants and the Turks while maternal work experience significantly reduces the dropout rate of native Danes. The share of ethnic minorities in 9^{th} grade significantly affects the dropout rate of children of immigrants in the aggregate while the number of siblings in the household increases the dropout rate for all groups except the Turks.

For all four ethnic groups, students who change to an academic upper secondary education have a significantly lower risk of dropping out. The reasons may be that primarily individuals who are better educationally prepared from grade school make this transition and that graduation from academic upper secondary educations does not depend on finding an apprenticeship. It is also interesting to note that for vocational studies the dropout rate is lower the older the native Danish student is when she starts the education. Vocational upper secondary educations qualify individuals for specific job categories. Older students have most likely worked some years as unskilled laborer, are more mature, and are also more likely to have family obligations; all of which imply that these students are more motivated to complete their education than their younger colleagues.

Table 3.12

Predicted probabilities of dropping out of vocational upper secondary educations and marginal effects of individual explanatory variables by ethnic group

	Native Danes	Children of immigrants	Pakistanis	Turks
	percentage			
Predicted transition probability	37.86	59.39	58.66	60.95
Characteristics of mother	percentage points			
Education	-0.6868	-0.5688	-2.4106 **	-1.3655 **
Gross income	0.0635	-0.2024	-0.2444	-0.3242
Work experience	-1.4229 *	0.0735	-0.3695	0.3564
Duration of stay in Denmark	-	-4.8651	0.0411	-4.0877
Characteristics of father				
Education	-3.2723 **	2.5135 *	4.2037 **	1.8024
Gross income	0.0079	0.4067	1.4747	1.4545 **
Work experience	-0.2034	-4.4927 **	-3.3211	-11.6687 **
Duration of stay in Denmark	-	-0.1129	-3.8381	4.6364
Family structure				
Nuclear family	-11.5595 **	2.6952	2.5073	12.4334
Number of children in household	2.9084 *	12.4699 *	19.7044 *	-16.8681
Neighborhood				
Disadvantaged neighborhood	3.3304	0.7207	10.4898 *	8.7987
Share of ethnic minorities in 9th grade	0.0063	0.6090 **	0.3686	0.3072
Characteristics of child				
Female	11.2322 **	-9.5734 **	-13.2324 **	-10.9555 *
Age when starting education	-59.5241 **	-35.0950	25.4610	-66.8249
Country of origin, Turkey	-	2.7776	-	-
Country of origin, Pakistan	-	2.0167	-	-
Change of study	-23.2317 **	-22.6423 **	-27.4674 **	-19.9407 *
School apprenticeship	8.0141	-37.7102 **	-	-

Note: * and ** imply significance at the 10 and the 5 percent level, respectively. Standard deviations are calculated using 500 random draws from the distribution of the underlying estimated parameters.

3.7.3 The joint marginal effect of family characteristics on educational choices

The results above confirm that it is difficult based on the individual marginal effects to conclude on the overall effect of parental background, family structure and neighborhood characteristics on educational choices. In table 3.13, the joint effect on all estimated transition probabilities of half a standard deviation's change in all family background variables is presented for each of the ethnic groups under study. The effects are computed as the difference between transition probabilities calculated on the average values of the explanatory variables where all family background variables have been improved by half a standard deviation and transition probabilities calculated on the average values of the explanatory variables. Family background includes parental education, income, and work experience, disadvantaged neighborhood, the share of ethnic minorities in 9^{th} grade as well as nuclear family and sibship size. For some variables, such as income and education, an improvement means an increase in the average value of the variable whereas an improvement in other variables, such as the share of ethnic minorities in 9^{th} grade and the size of the sibship, implies a reduction of the average value of the variable.

Table 3.13 shows that improving family background variables by half a standard deviation increases the probability that a native Danish child chooses an academic upper secondary education by about 19 percentage points or about 42 percent. The effect is significant at the five percent level. Improving family background also significantly reduces dropout rates from academic and vocational upper secondary educations, but the magnitude of the effects is smaller than the effects for transitions from grade school. Finally, improving family background significantly increases the probability of starting a qualifying education upon completion of an academic upper secondary education.

For children of immigrants, half a standard deviation's improvement in family background statistically reduces the probability of leaving school after grade school, starting a vocational upper secondary education and dropping out of an academic upper secondary education while increasing the probability of starting an academic upper secondary education. An improved family background for Turkish children only statistically affects transitions from grade school, reducing the probability of leaving school and choosing a vocational upper secondary education and increasing the probability of starting an academic upper secondary education. Finally, parental background statistically affects the choice of branch of upper secondary education and all transitions from academic upper secondary school for the Pakistanis.

Table 3.13

Predicted probabilities and the joint marginal effect of family background on educational choices by ethnic group

	Native Danes		Children of immigrants		Pakistanis		Turks	
	Predicted probability	Marginal effect	Predicted probability	Marginal effect	Predicted probability	Marginal effect	Predicted probability	Marginal effect
From grade school to								
Academic upper secondary	44.66	18.67 **	46.92	15.18 **	50.14	17.04 **	30.94	11.64 **
Vocational upper secondary	44.99	-13.22 **	38.35	-8.65 **	38.92	-10.64 **	41.37	-3.80 *
Leave school	10.36	-5.45 **	14.74	-6.53 *	10.94	-6.39	27.69	-7.84 **
From academic upper secondary to								
Graduation	90.69	2.73 **	85.14	1.70	84.24	2.68 **	82.92	0.49
Other	1.44	-0.51	4.26	0.88	4.30	0.14 **	4.20	0.03
Dropout	7.87	-2.22 **	10.60	-2.59 **	11.46	-2.82 **	12.89	-0.52
From vocational upper secondary to								
Graduation	60.22	5.26 **	37.70	4.78	34.45	7.73	34.03	5.26
Other	2.17	1.25	2.09	0.27	4.32	0.97	1.27	0.20
Dropout	37.61	-6.51 **	60.21	-5.04	61.23	-8.70	64.70	-5.45
From completed academic upper secondary school to								
Qualifying education	67.48	6.10 **	79.84	0.45	-	-	71.23	5.45
Other	32.52	-6.10 **	20.16	-0.45	-	-	28.77	-5.45

Note: Family background includes parental education, parental income, parental work experience, duration of stay in Denmark of parents, disadvantaged neighborhood, share of ethnic minorities in 9th grade, nuclear family and number of children in household. For native Danes, duration of stay in Denmark is not included. * and ** imply significance at the 10 and the 5 percent level, respectively. Standard deviations are calculated using 500 random draws from the distribution of the underlying estimated parameters.

In sum, family background significantly affects educational choices of native Danes, but it is interesting to note that family background does not significantly affect transitions from vocational upper secondary educations for any of the ethnic minority groups. The magnitude of the significant effects is greatest for native Danes. The effects on leaving school and starting a vocational upper secondary education are much smaller for the Turks than for the other ethnic groups when measured against the predicted probability.

3.7.4 Counterfactual simulations: changing all covariates

The observed differences in schooling choices and educational attainment between ethnic minorities and native Danes can be divided into differences in preferences for education and differences in endowments such as parental characteristics (Cameron and Heckman 2001). Preferences are expressed in the estimated parameters of the models and endowments in the values of the covariates. In table 3.14, the predicted transition probabilities are computed for all ethnic groups under study using average values of the covariates equal to those of an average native Dane. In addition, for each of the three ethnic minority groups the difference between predicted probabilities with covariates equal to those of an average native Danish child and predicted probabilities with their own covariates is also computed and it is indicated whether the difference is statistically significant. If the gap between the transition probabilities of native Danes and ethnic minority groups disappears when ethnic minority groups are given Danish background characteristics the observed differences in schooling choices can be assigned to differences in endowments and not behavior. If, however, differences in schooling choices persist, behavioral differences exist between the ethnic groups.

Giving children of immigrants background characteristics equal to those of an average native Danish child significantly reduces dropout rates from upper secondary educations as well as the share of children of immigrants who do not start an upper secondary education upon completion of grade school. The share of children of immigrants who choose an academic upper secondary education increases by 11 percentage points to over 57 percent. In fact, the difference in the choice of branch of upper secondary educations between children of immigrants and native Danes increases. For the Pakistanis, the difference in the choice of branch becomes even greater. In contrast, it is evident from the table that the Turks become much like native Danes. However, for all three ethnic minority groups, the dropout rate from vocational upper secondary educations is reduced when they are given background characteristics like an average native Danish child, but the difference between them and native Danes remains large.

Table 3.14

Predicted probabilities computed with background characteristics equal to an average native Dane as well as the percentage point difference in predicted probabilities for ethnic minorities with their own average characteristics and average native Danish characteristics by ethnic group

	Native Danes	Children of immigrants		Pakistanis		Turks	
	Predicted probability	Predicted probability[1]	Difference[2]	Predicted probability[1]	Difference[2]	Predicted probability[1]	Difference[2]
From grade school to							
Academic upper secondary	44.66	57.64	11.30 **	70.43	17.96 **	45.68	15.02 **
Vocational upper secondary	44.99	32.09	-5.74 **	25.94	-9.47 **	39.84	-0.96
Leave school	10.36	10.27	-5.57 **	3.63	-8.49	14.48	-14.07 **
From academic upper secondary to							
Graduation	90.69	86.10	1.17	84.68	0.08	84.09	2.27
Other	1.44	5.30	1.96	4.33	0.00	4.26	0.12
Dropout	7.87	8.60	-3.13 **	11.00	-0.09	11.65	-2.39
From vocational upper secondary to							
Graduation	60.22	45.51	7.83	44.19	8.46	50.29	14.87 *
Other	2.17	2.53	0.43 *	5.54	1.06	1.87	0.55
Dropout	37.61	51.97	-8.27 **	50.27	-9.52	47.84	-15.42 *
From completed academic upper secondary school to							
Qualifying education	67.48	76.49	-2.88	-	-	66.95	-3.82
Other	32.52	23.51	2.88	-	-	33.05	3.82

Note: * and ** imply significance at the 10 and the 5 percent level, respectively. Standard deviations are calculated using 500 random draws from the distribution of the underlying estimated parameters.

1 Average native Danish values of the following variables are used to compute the predicted probabilities for the ethnic minority groups: parental education, parental income, parental work experience, disadvantaged neighborhood, share of ethnic minorities in 9th grade, nuclear family and number of children in household. Average values of the variables for duration of stay of parents in Denmark remain at the average values of the ethnic minority groups themselves as do indicator variables for missing educational information of each parent and whether or not information about parents is available. The values of the average native Danish characteristics are corrected to account for the values of the indicator variables of the ethnic minority group. This is particularly important for the variables for educational attainment of parents because the number of missing values is large for ethnic minorities and zero for native Danes.

2 The difference is computed as the predicted probability computed with average native Danish characteristics less the predicted probability computed with the ethnic minority group's own average characteristics. In both cases, the estimated parameters for the ethnic minority group are used.

Hence the differences between ethnic minorities and native Danes remain large even when all ethnic groups are given the same background characteristics. The differences in the transitions from grade school are most likely caused by differences in behavior. In many countries, vocational occupations are considered low status. In a country like Denmark where tuition is free, parents from such countries will encourage their children to choose an academic upper secondary education. The results of the simulations confirm that children of immigrants and the Pakistani children are much more inclined to choose the academic branch.

The differences in the transitions from vocational upper secondary educations also suggest behavioral differences between ethnic minorities and native Danes. However, qualitative studies of dropout decisions from vocational upper secondary educations by ethnic minorities (Højmark Jensen 2003) also suggest that discrimination by employers with regard to apprenticeships, inadequate Danish language proficiency and educational preparedness, inadequate educational performance due to incompatibility with teaching methods that require a high level of individual maturity and initiative as well as group work, and finally cultural clashes at the work place as a result of the colloquial language used among native Danish colleagues are reasons why ethnic minorities drop out. According to Egelund (2003), the academic preparedness of almost 50 percent of ethnic minority children does not meet the requirements for successful completion of an upper secondary education in Denmark. In comparison, the figure is 18 percent for native Danish children. These individual, institutional, social and cultural issues are not controlled for in the models because data are unavailable.

In table 3.15, simulations of the share of children from each of the ethnic groups under study reaching selected educational attainment levels are presented. Educational attainment is computed as the product of predicted probabilities as discussed in section 6.1. For the ethnic minority children, educational attainment is computed using both their own background characteristics and characteristics equal to an average native Dane.

The table shows that a larger share of the children of immigrants and Pakistani children than native Danes would graduate from an academic upper secondary education if they had background characteristics like an average native Dane, otherwise about the same share would graduate. The increase is primarily due to a sharp increase in the share of children starting an academic upper secondary education although the dropout rate also decreases. It is interesting to note that the Turks become very similar to native Danes in terms of the share of children starting and completing an academic upper secondary education when covariates are equal to an average native Dane.

Table 3.15

Predicted educational attainment with own covariates and covariates equal to an average native Dane by ethnic group

	Native Danes	Children of immigrants		Pakistanis		Turks	
	Own covariates	Danish family covariates[1]	Own covariates	Danish family covariates[1]	Own covariates	Danish family covariates[1]	Own covariates
Academic upper secondary education				percent			
Start	44.66	57.64	46.34	70.43	52.47	45.68	30.66
Dropout	3.51	4.96	5.43	7.74	5.81	5.32	4.30
Graduate	40.50	49.63	39.36	59.64	44.39	38.41	25.08
Qualifying education							
Start	27.33	37.96	31.24	-	-	25.72	17.75
Vocational upper secondary education							
Start	44.99	32.09	37.82	25.94	35.41	39.84	40.80
Dropout	16.92	16.67	22.78	13.04	21.17	19.06	25.81
Graduate	27.09	14.60	14.25	11.46	12.65	20.04	14.45

Note: Educational attainment is computed as the product of predicted probabilities as discussed in section 6.1.

[1] Average native Danish values of the following variables are used to compute the predicted probabilities for the ethnic minority groups: parental education, parental income, parental work experience, disadvantaged neighborhood, share of ethnic minorities in 9th grade, nuclear family and number of children in household. Average values of the variables for duration of stay of parents in Denmark remain at the average values of the ethnic minority groups themselves as do indicator variables for missing educational information of each parent and whether or not information about parents is available. The values of the average native Danish characteristics are corrected to account for the values of the indicator variables of the ethnic minority group. This is particularly important for the variables for educational attainment of parents because the number of missing values is large for ethnic minorities and zero for native Danes. Both the predicted probability computed with average native Danish characteristics and the predicted probability computed with the ethnic minority group's own average characteristics are computed using the estimated parameters for the ethnic minority group.

Changing from own covariates to average native Danish covariates does not affect the share of children of immigrants and Pakistani children completing a vocational upper secondary education much. The share is about half that of native Danish children. However, the table also shows that the share of children from both ethnic groups starting a vocational upper secondary education decreases, particularly among the Pakistani children. Consequently, the dropout rate is also reduced.

The effect of changing covariates is different for the Turks who become more similar to the native Danes. The share starting a vocational education does not change much, but the dropout rate is substantially reduced and consequently, the share of Turkish children completing a vocational upper secondary education increases by 5-6 percentage points to 20 percent. The dropout rate thus remains much higher than the dropout rate among native Danes.

Finally, the table also shows that regardless of background characteristics, a larger share of children of immigrants starts a qualifying education and that changing covariates the Turks become similar to native Danes also with regard to this transition.

Behavior thus seems to be quite different between native Danish children and children of immigrants in the aggregate and in particular between native Danish children and Pakistani children, but more similar between native Danish and Turkish children. The findings suggest that for children of immigrants in the aggregate and for Pakistani children, the main reason for the observed differences in educational attainment is the high dropout rate from vocational educations whereas an additional problem for the Turks is the weak family background of the children.

3.8. Conclusion

Previous studies conclude that the educational attainment of ethnic minorities in Denmark is much lower than the educational attainment of native Danes and that large differences in the educational distributions are likely to persist because intergenerational mobility is low and of equal magnitude for the two groups. In this paper, educational attainment is modeled as the outcome of sequential multinomial decisions from the child leaves grade school until she graduates from a vocational upper secondary education or starts a qualifying education upon completion of an academic upper secondary education. This approach improves on previous work in four important ways. First, the model controls for educational selection bias and unobserved heterogeneity. Second, the model is able to correctly account for the institutional structure of the Danish educational system which contains parallel branches of study at both the upper secondary and tertiary level. Third, by modeling sequential educational choices, it is possible to identify critical decision points in the educational system at which ethnic minority behavior differs from that of native Danes. Finally,

it is possible to determine how background characteristics affect behavior at different decision points. In short, the model is better able to explain differences in educational attainment between population groups.

The model estimated is an application of a model developed by Cameron and Heckman (2001) who analyze age-and-grade-specific educational transitions for US males. However, the generality of their model comes at the cost of efficiency as also discussed by Colding (2004). Therefore, a more parsimonious model, in which the age dimension is excluded and the number of educational transitions analyzed has been reduced, is used in this paper. The analyses of educational progression are undertaken separately for four ethnic groups: native Danes; children of immigrants in the aggregate; the Turks; and the Pakistanis.

In spite of the parsimonious specification of the model, unobserved heterogeneity is only identified empirically for native Danes and children of immigrants in the aggregate. Breen and Jonsson (2000), who use a similar model on a large Swedish data set, report no difficulties with identification. However, they do conclude that even rather simple multidimensional models such as the one they use may demand fairly large data sets to be useful in empirical research. Relatively small sample sizes with large sample attrition due to a skewed age distribution of the population under study and educational selection are probably the reason that unobserved heterogeneity is only identified empirically for the Pakistanis in a model that does not include transitions at the tertiary level while it is not possible to identify unobserved heterogeneity for the Turks at all. The educational attainment of the Turks is thus analyzed using a sequence of independent cross sectional transition probabilities.

The bivariate analyses show that high dropout rates, particularly from vocational upper secondary educations, are the main reasons ethnic minority children in Denmark have much lower educational attainment than native Danes. As many as 60 percent of the ethnic minority children starting a vocational upper secondary education drop out compared to about 32 percent of the native Danes. In comparison, the dropout rates from academic upper secondary educations are about 14 and 9 percent for ethnic minority children and native Danes, respectively. An additional critical decision point for children of Turkish immigrants is whether or not to start an upper secondary education. A much smaller share of the Turks starts an upper secondary education compared to native Danes and other ethnic minority children and a larger share of those who do start choose the vocational branch. In contrast, the Pakistani children are more likely to choose the academic branch.

The multivariate analyses show that most of the explanatory variables have the expected effects on educational choices, but the magnitude and significance level vary by transition and ethnic group. Aggregate marginal effects show that the overall effect of family background and neighborhood characteristics significantly affects the choice of branch

of upper secondary educations and the dropout rates from academic upper secondary educations for native Danes, children of immigrants in the aggregate, and the Pakistanis. For the Turks family and neighborhood characteristics only significantly affect the decision to start an upper secondary education and the choice of branch.

The magnitude of the effects is greatest for transitions from grade school to the upper secondary level. Hence intergenerational transmission is most important early in the child's educational career. Interestingly, the magnitude of the effects is greater for native Danes than for ethnic minorities which unlike the findings of previous Danish studies suggests that intergenerational mobility is greater for ethnic minorities. This is a desirable result because the socioeconomic background of ethnic minority children is weaker than that of native Danes. Except for the Turks, the effect of family background and neighborhood characteristics are also sizeable on the dropout rate from academic upper secondary educations.

The effect of family background and neighborhood characteristics on dropout rates from vocational upper secondary educations is only significant for native Danes and the effect is much smaller than the effect on dropout rates from academic upper secondary educations. The analyses use administrative data from registers in Statistics Denmark. Register data are not susceptible to the errors in reporting common in surveys. However, on the downside, information is not available from clarifying behavioral questions. Dropout decisions from vocational upper secondary educations are likely to be affected by a number of factors for which information is not available in the registers. For example, inadequate educational preparedness and Danish language proficiency are according to qualitative studies of educational behavior of ethnic minorities in Denmark two important reasons why ethnic minorities drop out of upper secondary educations. In addition, vocational upper secondary educations consist of time spent at technical schools and time spent as an apprentice at a company. The demand for apprenticeships is greater than the supply overall. Consequently, social networks are extremely important for finding an apprenticeship which puts ethnic minorities at a disadvantage. For ethnic minorities the problem of finding an apprenticeship is further exacerbated by discrimination from companies who prefer to take in native Danes. Furthermore, the bivariate analysis showed that ethnic minority children concentrate in a few fields of vocational educations and thus compete with each other for the limited number of apprenticeships open to ethnic minorities. Interestingly, in contrast to native Danes, the dropout rate for women is lower than the dropout rate for men among the ethnic minorities. The reason is most likely that ethnic minority women concentrate in fields, such as the health field, with generally lower dropout rates.

Simulations show that the observed differences in educational attainment between ethnic minority children and native Danes do not simply reflect differences in background

characteristics. Even with their own background characteristics, a larger share of the children of immigrants and the Pakistanis start an academic upper secondary education compared to children of native Danes. The differences in the transitions from grade school increase substantially when these two ethnic minority groups are given background characteristics equal to an average native Dane. In many countries, vocational occupations are considered low status. In a country like Denmark where tuition is free, parents from such countries will encourage their children to choose an academic upper secondary education. Consequently, the result reflects behavioral differences between the two ethnic minority groups (children of immigrants in the aggregate and Pakistanis) and native Danes. For other transitions the differences between the groups persist although the gaps are somewhat reduced. This again suggests that factors not controlled for in the analyses are important for educational decisions at the upper secondary and tertiary level.

The transition probabilities of the Turks become more similar to those of native Danes when the Turks are given background characteristics equal to an average native Dane, particularly for transitions from grade school to an upper secondary education while substantial differences persist in transitions from vocational upper secondary educations.

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