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The Effects of an Upper Secondary Education Reform on the Attainment of Immigrant Youth

Abstract:
The national Norwegian school reform of 1994, which gave statutory right to at least three years of upper secondary education, had a significant impact on educational attainment among immigrant youth. In particular, we find that the immigrant transition rate from compulsory schooling to completion of the first year of upper secondary education improved from the pre- to the post-reform period. Using a sequential binomial logit framework, we present evidence that the improvement can be attributed to reductions in capacity constraints, rather than cohort heterogeneity. An important implication is that non-targeted educational reforms may have large impacts on the educational attainment of disadvantaged groups in general and ethnic minority youth in particular.

Keywords: schooling transitions, immigrant youth, reform effects

JEL classification: I21

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1 Introduction

The educational performance of immigrant youth has come to the attention of scholars and policy makers. Recent studies from several European host countries show that school dropout rates are higher and educational attainment is lower among children of non-Western immigrants than their native peers; see Gang and Zimmermann (2000) and Riphahn (2003; 2005) for evidence from Germany, van Ours and Veenman (2003) for the Netherlands, Nielsen et al (2003) and Colding (2006) for Denmark, Hammarstedt and Palme (2006) for Sweden, and Bauer and Riphahn (2007) for Switzerland.[1] A key policy concern is that such disparities in educational outcomes will contribute to the formation of economically disadvantaged ethnic minorities and slow down the long-term integration of non-Western immigrants in Europe.[2]

An important question is whether educational policy can alleviate ethnic disparities in attainment. For example, it is commonly held that educational systems with early school tracking reproduce educational inequalities across generations (Lauer, 2003; Bauer and Riphahn, 2006). The question we pose in this paper is whether school capacity constraints also contribute to lower attainment among ethnic minority youth. To study this question, we examine the outcome of a major reform of Norwegian secondary education that was implemented in 1994. An important component of this reform was that every graduate from compulsory schooling became entitled to enrollment in public upper secondary education. In the pre-reform years there were significant capacity constraints in secondary schools, both with respect to admission and to progression through the upper level. While it is important to stress that the 1994 reform was non-targeted, it may well be the case that immigrant youth were more affected by the capacity constraints of the pre-reform system than native youth. The main aim here is to investigate this issue.

This paper provides an empirical analysis of the progress through upper secondary education of immigrant and native Norwegian youth for the cohorts that graduated from compulsory schooling between 1992 and 1995; that is, we examine the attainments of two pre-reform and two post-reform cohorts. The progress through upper secondary education is studied as annual transitions between grade levels, for four years after compulsory schooling. The empiri-

[1] An exception among European countries appears to be the United Kingdom; Dustmann and Theodoropoulos (2006) document that the educational attainment of children of ethnic minority immigrants compares favorably both to their own parents and their white British-born peers.

[2] Evidence from the United States shows that the intergenerational linkage in education is a key determinant of the generational assimilation process of immigrant groups; see Borjas (1995; 2006), Trejo (1997), Card et al (2000). Cameron and Heckman (2001) examine racial and ethnic differences in college attendance. See also the reviews of the literatures on determinants of educational attainment in Haveman and Wolfe (1995) and intergenerational economic mobility in Solon (1999).

cal methodology pays particular attention to the vitally important transition from compulsory schooling to upper secondary education. Prior studies of immigrant-native differences in educational transitions in Norway are typically restricted to upper secondary students, an approach that overlooks the vitally important transition from compulsory schooling.[3]

There are large differences in educational attainment between immigrant groups by country of origin and the composition of the immigrant youth population changes from year to year. Aggregation over immigrant groups can therefore be misleading when studying changes over time (i.e., cohort differentials) in educational attainment. The approach chosen here is to study the two largest long-term immigrant groups, Pakistanis and Vietnamese, and compare these with ethnic Norwegian youth.

In the next two sections we provide further background on the reform as well as non-Western immigration to Norway, while data are presented in section 4. The identification strategy is discussed in section 5, followed by empirical results on the transition from compulsory schooling to the first year of the upper secondary school. Section 7 describes the sequential binomial logit framework along the lines of Cameron and Heckman (1998; 2001) for the sequence of transitions throughout the three levels of the upper secondary school, before presenting the estimation results. Section 8 concludes.

2 Norwegian upper secondary education and the 1994 reform

During the years of this study Norwegian youth typically finished compulsory schooling after ninth grade in the summer of the year they turned 16. The majority went directly on to upper secondary education in the autumn. The Norwegian upper secondary school system encompasses both theoretical education to prepare for tertiary education and vocational education and training (apprenticeships). Upper secondary schools were predominantly (about 95 percent) public and administered locally by the nineteen counties. Prior to the reform in 1994, there were substantial capacity constraints in some counties (NOU, 1991; Briseid, 1995).[4]

Capacity limits on admission varied across counties and slots were typically allocated according to performance (marks) in ninth grade, see NOU (1991) p. 35. To some extent, the

[3]Lødding (1999) and Opheim and Støren (2001) study differences between immigrant and majority youth enrolled in upper secondary education. Helland and Støren (2006) examine apprenticeships among ethnic Norwegian and minority youth enrolled in vocational programs.

[4]Data on demand for upper secondary education (number of applicants by county and track) are generally not available, implying that capacity constraints, or rationing for the first year, cannot be measured directly. Application data from 1988, presented in NOU (1991) p.28, show that 95 percent of the pupils who left compulsory schooling applied for admission to upper secondary schools, but only 84 percent was admitted.

primary group of applicants who just finished compulsory schooling, was crowded out by older applicants. In some of the larger cities, local pupils residing within the schools catchment area were given priority. In addition, the vocational track had a structure that made it difficult to proceed from the first year to further vocational schooling or apprenticeships. Such progression depended on first-year performance, the supply of apprenticeships, and the ability of the pupils in question to compete for these apprenticeships.

The major reform of secondary education, fully implemented by the autumn of 1994, changed the system in a number of ways. Primarily, every adolescent born in 1978 or later were entitled to start a three to four year upper secondary track upon completing compulsory schooling. To meet this, every county had to come up with an offer of a complete secondary education for all ninth graders in the spring of 1994 (as well as other youth under 20 who had dropped out of school earlier). As part of the reform, the design of the vocational track changed into a system of two years in school and two years of practice (apprenticeship). Due to excess demand for apprenticeships a substantial proportion of the weaker students spent all four years in school. The reform also increased the capacity and availability of slots in vocational track, in order to reduce bottlenecks in the transition from the first year (10th grade) with a joint curriculum to the second/third year with a craft-specific curriculum.

Although the reform was implemented relatively quickly, several counties expanded capacity in 1993 in order to accommodate the right to a full secondary education for everyone as of the autumn of 1994. The 1977 birth cohort was also smaller than the preceding cohorts, which contributed to reduced excess demand the year before the implementation of the reform. Still, the reform has some qualities of a natural experiment, as there was hardly any change in the distribution of background characteristics across the four cohorts of this study. The reform was implemented for the 10th grade in 1994, for the 11th grade in 1995, and for 12th grade in 1996. Thus, a comparison of, e.g., the transitions from lower secondary into the first year of upper secondary education for the pre-reform and the post-reform cohorts gives a good idea of the effects of the reform on this transition.

3 Ethnic Minority Youth in Norway

Large scale immigration of non-Western origin from outside Europe is a relatively recent phenomenon in Norway, roughly starting out with male labour migrants from Pakistan, Turkey,

Morocco and India in the early 1970s. By far the largest group of labour migrants came from Pakistan; see Bratsberg et al (2006) for a study of immigrant flows to Norway. After the mid 1970s, immigration from outside the Nordic countries was in principle restricted to specialists, refugees, and political asylees as well as family reunifications. During the late 1970s and in the early 1980s, Norway accepted a large number of "boat refugees" from Vietnam. In spite of the restrictions, immigration accelerated, but the immigrant population in Norway remained fairly small. The population share of immigrants increased from 4.3 percent to 5.9 percent during our data the period (1992-1999), gradually approaching 8.3 percent by 2006. To reduce problems of unobserved heterogeneity across cohorts, we limit our analyses to immigrant youth originating from Pakistan and Vietnam. These two groups constitute about half of the immigrant youth with a non-Western, non-European origin and about 1 percent of the compulsory schooling graduate cohorts of 1992-95.

4 Data

The data are extracted from official Norwegian registers, and include the full populations. The populations studied are the four graduating cohorts from compulsory schooling in the years 1992-95, as identified by the education register. We restrict the analyses to those who graduated during the calendar year they turned 15, 16, or 17. This includes the vast majority of pupils, between 98 and 99 percent of the relevant age cohorts. The data are based on matched registers, using personal identification numbers. In addition to the educational information, a range of demographic and economic data are available, such as immigrant status, country of origin and the date of first arrival in Norway. Intergenerational links enables us to include detailed parental background information.

The groups are defined on the basis of immigrant status, country of origin and date of first arrival in Norway. The immigrant groups consist of individuals with two parents born in either Pakistan or Vietnam. The youth samples include both those born in Norway and those born abroad provided they arrived in Norway before their 13th birthday. The native comparison group consists of individuals born in Norway by two Norwegian-born parents.

Data on participation in education and the highest completed grade level by October 1st every year between 1993 and 1999 are used in this study. Most secondary education tracks had readily defined grade levels 10-12 both before and after the school reform. For educational tracks

without a formal completion at grades 10 or 11, a grade level is considered completed if the pupil participates in a course at the next level. Thus, the data are not suitable for decomposition of transition rates into participation and completion conditional on participation.

Table 1 presents highest completed educational attainment four years after completion of compulsory schooling, by cohort and group. In general, the Pakistani youth have less favorable attainment than the Vietnamese and native youth groups. Attainment of the Vietnamese group is almost at the same level as for natives. In fact, while not tabulated, Vietnamese immigrants who arrived in Norway before first grade had educational attainments at the same level as natives.

Table 1 also reveals that educational attainment generally improved over the sample period, and particularly so for the Pakistani group. The proportion of the youth at age 20 with little or no educational qualifications beyond compulsory schooling decreased substantially for all three groups. The fraction of natives with compulsory schooling only decreased from 3.6 percent of the 1993 cohort to 2.6 percent of the 1995 cohort. The same proportion decreased from 18.8 to 8.6 percent for the Pakistani group, and from 5.0 to 4.3 percent for the Vietnamese group. Similarly, the proportion of natives with at most one year of completed upper secondary education decreased from 14.1 to 9.7 percent across the four cohorts; for Pakistanis, from 37.4 to 21.9 percent; and from 20.8 to 12.0 percent for the Vietnamese group.

The large differences in educational attainment of Pakistani and Vietnamese pupils are interesting, particularly as the Pakistani group on average has stayed in Norway for a much longer period. Cultural background may explain part of the difference, as empirical studies consistently have found higher educational success among immigrants originating in countries with a dominant Confucian tradition, e.g., Portes and MacLoed (1996). In Norway, studies have found that Vietnamese pupils spend distinctly more time on homework, Lauglo (1999), and that they outperform Pakistanis in the final year of compulsory schooling, Bakken (2003), as well as in upper secondary school, Støren (2006). It should be noted that, in our data, the Vietnamese youth are distinctly different from most other non-Western immigrant groups in terms of educational attainment.

As covariates in the analyses, we use parental educational background, age and income. The income measure is drawn from the pension register. This facilitates using an average over several years, thereby reducing measurement-error bias due to transitory changes in income. For this purpose, we use a period of 6 years, starting 2 years before and ending 3 years after graduation

from compulsory schooling. The drawback of these data is that annual incomes below 1 unit of the Norwegian pension system (approximately 4000 Euros in 2003) are not observed and treated as zero, and that incomes above 12 units (47,500 Euros) are top coded. Incomes are measured in NOK 10,000 from 1997. Adjustments for changes in the price level are implicit in the pension register data. In addition to the parental background information, gender, whether born in Norway or abroad, and the age at immigration are included as covariates. The mean and standard deviation of the covariates are given in Table 2. Missing values are typically set to zero, though dummies signifying missing variables are included as covariates in the analyses. Note from Table 2 that a much larger fraction of the Pakistani than the Vietnamese sample was born in Norway and that the parents of the immigrant samples have distinctly lower incomes and educational attainment than the parents of native youth.

5 Identifying the reform effect for minority youth

The data facilitate the study of annual transitions into and throughout upper secondary schooling, but in order to make the identification strategy transparent, we first focus on continuation after the end of compulsory schooling. Table 3 displays this transition (i.e., from 9th to 10th grade) as well as the population at risk in each cohort. As we show below, there were only minor changes in the background characteristics that influence educational attainment during this period, so a comparison of pre-reform and post-reform transition rates gives a good indication of the reform effects. However, a simple pre-post comparison will of course capture the impact of all other contextual factors that changed over the sample period (to be discussed more below).

The proportion of natives who completed the first year of upper secondary within one year of compulsory school was 0.88 in the pre-reform years and 0.92 in the post-reform years. For Pakistani pupils, the transition rate changed tremendously during the short period from 1992 to 1995, with an increase from 0.56 for the 1992 cohort to 0.83 for the 1995 cohort. However, the largest fall in the dropout rate did not exactly coincide with the reform year, but came instead the year prior to the reform. For the Vietnamese cohorts, the transition rate improved as well, and again the improvement was largest between the 1992 and 1993 cohorts. For the Vietnamese group, the first year transition rates were about the same as for the native control group for the last three cohorts. The improved immigrant transition rate between 1992 and 1993 indicates that the counties started to increase their capacity in anticipation of the reform,

even before the reform was fully implemented. With a few exceptions, the school reform seems to have affected the immigrant groups in about the same way as natives, but the increase in the transition rate to 10th grade was much stronger for the Pakistani group than for the other groups. The main question is whether the improvement in the transition to 10th grade for Pakistani students, and partly the Vietnamese, can be attributed to the reform. An obvious alternative explanation is pupil heterogeneity across cohorts, even within groups with the same country of origin. Note that sample sizes for immigrants are relatively small, so the stability of family background characteristics like for natives, is far from apparent. However, controlling for differences in pupil and family characteristics does not affect the cohort differentials, see below.

A direct test would be to estimate the effect of capacity constraints on individual transitions, but, unfortunately, information on the degree of rationing for compulsory school graduates of ethnic minority background who seek to enter upper secondary schooling is not available. However, the proportion of native Norwegian pupils in each county who completed the first year of upper secondary school within a year of leaving compulsory schooling is a natural proxy for the county- and time specific capacity constraint. Following this idea, we model Pakistani and Vietnamese transition probabilities as functions of the transition probabilities for natives in the same cohort-by-county cell. A crude analysis would be to regress the 76 (i.e., 19x4) county-by-cohort specific transition rates for each immigrant group on the corresponding rate for natives. Such a data set is essentially a panel data set, and the amount of information from introducing county differences is expanded from 4 data points (each cohort) to 76 data points, giving us the opportunity to investigate the strength of the relationship even in the presence of large unexplained variation in the response variable. In addition, it is possible to test the implicit assumption that the effect of differences in native transition rates across counties is the same as the effect of differences across cohorts. The method used here is a refinement of such an empirical strategy.

First, the model is specified in terms of transition probabilities rather than transition rates. Transition rates are only estimates of such probabilities, with measurement errors that are decreasing in the number of observations in each cell. With the model specified in terms of probabilities such measurement errors are explicitly taken into account. Second, the functional relationship between the transition probabilities for native and immigrant youth are specified as being linear in the log odds of the probabilities. One implication of this specification is that probability differences of the same absolute magnitude will be considered larger the further

away they are from 0.5 (e.g., a change from, say, 0.98 to 0.99 is larger than a change from 0.56 to 0.57). The third refinement is that individual explanatory variables are taken into account, separately for each of the native and two immigrant groups. Thus, the measure of "capacity constraints" can be interpreted as how difficult it was for a native pupil with average background characteristics to make the particular transition. Finally, the modeling explicitly takes into account differences in composition (such as the proportion born in Norway) across the minority county-cohort groups.

This identification strategy relies on the assumption that county-cohort specific effects, arising from other factors than the reform, are uncorrelated for natives and the ethnic minority groups. Otherwise, the county-cohort specific transition rates would simply pick up other factors, wrongly attributed to the reform. To check for the presence of time-variant county factors common to both immigrants and natives, local unemployment rates were included as covariates. The effects were found to be small and statistically insignificant. The absence of an influence of local labor market conditions on the school continuation probability at age 16 is also documented elsewhere, see Raaum and Røed (2006), p. 204.

The model is specified as follows. The log odds of the probability p_N that a native pupil in county r from cohort c with individual covariate vector x_N will complete 10th grade in the first year after compulsory schooling is given by

$$\log \frac{p_N}{1-p_N} = \gamma_{c,r} + x_N \beta_N, \tag{1}$$

and the log odds of the corresponding probability p_P for a Pakistani pupil with individual covariate vector x_P is given by

$$\log \frac{p_P}{1-p_P} = \theta_1 + \theta_2 \gamma_{c,r} + x_P \beta_P, \tag{2}$$

where $\gamma_{c,r}$, β_N, β_P, θ_1 and θ_2 are unknown parameters and parameter vectors to be estimated. A similar equation is estimated for the Vietnamese group.

The model is estimated in two steps, by first estimating equation (1) by maximum likelihood, and then using the parameter estimates of $\gamma_{c,r}$ as regressors in maximum likelihood estimation of equation (2). Little efficiency is lost by this procedure compared to simultaneous maximum likelihood, as there are far more natives than Pakistanis and Vietnamese in our populations.

6 Empirical results on school dropouts

Our first results focus on the transition between lower and upper secondary education, i.e., from 9th to 10th grade. The $\gamma_{c,r}$-parameters are interpreted as capacity constraints, reflecting variation in (inverse) dropout rates among majority youth across counties and time. The cohort-specific weighted means for each group (weighted by the proportion of the group in each cohort living in that county) are shown in Table 3. For the native sample, the mean increased from the pre- to the post-reform period, a reflection of the improvement in transition rates in Table 2. For the Pakistani group, the change in the capacity-constraint measure was slightly larger, simply due to the residential concentration in the capital area where transition rates increased substantially for natives. The Vietnamese were more widely spread across the country, and the weighted $\gamma_{c,r}$-parameters are similar to those of the majority group. When the $\gamma_{c,r}$-parameters are translated into transition probabilities, the dispersion across counties is also substantially reduced from the pre- to the post-reform period.

Table 5, column 1, reports the estimated effects of gender and family background for natives. The conventional pattern appears where girls drop out less frequently than boys and educational success relates positively to parental education, earnings, and age. The model also contains dummy variables for missing parents and missing educational information on parents. In addition, the 76 $\gamma_{c,r}$ -parameters summarized in Table 4 are not tabulated. The next columns are based on the Pakistani sample, where columns 2 and 3 address the issue of cohort heterogeneity in terms of family background characteristics. As the coefficients of the cohort dummies are basically the same across the two columns, it seems unlikely that the Pakistani pupils of the post-reform cohort had individual characteristics that made them more likely to continue education after completing compulsory schooling.

The measures of capacity constraints are included in the model reported in column 4, and two important results appear. First, the point estimate of θ_2 is 1.44. The interpretation is that a change in the county-cohort specific capacity constraint yields a change in the log odds transition probability of Pakistani youth that is almost 1.5 times that of natives. The finding is consistent with a mechanism in which capacity constraints disproportionally impact weaker students in ninth grade. As pointed out above, Pakistani students typically had less favorable performance than the other two groups. Second, the coefficients of the cohort dummies are substantially reduced when the capacity-constraint measures are included in the model. In particular, there

is no longer a significant difference between the pre- and post-reform cohorts. This pattern is clearly shown in columns 5 and 6 where the cohort dummies are restricted to a simple pre-post structure. The Pakistani post-reform cohorts significantly outperformed their older peers, but this performance differential disappears when we account for differences in capacity constraints facing pre- and post-reform cohorts.

In the model given by equation (2), it is implicitly assumed that the effect of differences in $\gamma_{c,r}$ is the same over counties and cohorts. For purposes of specification testing, we estimated two generalizations of the model. Let $\gamma_{c,\cdot}$ denote the mean value of $\gamma_{c,r}$ among Pakistanis from cohort c. One generalization is given by substituting equation (3) for equation (2).

$$\log \frac{p_P}{1-p_P} = \theta_1 + \theta_{2a}(\gamma_{c,r} - \gamma_{c,\cdot}) + \theta_{2b}(\gamma_{c,\cdot}) + x_P\beta_P. \tag{3}$$

In this specification, the parameter θ_{2a} represents the effect of within-cohort differences in capacity constraints across counties, while θ_{2b} represents the effect of changes in (average) constraints across cohorts. The restriction $\theta_{2a} = \theta_{2b}$ leads to the simpler model. The estimation results shown in the final column of Table 4 reveal remarkably similar estimates for θ_{2a} and θ_{2b} and the restriction of the previous specifications can clearly not be rejected by a Wald test.

Table 6 shows analogous analyses for the Vietnamese sample. The smaller sample implies that estimates are less precise, but the coefficient pattern is the same as for the Pakistani group: Variation in family characteristics do not explain cohort differentials, the capacity-constraint variable has a significant effect on the transition probability, and the cohort differentials drop considerably when we account for changes in capacity constraints. Finally, the capacity-constraint effect is almost the same, whether we estimate it within or between cohorts. It is also worth noting that the point estimate of θ_2 is lower than for the Pakistani group, consistent with the hypothesis that the reform had a greater impact on groups with low school performance.

7 Continuation, selection, and reform effects

One of the prime concerns that motivated the reform was the incomplete transition from 10th to 11th grade. Prior to the reform, there existed significant bottlenecks, particularly in the vocational track (Støren et al, 1998). The pattern of Table 1 with a decreasing share of pupils with only 10 years of education is consistent with the reform leading to a reduction in such constraints.

In a complete assessment of the effects of the upper secondary school reform, two more issues must be addressed. First, the reform affected delayed pupils (dropouts) from the pre-reform cohorts. Secondly, changes in the transition from one grade to the next (e.g., 9th to 10th grade) may induce compositional changes in the population at risk for the following transition (10th to 11th grade). In other words, differences in pre- and post-reform transition rates, and thereby estimated cohort effects, are potentially contaminated by selection effects arising from unobserved heterogeneity.

Tables 7 - 9 decompose the attainment statistics in Table 1 into annual transition rates, by cohort and group, thus expanding Table 3 to all possible grade-year transitions in the data. In the second year, the transition to 11th grade is possible for those who completed 10th grade, while the transition to 10th grade is still possible for those who did not complete 10th grade the previous year, and so on. Population sizes denote the individuals at risk for the transition, i.e., those who had completed the lower grade.

The reform affected all transitions for the 1994 and 1995 cohorts, as well as those from the 1993 cohort who were delayed at least one year and the 1992 cohort who were delayed at least two years. Thus, when we extend the analysis beyond the first transition (to 10th grade), there is no simple relationship between reform status and 9th grade graduation cohort. A comparison of pre-reform and post-reform transition rates for natives provides a first indication of how the reform changed transitions through upper secondary education. However, in the transitions in the second year and onwards, the population that make up the risk set is selected.

Among those who did not complete 10th grade in the first year after compulsory school, the proportion among natives who completed 10th grade in the next year (row 2) rose from 0.56 for the 1992 (pre-reform) cohort to 0.62 for the 1993 (here, post-reform) cohort. The second year transition rate to 10th grade dropped again for the later cohorts, this may be because the group was now smaller and thus likely to be less favorably selected. The transition rates to 11th grade also showed an upturn from 0.78 for the 1992 (pre-reform) cohort to 0.86 for the 1994 and 1995 (post-reform) cohorts. We interpret these changes as removal of capacity constraints, particularly in the vocational courses. The transitions to 12th grade showed a different development, with lower post-reform transition rates. For example, the rate dropped from about 0.8 to 0.7 for those who had completed 11th grade two years after compulsory school. This likely reflects a particular feature of the reform which implied that, within the vocational track 24 months of actual schooling were required to complete the 12th grade (often referred to

as the "third" year). With this in mind, we will focus on transitions from 10th to 11th grade.

For the Pakistani group, the transition rates to 10th grade in the second year after compulsory schooling showed a strong increase for the 1993 cohort (with the introduction of the reform) compared to the 1992 cohort, and a subsequent decrease for delayed pupils. The introduction of the reform can apparently also be seen in the transition rates to 11th grade, with a marked increase between the 1993 and 1994 cohorts. However, unlike the transition rate to 10th grade, the change in the transition to 11th grade is only at about the same level as for natives. For the Vietnamese, the increase in the second-year transition rate to 11th grade was also strong, with most of the increase taking place from the 1992 to the 1993 cohort.

7.1 Model specification

The model is specified in the spirit of Cameron and Heckman (1998; 2001). The transitions are modeled as a sequence of binomial logit models. For each year following graduation from lower secondary education, the response is whether or not the pupil increased the highest completed educational level. Thus, pupils who start the next level, but fail to pass exams, do not make the transition. The model specified here allows for 9 different transition types, corresponding to the various combinations of grade level and years since ninth grade tabulated in Tables 7-9. Selection effects reflect unobserved heterogeneity, modeled as a pupil specific, one-dimensional random effect that affects all transition probabilities for the individual. A separate parameter associated with the random effect is estimated for each type of transition.

The log odds of the probability $p_n^{g,y}$ that a native from cohort c, living in county r, completes grade level g, exactly y years after leaving compulsory school, conditional on having completed grade level $g-1$ but not grade level g a year before, is now given by

$$log(\frac{p_N^{g,y}}{1-p_N^{g,y}}) = \gamma_{c,r}^{g,y} + x_N\beta_N^{g,y} + \alpha_N^{g,y}v, \tag{4}$$

where $\gamma_{c,r}^{g,y}$, $\beta_N^{g,y}$, and $\alpha_N^{g,y}$ are parameters to be estimated for each of the 9 possible combinations of g and y and for four different cohorts c and nineteen counties r, and v is an unknown, individual-specific random variable, with independent standard normal distribution.

The log odds of the transition probability $p_P^{g,y}$ for Pakistani pupils is specified as,

$$log(\frac{p_P^{g,y}}{1-p_P^{g,y}}) = \theta_1^{g,y} + \theta_2^{g,y}\gamma_{c,r}^{g,y} + x_P\beta_P^{g,y} + \alpha_P^{g,y}v \tag{5}$$

with an analogous specification for the Vietnamese group.

The model has one restriction across different grade-year combinations. It is required that

$$\gamma_{c,r}^{g,y+1} = \tau_1^{g,y+1} + \tau_2^{g,y+1}\gamma_{c+1,r}^{g,y}, \tag{6}$$

where $\tau_1^{g,y+1}$ and $\tau_2^{g,y+1}$ are parameters to be estimated. (Identifiability requires the normalizations $\tau_1^{10,1} = \tau_1^{11,2} = \tau_1^{12,3} = 0$ and $\tau_2^{10,1} = \tau_2^{11,2} = \tau_2^{12,3} = 1$.)

Like in our analysis of the transition from lower to upper secondary school, the parameters $\gamma_{c,r}$ are interpreted as proxies for capacity constraints (for that grade level in that county in that year.) This measure affects everyone who is exposed to a transition to the same grade level in the same year (i.e., whether the pupil is delayed or not). The model specification is symmetric with respect to the different years of delay, groups and years.

Define the variables $d_{g,y}$ as equal to 2 if the pupil completed grade level g exactly y years after completing lower secondary education. Let $d_{g,y}$ be equal to 1 if the pupil did not complete grade level g exactly y years after completing lower secondary school, but had completed grade level $g-1$ but not grade level g a year before. Finally, define $d_{g,y}$ as equal to zero if (i) this type of transition is not modeled (e.g. $d_{12,1} = 0$ for everyone because no one was at risk for transition to 12th grade the year after completing 9th grade), (ii) the pupil had already completed grade level g by year $y-1$, (iii) the pupil had not completed grade level $g-1$ by year $y-1$, or (iv) the pupil's educational attainments was not observed at this stage due to sample attrition.

Now, the likelihood of an educational career can be expressed as

$$L = \int_{-\infty}^{\infty} \prod_{g=10}^{12} \prod_{y=1}^{4} (p_j^{g,y}(v))^{1(d_{g,y}=2)} (1 - p_j^{g,y}(v))^{1(d_{g,y}=1)} \phi(v) dv. \tag{7}$$

Thus, the likelihood of an educational career, conditional on the individual-specific random effect and observed characteristics, is simply the product of the likelihoods associated with the (usually) three or four transitions that this individual is exposed to.

The model is, for practical reasons, estimated sequentially, first by maximum likelihood for natives, and then by maximum likelihood for the two immigrant groups, with estimates of $\gamma_{g,y}$ from the first stage added to the models for the Pakistani and Vietnamese groups. The integral in the likelihood function is evaluated using Gauss-Hermite quadrature with 20 points.[5]

[5]For purposes of numerical stability, a weak penalty term involving the sum of squared α-parameters was appended to the likelihood function.

7.2 Unobserved heterogeneity and selection effects

While our model follows the approach of Cameron and Heckman (1998; 2001), it deviates with respect to the handling of unobserved heterogeneity. The Cameron-Heckman approach assumes that everyone (in a group) at risk for the same grade transition will follow the same equation for the transition probability. (This is almost, but not strictly, an identifying assumption for selection effects.) Thus, if students who are delayed in their educational career have lower transition rates than others at risk for a certain transition, this is interpreted as a selection effect and not a causal effect of delayed educational progress. We estimate separate parameters for pupils with standard progression and those who are delayed, allowing for a causal impact of delay on future transitions. Thus, our approach impose weaker assumptions when identifying selection effects.

Arguably, the best strategy for identification of selection models is to use appropriate exclusion restrictions, e.g. powerful time-varying covariates. The cross-cohort restrictions used here operate as such and can be interpreted as unobserved time-varying covariates that are estimated (as fixed effects). It is possible to find groups of students at risk for a certain transition with different histories in terms of (earlier) transition probabilities, but who face similar capacity constraints the current year, because the county-specific capacity constraints vary over time (and type of transition). Different transition rates for groups with different histories but facing the same current constraints indicate selection effects.

7.3 Empirical specification and results

The native control group model was specified with 11 covariates (gender, fathers income, age, education, mothers income, age, education, dummies for missing parents, dummies for missing educational information for parents) with free parameters for each type of transition. Intercept terms and cohort dummies were included, when not linear dependent with the county-time dummies. With 9 parameters for capturing selection effects, this gives a model with 474 parameters. (133 county-time dummies for transitions to grade level 10, 114 county-time dummies for transitions to grade level 11, 95 county-time dummies for transitions to grade level 12, 99 parameters associated with covariates, 12 parameters for linear effects of county-time dummies, 12 cohort dummies, and 9 selection parameters). The models for Pakistanis and Vietnamese were specified similarly, with the additional covariates capturing age at immigration and born

in Norway.[6]

The aim of the estimation exercise is to decompose the cohort-year-grade differentials of Tables 7-9 into causal reform effects and selection effects arising from compositional change (of unobserved characteristics). While the empirical model accounts for all of the nine transitions, the interpretational focus will be on the second year transition from 10th to 11th grade. The estimated parameters, over 700 in number, are not easily interpretable (except for their signs). The parameter estimates and their standard errors are therefore not reported, but are available upon request.

Table 10 shows the parameters associated with the random effects for the three groups, with Wald standard errors. While the exact values of the α-parameters are not pinpointed, the models with selection effects clearly represent statistically significant improvements over models without selection effects, with improvements in the log likelihood of respectively 37 and 15.5 for the Pakistani and Vietnamese samples. (The latter, and weakest, result has a p-value of less than 0.0003.) The model for natives indicates practically no selection effects on the basis of the first year transition (i.e., due to selective 9th to 10th grade transitions), while there are stronger selection effects from 11th grade to completion of 12th grade. For Pakistanis, the random-effects estimates suggest significant selection effects for the standard progression transitions both from 9th to 10th, and from 10th to 11th grade. The precision of the estimates for the Vietnamese are too imprecise to make firm conclusions.

The parameters in Table 10 are possible to interpret, in the sense that the model specified by, e.g., equation (4) is equivalent to stating that the transition occurs if and only if $y^*_{c,r} > 0$ with

$$y^*_{c,r} = \gamma^{g,y}_{c,r} + x_N \beta^{g,y}_N + \alpha^{g,y}_N v + \epsilon_{g,y}, \tag{8}$$

where $\epsilon_{g,y}$ are independent logistic variates. If we define $\nu_{g,y} = \alpha^{g,y}_N v + \epsilon_{g,y}$, it is possible to compute the correlation between $\nu_{g,y}$ for different grade levels by the formula

$$\text{corr}(\nu_{g,y}, \nu_{h,z}) = \frac{\alpha^{g,y}_N \alpha^{h,z}_N}{\sqrt{\pi^2/3 + (\alpha^{g,y}_N)^2}\sqrt{\pi^2/3 + (\alpha^{h,z}_N)^2}} \tag{9}$$

Capturing these correlations are the purpose of the α-parameters, and equation (9) shows the

[6]For some of the delayed transitions, sample sizes necessitated taking covariates out of the immigrant models, as the covariates turned out to be perfect predictors of the transition. There were 139 parameters in the Pakistani and 115 parameters in the Vietnamese model. The reduction in the number of covariates reflects that few students were exposed to certain transitions, which indicates that the exact effects of the involved covariates were not likely to be important for the overall results.

structure imposed by the one-dimensional random effects on these correlations. The highest (relevant) correlation between ν-parameters implied by Table 10 is about 0.5 associated with the transition to 11th grade in the second year and the transition to 12th grade in the third year following high school graduation for Norwegian natives.

We next turn to determinants of the transition from 10th to 11th grade during in the second year after compulsory schooling. These analyses are similar to those in Section 6; results are reported in Tables 11 and 12. The columns labeled "Natives," "Pak. M1-M3," and "Vie. M1-M3" report results from partial models of this transition, analogous to the first four columns of Tables 5 and 6. The columns "Pak. M4" and "Vie. M4" list estimates from the large model taking selection effects into account. For comparability the results are normalized.[7]

For Pakistanis, models M1-M3 in Table 11 show that substantial post-reform cohort effects disappear when the capacity constraints are accounted for. This finding is robust to introducing selection effects (column 5). Taken at face value, accounting for selection effects seems to increase the reform effects somewhat, as the parameter estimates associated with capacity constraints increase in value, while the cohort effects are not all that much affected.

For Vietnamese students, large post-reform cohort effects are only somewhat reduced by the introduction of capacity constraints (see Table 12). In the model with selection effects (column 5), the point estimates indicate only a weak effect of the capacity constraints. However, the uncertainty due to small sample size is substantial in these results.

To round off the analysis, we discuss conditional and unconditional transition rates from 10th to 11th grade based on the estimated model. The unconditional transition probabilities to 11th grade in the second year are computed by the formula

$$p_u = \int_{-\infty}^{\infty} P_j^{11,2}(v)\phi(v)dv, \tag{10}$$

while conditional transition probabilities are computed by

$$p_c = \frac{\int_{-\infty}^{\infty} P_j^{10,1}(v)P_j^{11,2}(v)\phi(v)dv}{\int_{-\infty}^{\infty} P_j^{10,1}(v)\phi(v)dv}, \tag{11}$$

[7]The normalization consists of multiplying parameters in M4 with the ratio $(\pi/\sqrt{3}) : \sqrt{\pi^2/3 + (\alpha_P^{11,2})^2}$. The scale of the θ-parameters are however also affected by the parameter $\alpha_N^{11,2}$ because this affects the scale of $\gamma_{c,r}^{11,2}$ and must be multiplied by the ratio $\sqrt{\pi^2/3 + (\alpha_N^{11,2})^2} : \sqrt{\pi^2/3 + (\alpha_P^{11,2})^2}$. This normalization is only an approximation, but would have been exact if ϵ was normally distributed (with variance $\pi^2/3$) and not logistic.

using Bayes' rule.

The conditional transition probability corresponds to what we see in the data (if the model is not misspecified). Conditional transition probabilities give the probability of transition weighted by the probability of being at risk for the relevant transition. Unconditional transition probabilities correspond to the transition rate in the hypothetical situation that the full population had completed the previous level of schooling. Thus, the difference between the conditional and unconditional rates measures the impact of selection (both from observed and unobserved characteristics).

In Table 13 we list conditional and unconditional transition rates for the second year transition to 11th grade before and after the reform. Both the conditional and the unconditional rates suggest substantial reform effects for all three groups, with increases in the transition rate in the order of .06 to .09. For the native and Vietnamese groups, within-period point estimates yield very similar conditional and unconditional transition probabilities, indicating little selection bias in estimates. For the Pakistani group, the point estimates indicate a substantial difference in the probabilities and larger selection effects. An important result is that the selection effect in the Pakistani sample fell in the post-reform period.

We set out with the view that the simple transition rates in Tables 7-9 can be used to assess the effects of the reform. Clearly, the assessment of reform effects will be confounded if the role of selection was altered by the reform, as a result of changes in the composition of the population at risk for a given transition. Because the difference between unconditional and conditional transition probabilities reflects selection, an estimate of the selection bias in reform effects will be given by the change in this difference from before to after the reform. In the last column of Table 13, we list this difference-in-difference estimate along with its confidence interval.[8] As the table reveals, the difference-in-difference figures indicate no selection bias in reform-effect estimates for the native and Vietnamese groups. For Pakistanis, the difference-in-difference figure suggests that the change in the raw transition rate understates the effect of the reform by two to three percentage points. Because the reform brought compositional change in the population at risk, a change that in turn led to a reduction in selectivity, the effect of the reform on the attainment of Pakistani students is actually higher than that implied by the increase in the raw transition rate.

On the basis of the various results above, we therefore conclude that the reform effects on

[8]Confidence intervals for the immigrant groups are based on non-parametric bootstrapping. A similar confidence interval for the native sample would be very small and extremely computationally intensive.

the transition from the first to the second year of upper secondary education were at least of the same magnitude for the immigrant groups as for natives. It is quite possible that the effects of the reform were considerably stronger for Pakistani students than for natives, but that this is masked by selection effects.

8 Conclusions

Educational performance of immigrant youth has fallen short of that among natives in Norway as well as in other European countries. In Norway, the attainment of the two largest non-Western groups who graduated from compulsory schooling in the period 1992-95, improved over time. This paper addresses the impact of the upper secondary school reform implemented nationwide in 1994, granting statutory right to at least three years of upper secondary education for those who completed compulsory schooling. Specifically, we examine whether the improvement in educational attainment among immigrant youth from the pre- to the post-reform years can be attributed to the reform. We find no indication that compositional change in observed family background, selection effects related to unobserved heterogeneity, or labor market conditions can explain the change in immigrant attainment across graduation cohorts.

The reform effects are identified via the grade-county-cohort specific transitions rates for native Norwegian students. These proxies of capacity constraints were both reduced and leveled out across the country by the reform, and they affected the immigrant transitions significantly and explained the major part of differences in transition rates between the pre- and the post-reform cohorts. Our interpretation is buttressed by the fact that the relationship between Norwegian and immigrant transition rates was about the same across counties within each cohort as across cohorts. The attainment of Pakistani youth in particular were far more sensitive to capacity constraints in upper secondary education than that of native Norwegians.

We find that the largest difference in attainment between immigrant and native youth can be attributed to the transition between compulsory schooling and the first year of upper secondary education. For immigrant youth, and Pakistanis in particular, dropout was substantially reduced by the reform, and this is the major reason for the improved educational attainments of immigrants compared to natives during this short period.

Our main conclusion is that the Norwegian upper secondary school reform implemented in 1994 played an important role in reducing differences in educational attainment between native

Norwegians and immigrants. The wider implication of this is that non-targeted reforms, with an emphasis on securing access to secondary education for everyone, may give a sharp reduction in the educational dropout rates among groups that are constrained in terms of limited access. Ethnic minority youth and children from poor families are likely to be overrepresented in these groups. The evidence from this study is thus in line with findings of recent studies of compulsory schooling reforms, such as Aakvik et al (2003), Meghir and Palme (2005), and Oreopoulos (2006), showing that extensions of years of compulsory schooling have the largest effect on the attainment of pupils with a disadvantaged background and short expected education careers.

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Table 1: Highest completed education level 4 years after compulsory schooling, by group and cohort

	grade level	coh. '92	coh. '93	coh. '94	coh. '95
Natives	pop.size	48477	46167	46778	46458
	9	0.036	0.032	0.024	0.026
	10	0.105	0.094	0.069	0.071
	11	0.182	0.184	0.205	0.231
	12+	0.677	0.689	0.702	0.672
Pakistanis	pop.size	266	254	313	339
	9	0.188	0.094	0.128	0.086
	10	0.188	0.150	0.137	0.133
	11	0.210	0.205	0.224	0.242
	12+	0.413	0.551	0.511	0.540
Vietnamese	pop.size	139	132	159	209
	9	0.050	0.045	0.025	0.043
	10	0.158	0.121	0.101	0.077
	11	0.295	0.197	0.258	0.301
	12+	0.496	0.636	0.616	0.579

Table 2: Covariates with mean and standard deviation, by group

	Norwegians		Pakistani		Vietnamese	
variable	mean	st.dev.	mean	st.dev.	mean	st.dev.
gender	0.49	0.50	0.45	0.49	0.49	0.50
born in Norway	n.a.	n.a.	0.70	0.46	0.09	0.28
father missing	0.037	0.19	0.074	0.26	0.12	0.32
father's income	25.7	12.6	11.7	11.4	11.0	10.0
father's education	11.2	3.4	5.3	5.8	6.8	5.5
father's education missing	0.005	0.07	0.44	0.50	0.15	0.35
father's age	43.3	10.1	44.1	13.4	41.0	16.6
mother missing	0.01	0.1	0.03	0.17	0.07	0.25
mother's income	13.8	8.7	3.2	5.4	8.0	8.4
mother's education	10.9	2.6	3.3	4.9	6.0	5.0
mother's education missing	0.006	0.08	0.59	0.49	0.16	0.36
mother's age	41.8	6.6	41.7	8.7	39.9	12.9
age at immigration	n.a.	n.a.	1.76	3.37	5.6	3.9

Table 3: Transition rates to completed 10th grade first year after compulsory schooling, by group and cohort. Population size in parentheses.

	cohort '92	cohort '93	cohort '94	cohort '95
Natives	0.88 (48788)	0.88 (46572)	0.92 (47127)	0.92 (46785)
Pakistanis	0.56 (275)	0.75 (261)	0.76 (318)	0.83 (344)
Vietnamese	0.81 (141)	0.88 (134)	0.91 (211)	0.89 (211)

Table 4: Mean of $\gamma_{c,r}$, by group and cohort

	cohort '92	cohort '93	cohort '94	cohort '95
Natives	-0.9648	-0.9662	-0.4942	-0.5731
Pakistanis	-1.4487	-1.3468	-0.8345	-0.8431
Vietnamese	-0.9888	-0.9858	-0.5323	-0.6169

Table 5: Parameter Estimates - Models of Pakistani pupils' completion of 10th grade in the first year after compulsory schooling, with standard errors in parentheses

Variable	Natives	Pak. M1	Pak. M2	Pak. M3	Pak. M4	Pak. M5	Pak M6
intercept	n.a.	0.2560	-0.418	-0.1977	-0.299	-0.0993	-0.1160
		(0.1216)	(0.913)	(0.9275)	(0.897)	(0.915)	(0.912)
female	0.146	n.a.	-0.0071	-0.0213	-0.0011	-0.0124	-0.0129
	(0.0161)		(0.1397)	(0.1412)	(0.138)	(0.139)	(0.139)
born in Norway	n.a	n.a	0.522	0.5730	0.531	0.593	0.594
			(0.234)	(0.231)	(0.236)	(0.236)	(0.236)
father's income	0.0206	n.a	0.0233	0.0266	0.0240	0.0274	0.0275
	(0.0008)		(0.0070)	(0.0071)	(0.0069)	(0.0070)	(0.0070)
father's education	0.0557	n.a.	-0.0266	-0.0189	-0.0168	-0.0116	-0.0112
	(0.0043)		(0.0415)	(0.0418)	(0.0407)	(0.0411)	(0.0410)
father's age	0.0011	n.a.	-0.0035	-0.0055	-0.0002	-0.0029	-0.0029
	(0.0021)		(0.0167)	(0.0169)	(0.0165)	(0.0168)	(0.0168)
mother's income	0.0206	n.a.	0.012	0.0066	0.0116	0.0070	0.0066
	(0.0010)		(0.0142)	(0.0144)	(0.0141)	(0.0143)	(0.0142)
mother's education	0.0577	n.a.	0.0605	0.0640	0.0611	0.0628	0.0630
	(0.0049)		(0.0317)	(0.0322)	(0.0314)	(0.0320)	(0.0320)
mother's age	0.0215	n.a.	0.0085	0.0133	0.0070	0.0124	0.0127
	(0.0022)		(0.0176)	(0.0178)	(0.0174)	(0.0176)	(0.0176)
age at immigration	n.a.	n.a.	-0.0315	-0.0187	-0.0317	-0.0185	-0.0178
			(0.0312)	(0.0317)	(0.0308)	(0.0314)	(0.0313)
capacity constraints	n.a.	n.a.	n.a.	1.4402	n.a.	1.4364	1.500
				(0.3130)		(0.3130)	(0.191)
cap. con. cross-coh.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.5465
							(0.2485)
cohort93	n.a.	0.8274	0.7719	0.6400	n.a.	n.a.	n.a.
		(0.1873)	(0.1942)	(0.1991)			
cohort94	n.a.	0.9022	0.9465	0.0569	n.a.	n.a.	n.a.
		(0.1791)	(0.1873)	(0.2716)			
cohort95	n.a.	1.3190	1.4192	0.5340	n.a.	n.a.	n.a.
		(0.1877)	(0.1956)	(0.2771)			
post-reform	n.a.	n.a.	n.a.	n.a.	0.83	-0.0914	n.a.
					(0.139)	(0.233)	

Table 6: Parameter Estimates - Models of Vietnamese pupils' completion of 10th grade in the first year after compulsory schooling, with standard errors in parentheses

Variable	Natives	Vie. M1	Vie. M2	Vie. M3	Vie. M4	Vie. M5	Vie M6
intercept	n.a.	1.4404	-0.7871	-0.5900	-0.4591	-0.2704	-0.3306
		(0.2140)	(1.1508)	(1.1602)	(1.1309)	(1.1402)	(1.1231)
female	0.146	n.a.	0.0516	0.0666	0.0892	0.1036	0.1055
	(0.0161)		(0.2478)	(0.2505)	(0.2456)	(0.2484)	(0.2484)
born in Norway	n.a	n.a	0.6354	0.8322	0.5167	0.7381	0.7173
			(0.6708)	(0.6752)	(0.6663)	(0.6719)	(0.6700)
father's income	0.0206	n.a	0.0181	0.0213	0.0178	0.0209	0.0208
	(0.0008)		(0.0169)	(0.0170)	(0.0169)	(0.0169)	(0.0169)
father's education	0.0557	n.a.	0.0098	0.0037	0.0092	0.0023	0.0025
	(0.0043)		(0.0415)	(0.0417)	(0.0416)	(0.0418)	(0.0418)
father's age	0.0011	n.a.	-0.0206	-0.0179	-0.0219	-0.0187	-0.0186
	(0.0021)		(0.0259)	(0.0258)	(0.0256)	(0.0256)	(0.0256)
mother's income	0.0206	n.a.	0.0112	0.0115	0.0104	0.0106	0.0109
	(0.0010)		(0.0196)	(0.0197)	(0.0193)	(0.0195)	(0.0194)
mother's education	0.0577	n.a.	-0.0116	-0.0139	-0.0113	-0.0129	-0.0129
	(0.0049)		(0.0399)	(0.0402)	(0.0398)	(0.0401)	(0.0402)
mother's age	0.0215	n.a.	0.0774	0.0756	0.0769	0.0751	0.0751
	(0.0022)		(0.0305)	(0.0307)	(0.0304)	(0.0306)	(0.0306)
age at immigration	n.a.	n.a.	-0.0576	-0.0438	-0.0628	-0.0495	-0.0496
			(0.0387)	(0.0397)	(0.0381)	(0.0391)	(0.0391)
capacity constraints	n.a.	n.a.	n.a.	1.1981	n.a.	1.2251	1.1896
				(0.4062)		(0.4047)	(0.4047)
cap. con. cross-coh.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.0627
							(0.6023)
cohort93	n.a.	0.5577	0.5242	0.5234	n.a.	n.a.	n.a.
		(0.3417)	(0.3515)	(0.3559)			
cohort94	n.a.	0.8351	0.8525	0.3086	n.a.	n.a.	n.a.
		(0.3454)	(0.3544)	(0.4000)			
cohort95	n.a.	0.6127	0.4786	0.0125	n.a.	n.a.	n.a.
		(0.3047)	(0.3219)	(0.3624)			
post-reform	n.a.	n.a.	n.a.	n.a.	0.4169	-0.0998	n.a.
					(0.2477)	(0.3016)	

Table 7: Population size and transition rate to each grade level, by years since compulsory schooling and cohort, the native control group

year	level	cohort '92		cohort '93		cohort '94		cohort '95	
		pop. size	rate	pop. size	rate	pop. size	rate	pop. size	rate
1	10	48788	0.88	46572	0.88	47127	0.92	46785	0.92
2	10	5781	0.56	5376	0.62	3569	0.56	3737	0.54
2	11	42993	0.78	41119	0.82	43519	0.86	42973	0.86
3	10	2547	0.22	2038	0.19	1548	0.20	1706	0.18
3	11	12475	0.53	10771	0.54	8116	0.56	8016	0.53
3	12	33554	0.78	33528	0.80	37262	0.72	36890	0.67
4	10	1982	0.12	1642	0.10	1232	0.09	1385	0.11
4	11	6445	0.25	5341	0.21	3864	0.19	4025	0.21
4	12	13548	0.46	11940	0.38	14864	0.40	16545	0.40

Table 8: Population size and transition rate to each grade level, by years since compulsory schooling and cohort, the Pakistani group

year	level	cohort '92		cohort '93		cohort '94		cohort '95	
		pop. size	rate	pop. size	rate	pop. size	rate	pop. size	rate
1	10	275	0.56	261	0.75	318	0.76	344	0.83
2	10	120	0.37	66	0.50	76	0.38	59	0.42
2	11	154	0.74	194	0.73	241	0.81	284	0.78
3	10	76	0.17	32	0.09	46	0.09	32	0.00
3	11	83	0.48	81	0.44	73	0.44	87	0.47
3	12	113	0.73	143	0.78	195	0.73	221	0.65
4	10	58	0.14	29	0.17	42	0.05	32	0.09
4	11	53	0.19	46	0.28	45	0.09	46	0.09
4	12	70	0.34	64	0.34	82	0.20	117	0.33

Table 9: Population size and transition rate to each grade level, by years since compulsory schooling and cohort, the Vietnamese group

year	level	cohort '92		cohort '93		cohort '94		cohort '95	
		pop. size	rate	pop. size	rate	pop. size	rate	pop. size	rate
1	10	141	0.81	134	0.88	161	0.91	211	0.89
2	10	27	0.59	16	0.50	15	0.53	24	0.54
2	11	110	0.75	117	0.83	146	0.84	185	0.90
3	10	11	0.36	8	0.25	7	0.43	11	0.18
3	11	42	0.57	27	0.44	32	0.60	32	0.56
3	12	81	0.75	95	0.86	118	0.81	166	0.73
4	10	7	0.29	6	0.00	4	0.00	9	0.00
4	11	22	0.14	16	0.00	16	0.19	16	0.00
4	12	41	0.49	26	0.44	41	0.46	63	0.38

Table 10: Parameter estimates with standard errors in parentheses, parameters associated with selection effects

parameter	natives	Pakistanis	Vietnamese
$\alpha^{10,1}$	0.0260	0.6641	1.4801
	(0.0508)	(0.3103)	(0.7300)
$\alpha^{10,2}$	-2.2234	-2.0586	1.9145
	(0.3071)	(1.1523)	(1.4557)
$\alpha^{10,3}$	-0.2041	1.9714	-1.9089
	(0.3907)	(1.1002)	(1.3460)
$\alpha^{10,4}$	-0.8647	0.9507	0.1354
	(0.9475)	(1.7125)	(1.8451)
$\alpha^{11,2}$	1.1981	1.5138	-0.2411
	(0.0478)	(0.6557)	(0.6400)
$\alpha^{11,3}$	1.1971	-1.9408	-2.9859
	(0.1149)	(1.0194)	(1.2426)
$\alpha^{11,4}$	0.5543	1.9453	-0.3364
	(0.0662)	(1.0519)	(0.4035)
$\alpha^{12,3}$	4.7199	-0.2836	-0.7262
	(0.5223)	(0.6606)	(1.1024)
$\alpha^{12,4}$	1.6996	-1.2905	-1.3439
	(0.1387)	(0.3913)	(0.8884)

Table 11: Parameter Estimates - Models of Pakistani pupils' completion of second year of upper secondary in the second year after compulsory schooling, with standard errors in parentheses

Variable	Natives	Pak. M1	Pak. M2	Pak. M3	Pak. M4
intercept	n.a.	1.0473	0.4843	0.7135	1.2133
		(0.1838)	(1.1032)	(1.1333)	(1.3602)
female	0.0141	n.a.	0.1566	0.1599	0.1562
	(0.0132)		(0.1703)	(0.1704)	(0.1888)
born in Norway	n.a	n.a	0.2338	0.2444	0.3267
			(0.3034)	(0.3042)	(0.3384)
father's income	0.0172	n.a	0.0103	0.0107	0.0136
	(0.0007)		(0.0079)	(0.0079)	(0.0083)
father's education	0.0666	n.a.	0.0994	0.0985	0.1065
	(0.0035)		(0.0447)	(0.0448)	(0.0495)
father's age	0.0013	n.a.	-0.0124	-0.0128	-0.0138
	(0.0018)		(0.0204)	(0.0204)	(0.0172)
mother's income	0.0129	n.a.	0.0065	0.0062	0.0088
	(0.0008)		(0.0170)	(0.0170)	(0.0140)
mother's education	0.0645	n.a.	0.0437	0.0419	0.0456
	(0.0041)		(0.0368)	(0.0369)	(0.0390)
mother's age	0.0157	n.a.	-0.0070	-0.0062	-0.0028
	(0.0020)		(0.0213)	(0.0213)	(0.0166)
age at immigration	n.a.	n.a.	-0.0692	-0.0665	-0.0694
			(0.0410)	(0.0412)	(0.0451)
capacity constraints	n.a.	n.a.	n.a.	0.7002	0.8819
				(0.7887)	(0.7070)
cohort93	n.a.	-0.0427	-0.0655	-0.2692	-0.2238
		(0.2450)	(0.2530)	(0.3417)	(0.3133)
cohort94	n.a.	0.4241	0.5070	0.1835	0.2773
		(0.2472)	(0.2571)	(0.4440)	(0.3975)
cohort95	n.a.	0.2283	0.3263	-0.0219	0.1114
		(0.2332)	(0.2424)	(0.4592)	(0.4006)

Table 12: Parameter Estimates - Models of Vietnamese pupils' completion of second year of upper secondary in the second year after compulsory schooling, with standard errors in parentheses

Variable	Natives	Vie. M1	Vie. M2	Vie. M3	Vie. M4
intercept	n.a.	1.1231	0.4253	0.6229	0.6269
		(0.2216)	(1.1365)	(1.1862)	(1.0293)
female	0.0141	n.a.	-0.0464	-0.0334	-0.0464
	(0.0132)		(0.2483)	(0.2994)	(0.2598)
born in Norway	n.a	n.a	-0.3873	-0.3844	-0.3832
			(0.6265)	(0.6272)	(0.6251)
father's income	0.0172	n.a	0.0157	0.0159	0.0147
	(0.0007)		(0.0170)	(0.0170)	(0.0170)
father's education	0.0666	n.a.	0.0427	0.0422	0.0441
	(0.0035)		(0.0406)	(0.0406)	(0.0414)
father's age	0.0013	n.a.	-0.0296	-0.0297	-0.0287
	(0.0018)		(0.0240)	(0.0239)	(0.0206)
mother's income	0.0129	n.a.	0.0293	0.0301	0.0302
	(0.0008)		(0.0207)	(0.0207)	(0.0210)
mother's education	0.0645	n.a.	-0.0175	-0.0190	-0.0179
	(0.0041)		(0.0398)	(0.0398)	(0.0406)
mother's age	0.0157	n.a.	0.0574	0.0567	0.0552
	(0.0020)		(0.0284)	(0.0283)	(0.0337)
age at immigration	n.a.	n.a.	-0.1527	-0.1529	-0.1493
			(0.0403)	(0.0404)	(0.0401)
capacity constraints	n.a.	n.a.	n.a.	0.4268	0.0924
				(0.7306)	(0.6990)
cohort93	n.a.	0.4559	0.3193	0.2164	0.2783
		(0.3308)	(0.3475)	(0.3897)	(0.3833)
cohort94	n.a.	0.5029	0.5164	0.2673	0.4288
		(0.2472)	(0.3335)	(0.5398)	(0.4909)
cohort95	n.a.	1.0444	0.9944	0.7495	0.9181
		(0.3282)	(0.3537)	(0.5464)	(0.5107)

Table 13: Conditional and unconditional transition rates to 11th grade, before and after reform

group	pre-reform			post-reform			
	cond.	uncond.	diff.	cond.	uncond.	diff.	diff. in diff.
Natives	0.8017	0.7976	0.0041	0.8570	0.8546	0.0024	0.0017
Pakistani	0.7274	0.6765	0.0509	0.7899	0.7623	0.0276	0.0233 (-0.0005,0.0720)
Vietnamese	0.7859	0.7927	-0.0068	0.8664	0.8698	-0.0034	-0.0034 (-0.0270,0.0064)