

ETHNIC AND PARENTAL EFFECTS ON SCHOOLING OUTCOMES
BEFORE AND DURING THE TRANSITION:
EVIDENCE FROM THE BALTIC COUNTRIES *

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FAMILY BACKGROUND AND SCHOOLING OUTCOMES
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Abstract

A human capital gap between titular ethnicities and Russian speaking minorities has emerged in all three Baltic countries and remains significant after controlling for parental education. The recent dynamics of the unexplained ethnic gap in tertiary attainment suggests that the gap is declining in Lithuania (despite absence of Russian language higher education) and, although at a slower pace, in Estonia, while it is persistent in Latvia.

In Estonia, ethnic gap in secondary enrollment reinforces inequality of human capital distribution between ethnicities.

Parental education is found to have a strong positive effect on propensity to enroll in and complete secondary and tertiary education, both in Soviet era and during transition. There is evidence that transition to the market has weakened mother's education for the titular ethnicities, while the opposite is true for the minorities.

Key words: Parental education; ethnic minorities; transition

JEL: J24, J15, P51

1. Introduction

The transition to a market system has affected inequality along a number of dimensions. One of the most interesting but least studied is the transition's effect on intergenerational mobility.

A positive correlation between parental and children's educational attainment is an almost universal finding; see Card (1995) for a survey. Recent literature (see e. g. Black et al, 2003; Chevalier, 2004) has addressed the question whether the link between parents' and children's education is causal, with the results so far supporting a positive answer, at least for natural parents. Theoretical models of educational choice in a family framework have been suggested in Altonji and Dunn (1996), Ermisch and Francesconi (1999, 2001); Rey and Racionero (2002). Dustmann et al (2002; UK), Chevalier (2004; UK) and Corak et al (2004; Canada) are examples of recent empirical studies which confirm that schooling decisions and outcomes in developed market economies are affected by parental education and family income. Woessmann (2004) finds strong and remarkably similar in size effects of family-background on student performance in the US and 17 Western European school systems.

However, the literature is silent on parental effects under communism; very little is known also about intergenerational transmission of human capital in the transition context¹; Fan *et al* (1999) and Spagat (2002a, 2002b) provide theoretical models suggesting that one can expect some adverse effects of restructuring on intergenerational correlations.

There are several channels for intergenerational links. More educated parents are likely to be more able, and children might inherit their ability. Educated parents are more likely to provide a learning-friendly environment, to enroll children in better

¹See Beblo and Lauer (2002) for Poland.

schools, and to encourage post-secondary schooling, both explicitly and by their own example. Carneiro and Heckman (2002) remark that “importance of long-term family influences on educational attainment has been confirmed in many different environments including those with free tuition and no restrictions on entry” (they refer, in particular, to Blossfeld and Shavit (1993); Cameron and Heckman (1998)). This finding remains true also after controlling for income (Carneiro and Heckman, 2003).

The effect of parental income has two competing explanations (see e. g. Carneiro and Heckman, 2002). The first one (short-term credit constraint) emphasizes that financing college education might be a problem for families that face credit constraints in a child’s adolescent years. The second argument stresses long-term effects and points out that parental income works very much like parental education in shaping children’s cognitive ability and taste for education. Carneiro and Heckman (2002) show that after controlling for ability income effect is very weak. This provides support for the second explanation².

Increasing (respectively, decreasing) the impact of parental education or some specific demographic characteristic on children’s education contributes to a widening (respectively, narrowing) inequality of distribution of the human capital across social groups (see Appendix 1 for a formal exposition). Understanding the nature, strength and dynamics of the correlation between parental income and education and children’s education, as well as between demographic characteristics and educational attainment is therefore important for policy purposes.

In this context, ethnic skill differentials and their transmission across generations have received considerable attention in the literature. Borjas (1992) shows, that the skills of today’s generation depend both on the skills of their parents and on the average skills of the ethnic group in the parent’s generation. Cameron and

² The authors notice, however, that their results apply only to contemporary American society, where public policies to promote post-secondary education are already in place.

Heckman (2001) find that college enrollment of different ethnic groups responded differently to rising returns to college education, and the differences are associated with long-run family background factors. Hanushek (2001) investigates the evolution of black–white achievement gaps; he finds that blacks are more sensitive than whites to integration and *changes* in parental education. Black and Sufi (2002) find a significant effect of interaction between race and socioeconomic status on college enrollment in the U.S. Chiswick and Deb Burman (2004) find that immigrants’ ethnic origin helps to predict whether the immigrant-native gap in educational attainment is narrowing or widening for higher order immigrant generations. Portes and Hao (2004) provide evidence for importance of ethnic composition of high-school students on educational attainment of the second generation immigrants.

This paper uses empirical evidence from the three Baltic countries to address the following questions: *Conditional on family background, are schooling decisions and outcomes of ethnic minorities substantially different from that of majority population? How strong were the family background effects on schooling outcomes under communism and how have they evolved during the transition?*

The Baltic countries provide an interesting and policy relevant case for studying ethnicity effects on education. Sizable minorities (from 16% in Lithuania to 42% in Latvia by 2002) are predominantly Russian speaking. Integration of these minorities remains a major challenge, especially in Latvia and Estonia, where more than a half of minority population are not citizens of respective countries and lack state language skills (see Table 1 for details).

Section 2 presents the background information on higher education³ in the Baltic countries in Soviet era and during the transition. Section 3 describes the data. Econometric models and estimation strategy are discussed in Section 4. Section 5

³ Hereafter “higher education” and “tertiary education” are used as synonyms. “University” is used (loosely) instead of “institution of higher education.” “Students” are “tertiary students” if not stated otherwise.

documents that a human capital gap between titular ethnicities and Russian speaking minorities has emerged in all three countries and remains significant after controlling for parental education.

Section 6 aims to find out at which stages of the schooling ladder in each country the two language groups diverge. The results suggest that In Estonia and Latvia, ethnic gap in secondary enrollment reinforces inequality of human capital distribution between ethnicities.

Section 7 analyses the evolution of the ethnic gap in human capital. Using the models estimated in the previous sections, we find that in Lithuania, despite absence of Russian language higher education, the *unexplained* ethnic gap in tertiary attainment declines starting from mid1990s. By contrast, in Latvia the gap is widening. These country-specific findings are complemented by cohort-specific three-country pooled sample estimates (based on another data source) which suggest that the unexplained ethnic gap has emerged in the 1970s and increased dramatically in the 1990s.

Sections 8 and 9 build on the previous econometric results. Section 8 explores parental education effects (in particular, the question whether there are differences between ethnicities in this respect). Parental education is found to have a strong positive effect on propensity to enroll in and to complete secondary and tertiary education, both in Soviet times and during transition. The strength of the parental effects under communism is particularly impressive given state policy to advance offsprings of working class parents. Some support is found in favor of the hypothesis that transition to the market have led to a weakening of the effect of mother's higher education and a strengthening of the direct family income effect. Section 9 presents evidence for significant income effects on participation in post-secondary education;

ethnic effects, however, do not result from the income differences between the ethnic groups. Section 10 concludes.

2. The market for higher education before and during the transition

Why did people in the Soviet Union apply to universities? The fact that returns to education in centrally planned economies were low, is well established (see, e. g. Svejnar (1999) for a survey; more recent papers include Filer et al (1999), Campos and Jolliffe (2002), Fleisher et al (2004)), Munich et al (2005)). While higher education was free, the decision to enter university still was costly. First, forgone earnings were substantial (only some students received scholarships, and the typical scholarship was about 30% of a young worker's salary). Second, psychic learning costs of course existed as elsewhere. Third, in many cases there were direct costs (preparation and/or bribing) associated with enrollment.

How can one reconcile this with the standard human capital theory suggesting that an individual should go to university if present value of expected lifetime benefits exceeds the costs? One explanation comes from the theory of comparative advantage in the labor market (Bjorklund and Moffitt, 1987; Carneiro and Heckman, 2002; Carneiro et al 2003; Heckman and Li, 2003). Persons are heterogeneous, and education might pay off for those who have chosen it, even if observed returns to schooling, based on actual earnings, are low. Second, higher education might provide significant non-monetary benefits in terms of working conditions and job satisfaction.

For some persons these benefits are of higher value than for others, and it is plausible that more educated parents in the Soviet Union were more likely to encourage their children to enter university. Starting in the 1970s, young males had an additional incentive to pursue full-time higher education, as many universities

have established their own military departments through which students could avoid the draft. Again, educated parents were usually more concerned with this issue. It appears that while financial incentives for acquiring higher education were lower than in the West, the role of parental education in schooling decisions could be substantial.

Despite absence of official tuition fees, family income also had a role to play. First, off-springs of low-income (as well as less educated) parents often either entered the labor market immediately after basic school or chose the vocational rather than academic track of secondary education. Graduates of secondary vocational schools were much less likely to apply to universities than their counterparts with general secondary education.

Second, conditional on application, low-ability and average-ability applicants were more likely to be enrolled to universities if their parents could afford high costs of preparation and/or bribing associated with enrollment (see Appendix 2 for details).

One can thus conclude that under communism, both parental education and family income of a secondary school graduate were likely to be positively correlated with both the willingness to apply to a university and with the probability of being enrolled.

The transition from central planning has brought dramatic changes into the market for higher education. In Latvia, for example, number of state-financed students declined by roughly one third between 1989 and 1994 and remained stable thereafter, while number of students paying tuition fees increased more than 20 fold between 1992 and 2002 and accounted for 73 percent of all students in 2002⁴.

Many programs admit virtually all applicants who are willing to pay. In this way, an ability threshold is replaced by an income threshold (annual tuition fees in each of

⁴ Source: Ministry of Education and Science; Statistical Yearbooks (various years), and own calculation.

the three Baltic countries vary between 3 and 6 times average net monthly wage). On average, admission/application ratio in Latvia has been above 60 percent since 1998⁵; it would be even higher if calculated with respect to the number of applicants rather than applications.

[Figure1 about here]

In all three Baltic countries, the total number of students increased sharply between 1995 and 2003 (Figure 1)⁶. This can be attributed to several factors: rising returns to education, which provided strong participation incentives; removal of quantitative supply constraints; emergence of new fields of study; the lower ability barrier for those willing to pay; and introduction of study loans in mid (Estonia) or late (Latvia and Lithuania) 1990s.

This historic change of environment has had another dimension. The Baltic countries have sizable ethnic minorities, predominantly Russian speaking (also Polish in Lithuania): 16% in Lithuania, 32% in Estonia, and 42% in Latvia (2002). Minority population technically consists of four main groups: (i) families living here for many generations; (ii) those who moved in from other parts of the former Soviet Union in 1944-1990; (iii) descendants of the Soviet era migrants; (iv) some of the offsprings from mixed minority-majority marriages. After a decade of transition, integration of these minorities remained a major challenge, especially in Latvia and Estonia, where more than a half of minority population were not citizens of respective countries and lacked state language skills (see Table 1 for details).

[Table 1 about here]

By 1989, in each of the three countries instruction in higher education institutions has been provided both in the language of ethnic majority (which will be sometimes referred to as *titular* language) and in Russian, in proportions roughly

⁵ In Estonia the ratio was less than 40 percent in 1998-99, suggesting somewhat stronger competition.

⁶ In early 1990s the number of students decreased compared to late 1980s, at least in Latvia.

consistent with population proportions⁷. After regaining independence, Estonia, Latvia, and Lithuania have gradually, but almost completely, replaced instruction in Russian by instruction in the titular languages, at least in state-financed higher education. Phasing out state-financed higher education in Russian began in 1992 (students enrolled in Russian groups before could continue in Russian). By the year 2002, the proportion of students receiving instruction (predominantly) in Russian was about 10 percent in Estonia and Latvia and less than 1 percent in Lithuania (see Table 2 for details).

[Table 2 about here]

Almost all students instructed in Russian were paying tuition. At the same time large numbers of minority students study in state languages (it is hard to tell how many are state-financed, but this proportion is definitely not negligible). However, Figure 2 documents that in all three Baltic countries the ratio of gross tertiary graduation rates between minority and majority population has dropped compared to the pre-transition levels.

[Figure 2 about here]

3. Data

This paper explores two types of data sources. The first is the Living Conditions Survey NORBALT II conducted in the three Baltic countries in 1999 by the *Fafo* Institute for Applied Social Science in Oslo (see Aasland and Tyldum (2000) for details). The NORBALT datasets combine information usually found in Labor Force surveys and Living Conditions surveys. In particular, they provide total household income, as well as subjective evaluation of household economic situation and its progress over the past 5 years. More than 4,000 households in Estonia, 3,000

⁷ There were some asymmetries in terms of fields, though; for example, studies in titular languages offered a wider choice in humanities, while some programs in technical sciences were available only in Russian.

households in Latvia and about 3,000 households in Lithuania are covered. For one randomly selected individual (RSI) per household the available data include personal income, migration history, and education of parents who have died or live separately. For each country, RSI constitute a representative sample of the population aged 18+. This allows analyzing schooling decisions made in the pre-transition Soviet Union.

The other sources are Labor Force Surveys (LFS): Estonian – 2001 and 2004, Latvian – 2002-2004, Lithuanian – 2002 (Q2, Q4) and 2003(Q2, Q4). These more recent data have information on parental education only when parents live in the same household. However, the total sample size in the LFS is much larger than in the NORBALT surveys, so there are a large number of observations for young respondents with non-missing parental education. An advantage of these datasets is that they give the exact year when the respondent completed the highest level of education.

4. Estimation strategy

The human capital accumulation process in an educational system with mandatory basic education can be described by a sequence of binary choice models related to

- (i) decision to continue education after basic school;
- (ii) choice between academic or vocational secondary education;
- (iii) completion of secondary school;
- (iv) application for tertiary education;
- (v) enrollment in a college or university;
- (vi) completion of tertiary schooling.

Starting from stage (ii), the outcome is observed only conditional on a positive outcome in one of the previous stages. Hence a full structural model should include a

sequence of models with sample selection. Estimating such a model is not attempted here due to data limitations. Instead, we estimate a sequence of simple reduced form probit models. The baseline model of completed tertiary education can be written as follows:

$$y_i^* = \beta'X_i + \gamma'S_i + \varepsilon_i, \quad y_i = 1 \text{ if } y_i^* > 0, \quad y_i = 0 \text{ if } y_i^* \leq 0 \quad (1)$$

Here $y_i = 1$ if the individual has completed tertiary education, otherwise $y_i = 0$. Vector X includes demographic characteristics of the individual, as well as dummy variables describing the relevant residential area, S is a vector describing parental education, and ε is a random error. We specify S as follows:

$$S = (M_2, M_3, M_0, F_2, F_3, F_0), \quad (2)$$

where M_2 (respectively, M_3) is a dummy for mother's secondary (respectively, tertiary) education, M_0 – a dummy for unknown mother's education, and F_2, F_3, F_0 are defined in a similar way for father; less than secondary education is the reference category. The model is estimated on the sample of all respondents of relevant age (21+, 21- 45 etc.) with completed basic education. The focus of the paper is on educational choices and outcomes in the Baltic countries. Hence we exclude immigrants from abroad at age 18 or older (see Appendix 3 for details).

If, as expected, parental education has a positive effect on children's propensity to participate in, to be enrolled in, and to complete secondary and tertiary education, there is no ambiguity about the sign of the parental education effect on completion of tertiary studies. However, in the reduced form model we are not able to decompose this effect into parts related to schooling decision (application), enrollment conditional on application, and completion conditional on enrollment.

Likewise, we are not able to decompose the estimated ethnic effects on tertiary attainment into components related to every stage of the process. However, we proxy signs and sizes of these components by estimating several models (similar

to (1)) related to different stages of the schooling process: a model of secondary enrollment, a model of completed secondary education, a model of tertiary enrollment conditional on basic education, a model of tertiary enrollment conditional on secondary education, and a model of tertiary attainment conditional on basic education (i.e. model (1)). A model of tertiary attainment conditional on secondary education was estimated as well; results did not give much extra insight compared to model (1) and are not reported. In this paper we leave aside the choice between academic and vocational secondary school (which appeared to be almost unrelated to the ethnic gap).

In the NORBALT data parental schooling is observed for a representative sample of the whole population; missing values (represented by dummies M_0 , F_0) are rare and mostly related to single-parent families.

In the LFS, however, parental schooling is observed only when parents live in the same household. We therefore restrict the LFS-based samples to persons aged no more than 45. Such a restriction ensures that about 95 percent of respondents with non-missing education of at least one parent, as well as 94 to 98 percent of those who completed tertiary education after 1991, are included. So with LFS data, instead of (1) we estimate the following model:

$$y_i^* = \beta'X_i + \gamma'S_i^* + \varepsilon_i, \quad y_i = 1 \text{ if } y_i^* > 0, \quad y_i = 0 \text{ if } y_i^* \leq 0, \quad (3)$$

where $S^* = (M^*_2, M^*_3, M^*_0, F^*_2, F^*_3, F^*_0) = S$ if both parents live together with respondent, while we set $M^*_2 = M^*_3 = 0, M^*_0 = 1$ (respectively, $F^*_2 = F^*_3 = 0, F^*_0 = 1$) if respondent's mother (respectively, father) does not live in the same household. This means that estimates of the parental effects are based only on respondents living together with parents, while estimates of other parameters are based on all respondents.

In the models of secondary and tertiary enrollment majority of respondents has non-missing parental education (see Table 4 for details), so the measurement error is modest. On the other hand, even in the worst cases (when estimating (1) on the sample of 21 to 45 year olds), from 20 to 30 percent (or several thousand) respondents, depending on country and ethnicity, have non-missing mother's education, and from 11 to 20 percent have non-missing father's education. Econometric issues related to these data imperfections are discussed in Appendix 3.

Most our models will not control for income. Such an approach is consistent with long-term nature of parental effects, assuming that parents' education determines permanent income. The estimated effects of parents' education on likelihood that children enroll in (or complete) higher education are measures of the total impact: direct impact + impact through permanent income.

Models of tertiary enrollment (Section 9) are estimated both without income control and with household per capita income (excluding the respondent's income if any). The results shed some light on relative size of direct and indirect effects of parental education.

5. Emerging inequality in the distribution of human capital across ethnicities

Necessity to pass the exams and to study in a language different from their first language and from the language of instruction in their secondary school may have led, at least initially, to lower tertiary enrollment, as well as to a higher drop-out rate among minority population, other things equal.

Figure 2, based on evolution of the ratio of tertiary graduation rates of the two ethnic groups, suggests that an ethnic gap in the stock of human capital has emerged during the transition in all three Baltic countries. Figure 3 complements evidence from Figure 2 by comparing the shares of persons who have completed (or

are enrolled in) tertiary education among majority and minority population for two cohorts: those aged 41-50 and their counterparts aged 21-30.

[Figure 3 about here]

The patterns are clearly country-specific. In the older cohort, on average from 21 to 24 percent have completed (or are enrolled in) tertiary education; the ethnic gap is relatively small: one to two percentage points in Estonia, three to four percentage points in Latvia and Lithuania. In the younger cohort, the gap has increased dramatically in Estonia (reaching 7.6 percentage points in 2001 and 9 percentage points in 2004) and in Latvia (10 percentage points in 2002-2003). In Lithuania, the gap has increased only slightly, and it has even become smaller in relative terms. This is especially interesting given that Lithuania is the only Baltic country where higher education in Russian is virtually absent (Table 1). In Lithuania, thus, the emergence of the ethnic gap during the transition (documented in Figure 2) is likely to be primarily due to the fact that ethnic Lithuanians aged 30 to 45 were more actively pursuing Masters' degrees than their minority counterparts (this is not captured by Figure 3 which does not distinguish between various stages of tertiary education, while Figure 2 is based on the year of completion of the *highest* degree).

In all three countries, the younger cohort has a higher stock of human capital than the previous generation, but in Estonia and Latvia progress was a lot stronger for titular population than for minorities (in Estonia, the minority youth in 2001 was even less educated than those aged 41-50, but this was compensated by enrollment boom in 2001-2004). In Lithuania, both groups have made an impressive progress.

To test whether the ethnic gap in tertiary attainment remains significant after controlling for age, gender, parental education, and residence, Table 3 presents reduced form probit models of completed higher education (conditional on completed basic education) estimated for each of the three countries using data from 1999

NORBALT survey, as well as LFS data collected three to five years later. In the former case the samples include population aged 21+ (average age about 47), and parental education is non-missing for more than 90 percent of respondents; in the latter case the samples are restricted to persons aged 21 to 45. Such a restriction ensures that about 95 percent of respondents with non-missing education of at least one parent⁸, as well as 94 to 98 percent of those who completed tertiary education after 1991, are included. Large proportion of observations with missing parental education (specific dummies are created for this group) does not cause bias in the ethnic and gender coefficients in LFS-based models: these coefficients (both in NORBALT and LFS models) hardly change when parental education variables are dropped from the models⁹.

[Table 3 about here]

Coefficient on the ethnic minority dummy is negative in all models and (except for Latvia in 1999) highly significant. In all three countries this coefficient is larger in size for the more recent and younger sample; according to the proposition in Appendix 1, this suggests that the *ceteris paribus* ethnic gap in human capital has been widening (the difference, however, is statistically significant only in Latvia, where the *minority* beta has changed from -0.120 (s.e. 0.075) to -0.372 (s.e. 0.039)). Probability to have completed tertiary education among minority population aged 21-45 is 8 to 10 percentage points lower than for their otherwise similar majority counterparts.

The observed ethnic gap in tertiary attainment of population aged 21 to 45 is three percentage points in Estonia, and five – in Latvia and Lithuania. Table 4, column [5], confirms that in all three countries this gap is statistically significant and cannot be explained by parental education, gender, age and residence location: if these characteristics would be related to tertiary attainment in the same way for minorities

⁸ Recall that in the LFS this is the case only when the parent lives in the same household.

⁹ Moreover, when NORBALT samples are restricted to age ≤ 45 , the ethnic coefficients are very similar to those in the LFS-based models (but still somewhat smaller in size).

as for titular population, proportion of persons with higher education among minorities would be higher than among titular population; total unexplained gap is 7 percentage points in Estonia, 10 points in Latvia, and 14 points in Lithuania. The next section provides a more formal exposition of these and related results.

6. Looking down the schooling ladder: where does the divergence stem from?

Table 4 summarizes the ethnic and parental education effects from six probit models intended to explain schooling decisions and outcomes at different levels, as outlined in section 4 above. Results on participation in further education refer to late transition, while results on educational attainment refer to population aged 18/21 to 45 years and hence reflect opportunities faced and choices made during the last decade of Soviet era, as well as in 1990-2004.

Each model has been estimated three times (for the titular population, minority population, and pooled sample) for each of the three countries. For each model, the table also provides decomposition of the observed mean difference in enrollment or attainment between titular and non-titular population into explained and unexplained components. Here

$$\textit{Explained difference} = E[\Phi(\beta'_{\textit{titular}} X) | \textit{titular}] - E[\Phi(\beta'_{\textit{titular}} X) | \textit{nontitular}], \quad (7)$$

where $E[\mid]$ stands for conditional sample mean, Φ is the standard normal cumulative distribution, and β is the vector of estimated probit coefficients. The first term on the right is just observed probability of the positive outcome among titular population, while the second term is the expected probability of such an outcome among non-titular population if this probability would depend on characteristics in the same way as for titular population¹⁰. In other words, explained difference is caused by different distributions of characteristics among the two groups. On the other hand,

¹⁰ This decomposition has been used by Gang *et al* (2002); see also Yun (2004).

$$\text{Unexplained difference} = \text{Observed difference} - \text{Explained difference.} \quad (8)$$

Significance of the unexplained difference has been tested using methodology of Yun (forthcoming; see also Yun 2005, pp. 15-16).

[Table 4 about here]

In Estonia, one finds a substantial difference between the ethnic groups in the current (by 2001) propensity to enroll in secondary education (column [1]). The observed difference of almost 7 percentage points in enrollment rates among 15-18 year olds is completely unexplained by parental education and other observed characteristics: unexplained gap is 9 percentage points, and *ceteris paribus* difference almost 12 percentage points, both highly significant. This gap is of post-Soviet origin, because as seen in column [2], the difference in secondary attainment among respondents aged 18-45 is in favor of non-titular population.

Remarkably, just three years later, both observed and unexplained gap in secondary enrollment shrinks by three percentage points each. Likewise (see column [4] in Table 4), the observed ethnic gap in tertiary enrollment of 17-24 year old secondary school graduates goes down from 13 to 5 percentage points between 2001 and 2004, and the unexplained gap – from 10 to 5 percentage points (both gaps are not statistically significant in 2004). Plausibly, increased enrollment of minorities in secondary as well as tertiary studies was motivated by a sharp increase in supply of tuition-based tertiary schooling (also by state universities) in 2000-2004. However, both in 2001 and 2004, conditional on at least basic (rather than secondary) education, tertiary enrollment of the young non-Estonians lags behind Estonians by 5 percentage points (significant at 10% level), while the unexplained difference is 8 percentage points, and *ceteris paribus* the enrollment gap is 9 percentage points (both significant at 5% level), see column [3] in Table 4.

Lower secondary enrollment of non-Estonians in 2001 clearly contributed to persistence of these gaps, as well as to emergence of a 6 percentage point unexplained gap in secondary attainment of the 18-45 year olds in 2004.

To sum up the above discussion and the results on tertiary attainment (column [5] in Table 4) reported earlier, non-Estonians in the beginning of the 21st century have a lower propensity to continue education after basic school and to enroll in tertiary studies after secondary school, compared to (otherwise similar) Estonians. The ethnic gap in secondary and tertiary enrollment tends to decrease but still contributes to a persistent ethnic gap in tertiary attainment of population aged 21-45.

Similar analysis for Latvia (2002-2004) and Lithuania (2002-2003)¹¹ (see columns [3], [4] in Table 4) finds that minorities, on average, lag behind titular population by 5 to 6 percentage points in tertiary enrollment of all 17-24 year olds, and by 10 percentage points in tertiary enrollment of secondary graduates of the same age. These gaps are not explained by family background and residence location, so unexplained average ethnic gaps, as well as the *ceteris paribus* gaps in propensity to enroll in tertiary studies range between 9 and 15 percentage points. This clearly suggests that the ethnic gap in tertiary attainment (documented in the previous section, see column [5] in Table 4) is likely to remain significant in the near future.

The share of individuals with at least completed upper secondary education is somewhat higher among the non-titular population (see column [2] in Table 4). The difference is smaller than it should be according to parental education and other characteristics, but the unexplained ethnic gaps in secondary attainment (6 percentage points in Estonia, three points in Latvia, and two points in Lithuania) are

¹¹ In these cases the results are based on pooled rather than year-by-year samples, because the differences between the years were not substantial.

modest compared to attainment rates which range between 80 and 90 percent. Hence, past differences in secondary enrollment between the ethnic groups do not seem to contribute substantially to unexplained gap in tertiary attainment.

7. Evolution of the ethnic gap

One can use different indicators to measure inequality in educational attainment. Figure 2 (already discussed above), based on the *ratio* of graduation rates by ethnic group and cohort, suggest that while the dynamics during the Soviet era was different in the three countries, in each of them relative position of the minorities in the early transition period worsened compared to the previous period; the same Figure suggests, however, a different dynamics *during* the transition, which we will investigate in more detail later in this section.

In the Baltic countries, due to significant number of mixed marriages, mother tongue differs from ethnicity for a not negligible proportion of population (see Table 1). We therefore use the latest (2000-2001) Population Census data to complement Figure 2 with a long-term picture based on mother tongue rather than ethnicity (Figure 4). Figure 4 confirms a declining trend of the relative position of the Russo-phone minorities in Estonia and Lithuania¹² starting already in early 1970s (according to the likely period of tertiary schooling) and accelerating late 1980s and early 1990s. In Estonia, a recovery is observed in late 1990s. Interestingly, the recovery in tertiary attainment for this particular cohort seems complete, while the recovery in *gross* tertiary graduation rate, according to Figure 2, is far from complete. In Lithuania, the Russo-phone minority was more educated than native speakers up until the end of the Soviet era, but this is not the case for the cohorts which left secondary school in the 1990s. By contrast, tertiary attainment of the Polish-speaking minority in

¹² We do not have Latvian Census data.

Lithuania was very low under communism, but shows an increasing trend since 1970s. Taken together, both language minorities (Russian-speakers and Polish-speakers) feature a declining trend, however.

Another approach to the ethnic gap is to account for family background and other observed characteristics. Figure 5 presents, for each country, predicted probabilities of completed tertiary education by age and ethnicity, based on probit models estimated by country and ethnicity.¹³ To focus on the evolution of the ethnic gap *during the transition*, we have included respondents aged 21 or older in the year of observation (2001 and 2004 for Estonia, 2002-2004 for Latvia, 2002-2003 for Lithuania) and born in 1972 or later. Immigrants from abroad at age 18 or older are excluded. There is a clear evidence of the ethnic gap being increasing in the early transition in all three countries. The Figure suggests also that in Lithuania, the most recent cohorts of minorities, conditional on family background and place of residence, perform even better than Lithuanians. In Estonia, catching-up made by the most recent minority cohorts is also evident, but the gap is far from being closed. In Latvia, the dummy for the recent cohort was not significant (in both models - minority as well as majority). Both in Latvia and in Estonia, the gap *in relative terms* remains more or less stable during the last five years of observation, although the percentage-point difference in tertiary attainment becomes smaller (as the attainment rate itself is smaller for the younger cohorts).

[Figure 5 about here]

¹³ Gender, parental education, time, region, and rural dummies are fixed at mean values for the pooled sample in respective country. Parental education is missing for significant proportions of respondents, but 49 to 56 percent of them in Latvian and Lithuanian samples, and 32 to 37 percent in Estonian samples live together with at least one parent, so that there are enough observations to include parental controls. We do not restrict the samples but include dummies for missing parental education. The curves shown in the Figure do not change much when parental education is not controlled for.

To shed more light on the evolution of the ethnic effects as well as parental education effects, Table 5 presents results by cohort for the models of completed tertiary education based on the pooled three-country sample of the 1999 NORBALT survey, where information on parental education is non-missing for vast majority of observations.

[Tables 5 about here]

Significant negative effects of non-titular ethnicity on the probability to complete tertiary education have emerged in all three countries in the 1970s and have increased dramatically in the transition period: the estimated probit coefficients on the ethnic minority dummy has changed from small and non-significant in 1940s-1960s to -0.246 (0.087) in 1970s to -0.660 (0.126) in 1990s¹⁴. According to the proposition in Appendix 1, this indicates the direction of the evolution of the ethnic gap in human capital. The average unexplained gap, absent in 1940s-1960s, has reached 7.5 percentage points in 1970s and 12 percentage points in 1990s. We have made similar comparison also for LFS-based models estimated (by country) separately for those born between 1957 and 1971 on one hand, and between 1972 and 1983, on the other (these results are not shown). The minority coefficients are larger in size for the latest cohort (which could receive tertiary education only in the post-transition period) for Latvia: -0.443 (0.067) vs. -0.320 (0.046), as well as Estonia: -0.398 (0.117) vs. -0.335 (0.090), while it goes the other way around in Lithuania: -0.360 (0.088) vs. -0.441 (0.070).

¹⁴ Results for models with interactions (not shown) indicate that in 1980s these ethnic effects affected only persons whose mothers did not have higher education; for this category the ethnic effect, although less significant, is found also in 1960s.

8. Parental education effects in Soviet era and during the transition

Consistent with expectations outlined in the Introduction, the effect of parental education on the likelihood that children have completed tertiary studies is positive both in the NORBALT-based results (reflecting mostly choices made in Soviet time and early transition) and in the LFS based results (reflecting predominantly choices made in 1980s and during the transition, including the beginning of the Millennium), see Tables 3-7. The strongest effect is that of mother's higher education, which is very significant in all three countries and for both language groups (with few cohort-specific exceptions discussed later). Father's higher education and mother's secondary education have smaller but substantial impacts.

Table 5, based on the NORBALT data, documents the parental effects by cohort and ethnicity. The results suggest that for titular population impact of mother's education was very strong in Soviet era (at least since 1950s): marginal effects of mother with tertiary (respectively, secondary) education range from 20 to 30 (respectively, 10 to 18) percentage points. There is one notable exception: Stalin's deportations of wealthy families (mostly of titular ethnicity) in 1940 and 1948, World War II, and post-war massive emigration to the West fully eliminated effect of mother's higher education for ethnic Estonians, Latvians and Lithuanians born in 1940s. For non-titular population the effect of mother's higher education was even stronger: marginal effects exceed 30 percentage points (except for the cohort born in 1950s).

During the transition, the proportion of university seats available to those with poor or average ability but high willingness to pay has increased (see Section 2). Hence ability (and therefore parental education) is likely to have become less significant, while the importance of parental income should have increased. Moreover, once financial incentives for studies are in place and understood by youth,

parental encouragement could become less important, which also can weaken the impact of parental education.

Table 5 (panel C) supports this story for titular population. The probit coefficients imply that the positive effect of father's higher education, as well as the negative effect of the father not living in the household, was increasing sharply during the 1980s and 1990s¹⁵. Plausibly, this manifests an increasing importance of family income (which became positively correlated with parental education in the pre-transition and especially transition periods). In the same time, coefficients of mother's higher education were declining. Although the difference in estimated coefficients between 1970s and 1990s is not statistically significant, the change in the marginal effects from 0.304 to 0.135 (as well as from 0.175 to 0.073 in case of mother's secondary education) is a lot stronger than could be explained by a decrease in the probability of positive outcome from 0.218 to 0.162¹⁶.

Recall that parental effects in our models reflect both direct and income-related impact of parent's educational attainment. It is well known, however, that in the Soviet Union income was almost not correlated with educational attainment, so our estimates of parental effects under communism can be considered as unbiased estimates of pure effect of parents' education, despite omission of the income variable. For those born after 1973, parental income at the relevant time was positively correlated with parental education¹⁷, so one can expect that effect of parental education is biased upward¹⁸. Hence the fact that in the titular sub-

¹⁵ This conclusion is also supported by comparison of father's higher education coefficients in the NORBALT and LFS based models with mean sample age of 47 and about 30 years respectively, see Table 3.

¹⁶ Estimates with Interactions suggest that the decline of the maternal effect within titular population in the 1990s was less pronounced in Latvia than in two other countries; however, according to LFS-based estimates (not reported) such a decline was observed in Latvia in 2000-2004, while Estonia and Lithuania in the same time witnessed a recovery of (perhaps, income-related) maternal effect.

¹⁷ See estimated earnings functions in Kroncke and Smith (1999), Hazans (2003, 2005).

¹⁸ This is also true for those born before 1923 in one of the Baltic countries (which were independent market economies between 1918 and 1940). This group, however, makes up less than 5 percent of the relevant NORBALT samples, while the LFS-based samples do not include such respondents at all.

population our estimates of the effect of mother's education are lower for the transition period than for the previous one, support the hypothesis that the transition has weakened (at least temporarily) the net impact of parents' human capital on children's schooling outcomes.

Remarkably, for the non-titular population the dynamics of parental effects in the early transition was completely different. Between 1980s and 1990s, estimated coefficient on mother with secondary education increased from 0.228 (0.185) to 0.997 (0.376), while that on mother with tertiary education – from 1.130 (0.312) to 1.711 (0.442). Plausibly, the maternal effect, being the main channel of direct (rather than through income) family impact, has become more influential for minorities because they were confronted, on top of the market reforms, by the language-of-instruction issue. This hypothesis is to some extent consistent with the finding of *Fleisher et al* (2004) that returns to education were raising faster in countries with higher speed of reforms and more volatile macro indicators, suggesting that well-educated individuals have an advantage in adaptability to any changes. One can suggest that the increase of the strength of maternal effects within minority population is likely to be a temporarily phenomenon.¹⁹

In the same time, father's education effects for the minorities have lost any significance (Table 5, panel D, first column). Results in Table 6 (broken down by country rather than cohort) suggest that the impact of father's higher education is somewhat weaker for the non-titular population than for the titular ethnicities in each of the three countries.

[Table 6 about here]

¹⁹ Available evidence from the LFS-based models is consistent with these effects being smaller in the 2000s compared to the previous five years in Latvia and Lithuania; these results are not reported.

A weaker impact of father's education within minority population during the early transition might be related to the fact that in most cases Russian-speaking males with higher education were educated as engineers, natural scientists or military professionals²⁰, three groups which were strongly hit by the restructuring. Adaptation process was difficult for representatives of these groups who typically had poor state language skills because in their working life during the Soviet era they never or rarely were exposed to a language other than Russian. Plausibly, fathers from these groups were less likely to have high earnings and to provide an encouraging example for their children than other fathers with higher education.

This effect seems to be of a transitory nature, because it is not found 3-5 years later in the samples dominated by young individuals (see Panel B of Table 6). Moreover, the models for tertiary enrollment in 2001-2004 estimated by ethnicity (not shown here) feature somewhat larger marginal effects of father's higher education for minorities in all three countries. This is consistent with the hypothesis that income as a determinant of educational attainment has become more important for the minorities than for the titular population. Such a hypothesis is supported by two circumstances: (i) Russian-language tertiary instruction is only available for a fee; (ii) For Russian-speakers studying in titular languages in public universities paying tuition is often an alternative to dropping-out in case of language-caused difficulties, because the rules are less stringent for tuition-based than for budget-funded students. Empirical results which support this hypothesis are found in the next section.

²⁰ According to Latvian LFS (other sources do not provide the field of study), 65 percent of non-Latvian males with higher education born between 1938 and 1957 belong to these categories.

9. Income effects on post-secondary enrollment

In this section we use results related to participation in post-secondary education in the late 1990s to address the following questions:

- (i) Is current family income a significant determinant of the decision to continue education after secondary school?
- (ii) Is the liquidity constraint more important for ethnic minorities than for the titular population?
- (iii) Is there any evidence that the income effect is of long-term nature?
- (iv) Does omission of the income variable significantly change estimates of the effects of parental education?

[Table 7 about here]

Table 7 presents results based on 1999 Living Conditions Survey. The sample consists of respondents who are younger than 25 and have completed upper secondary education (ISCED 3A but not higher). To have enough observations, the Estonian, Latvian and Lithuanian samples are pooled together. Income is converted to euros using the nominal exchange rates in October 1999.²¹

Recent immigrants from abroad are excluded. The income variable is (log of) total household income less respondent's earnings (if any), with the idea to capture the family's financial standing before enrollment. Respondent's earnings are excluded for several reasons (although many students use them to cover the tuition fee). First, the very presence of these earnings, as well as their size is endogenous to schooling decision (students are more likely to work part-time or not to work at all than young people who do not participate in further education). Second, these

²¹ Price levels in the three countries differ somewhat, but not strongly; different sources disagree on PPP adjusted exchange rates. However, adjusting for price differences between the countries would change only the values of country-specific dummies, which are not the parameters of interest in this study.

earnings in most cases did not exist before enrollment, as the students often start working only in their third or fourth year of study.

Young individuals who are the main contributors to family income are excluded. To test whether this restriction does not cause bias, probit models with sample selection (using dummies for 6 household types as instruments) were estimated as well; the hypothesis of independent equations was not rejected for the pooled sample (Prob > chi2 = 0.273) and for the titular population (Prob > chi2 = 0.582), but rejected for the non-titular population ($\rho = -0.783$; Prob > chi2 = 0.027). Only the latter estimates are reported (column [7] in Table 7), and they are almost identical to simple probit estimates.

The dependent variable is 1 if the respondent „is currently studying,” which may refer either to tertiary education or to non-tertiary postsecondary vocational studies²².

The first column presents results without controlling for income for all available observations, while in the second column the same model is estimated only for those observations for which it was possible to construct the income variable. Coefficients of interest do not differ significantly among these specifications. The remaining specifications include the income variable. Column four includes also a dummy for households which reported substantial improvement in their economic situation compared to 5 years ago. The last three columns show estimates separately for the titular and minority populations.

The results indicate that in the late 1990s income had a significant role in schooling decisions, although the size of the income effect was modest. Doubling *per capita* income increased the probability of participation in further education by 6

²² The NORBALT data do not allow distinguishing between these cases.

percentage points according (note that average enrollment in the sample is 56.6 percent).

Omitting the income variable does not change estimates of the effect of mother's education but increases the size and significance of the coefficient on father's higher education. Income dependence is more pronounced among the non-titular population: Relative to the post-secondary enrollment level, the marginal effect of income is 1.5 times larger and a lot more significant for minority youth than for their native counterparts; however, the difference in coefficients is not statistically significant. Consistent with the findings in the previous section, father's education effect on postsecondary enrollment disappears completely in the non-titular subsample once family income is controlled for (see columns [6], [7] in Table 7).

Stronger income effect for minorities can be explained both by the fact that tertiary studies in Russian are only available for a fee and by a lower income level among minority population: according to the NORBALT (1999) survey, the observed gap in *per capita* household income of the 17-24 year olds with secondary education was 9 percent in Latvia, 13 percent in Lithuania, and 15 percent in Estonia. Given the modest size of the income effect, these income differences, however, can explain only a very small part in the observed ten percentage point post-secondary enrollment gap between the two sub-populations.

Other things (including income) equal, young people are significantly less likely to participate in postsecondary studies if the economic situation of their household was substantially worse 5 years ago (see column [4] in Table 7). The marginal effect is a substantial 6 percentage points. One explanation might be that these families were unable to save for educational purposes. On the other hand, this finding is consistent with the idea of long-term family impact. During the early

transition children from high-income and middle-income families had better learning conditions than their poorer counterparts.

10. Conclusion

This paper has documented rapid changes which took place in the process of accumulation of human capital in the three Baltic countries since the fall of communism. After 15 years of transition, the propensity to continue education after basic school still has not fully recovered, although the propensity to enroll in tertiary education is now higher than in the last years of Soviet era. This is consistent with the fact that, by international standards, returns to secondary education in the Baltic countries are low, while returns to university degree are high (see Hazans, 2003; 2005 for details).

After eliminating Russian-language instruction from state-financed higher education, a wide tertiary participation gap has emerged between the titular ethnicity in each country and the sizable (predominantly Russian speaking) ethnic minorities. For all three countries the gap in participation, as well as the gap in propensity to complete higher education, remains significant after controlling for parental education and (as far as tertiary enrollment is concerned) parental income. Both the language issue and (especially in Estonia) lower returns to schooling for minority population might be among potential reasons.

Remarkably, however, the least troubling *dynamics* in the distribution of human capital across ethnic groups is found in Lithuania, the only one of the three countries without a substantial provision of Russian-language higher education even by the private sector. The adjustment process here has been very fast especially in the late 1990s and early 2000s, despite the fact that minorities had a relatively lower stock of parental human capital.

What are the likely reasons for the Lithuanian phenomenon? One which comes to mind first is that minorities are better integrated in Lithuania than in the other two countries (see Table 1), and that young non-Lithuanians have better state language skills than their counterparts in Estonia and Latvia. This issue requires further research. One could also suggest that the fact that about half of Lithuanian minorities are ethnic Poles may play a role. Indeed, the Polish minority, which was the least educated one during the Soviet era, has done more “catching up” than others. However, although during the transition period trends in graduation rates were different for Polish and other minorities (Figure 4), trends in *propensity* to complete tertiary education were similar (Figure 5). There is also no significant difference between the Poles and other minorities in terms of secondary enrollment of 15-18 year olds. Hence the Polish factor cannot be the major explanation.

At tertiary level, the unexplained ethnic gap in human capital is more pronounced in Latvia and Lithuania (but in the latter case there is a clear tendency for this gap to narrow). In Estonia and (to a much lesser extent) in Latvia, the ethnic gap in secondary enrollment threatens to reinforce inequality in the distribution of human capital across ethnic groups.

Parental (especially mother’s) education is found to have a strong positive effect on the propensity to enroll in, and complete, secondary and tertiary education, both in Soviet era and during the transition. There is evidence that transition to the market has weakened mother’s education for the titular ethnicities, while the opposite is true for the minorities.

. At the same time the positive effect of father’s higher education, as well as the negative effect of father not living in the household, was strengthening in the 1980s and 1990s. Plausibly, this manifests increasing importance of family income for schooling decisions.

Significant short-term and long-term income effects on postsecondary enrollment are found to be in place in late 1990s, but these effects are not as sizable as one could expect given the degree of commercialization of higher education in the countries considered.

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Table 1. Population by mother tongue, knowledge of state language, and possession of national citizenship. Estonia and Latvia, 2000; Lithuania, 2001

Percent

	Estonia	Latvia	Lithuania
Minority population			
Mother tongue = State language	2.6	7.2	7.8
Mother tongue = Russian	93.9	83.8	46.7
Mother tongue = Other or not indicated	3.5	9.1	45.5 ^a
Possession of national citizenship	39.5	39.7	94.0
Total population			
Mother tongue = State language	67.3	58.2	82.0
Some command of state language ^b	12.2	24.6	10.2
Mother tongue = Russian	29.7	37.5	8.0
Some command of Russian ^b	42.2	51.5	60.3
Possession of national citizenship	80.0	74.5	99.0

Notes: ^a Including 30.6 percent with Polish mother tongue.

^b Except mother tongue; for Estonia and Latvia this indicator refers to population aged 7+.

Source: Data of Population and Housing Censuses.

Table 2. Ethnic composition of population and language of instruction in higher education establishments. Estonia, Latvia, and Lithuania, 1989-2002.

	Estonia			Latvia			Lithuania		
	Minority population, percent of total	Percent of students instructed in		Minority population, percent of total	Percent of students instructed in		Minority population, percent of total	Percent of students instructed in	
		Russian	English		Russian	English		Russian	English
1989	36.0	35.0*	0.0	48.0	45.0*	0.0	20.0	20.0*	0.0
1996	33.1	13.4	3.0	43.1	11.3	2.3	18.0	1.8	n.a.
2002	31.8	11.2	1.9	41.8	10.3	1.2	16.1	0.6	2.0

Sources: Demographic data are from demographic yearbooks. *Estimate, S. Buka (2004). Sources of data on instruction by language in 1996 and 2002 are official publications of national ministries of education or national statistical offices.

**Table 3. Determinants of completed higher education by country.
The Baltic countries, 1999 and 2001-2004.**

Country	Estonia		Latvia		Lithuania	
Years Data Sample ^b : Age	1999 NORBALT ^a 21+	2001, 2004 LFS 21-45	1999 NORBALT 21+	2002-04 LFS 21-45	1999 NORBALT 21+	2002-2003 LFS 21-45
	Means					
Female	0.544	0.498	0.560	0.496	0.541	0.504
Minority	0.261	0.319	0.366	0.404	0.131	0.165
Age	47.2	33.3	47.8	33.9	47.0	34.0
Educational attainment						
Mother: secondary	0.300	0.102	0.262	0.172	0.168	0.151
Mother: higher	0.068	0.033	0.057	0.044	0.058	0.038
Father: secondary	0.257	0.054	0.240	0.092	0.150	0.093
Father: higher	0.085	0.017	0.073	0.025	0.063	0.027
Mother: unknown ^c	0.040	0.801	0.039	0.703	0.058	0.715
Father: unknown ^c	0.091	0.890	0.098	0.837	0.093	0.815
Respondent: higher	0.171	0.183	0.156	0.197	0.155	0.259
	Probit coefficients^d: models without parental education					
Female	0.116** (0.053)	0.219*** (0.041)	0.197*** (0.070)	0.388*** (0.030)	0.250*** (0.071)	0.338*** (0.027)
Minority	-0.179*** (0.065)	-0.366*** (0.071)	-0.170** (0.073)	-0.373*** (0.039)	-0.317*** (0.122)	-0.412*** (0.057)
	Probit coefficients^d: models with parental education					
Female	0.131** (0.056)	0.231*** (0.042)	0.188** (0.074)	0.398*** (0.031)	0.248*** (0.073)	0.341*** (0.028)
Minority	-0.211*** (0.069)	-0.363*** (0.072)	-0.120 (0.075)	-0.372*** (0.040)	-0.330*** (0.124)	-0.401*** (0.057)
<i>Minority marginal effects^e</i>	<i>-0.043***</i>	<i>-0.080***</i>	<i>-0.024</i>	<i>-0.091***</i>	<i>-0.059***</i>	<i>-0.107***</i>
Parental education (vs. basic)						
Mother: secondary	0.424*** (0.082)	0.327** (0.130)	0.535*** (0.099)	0.382*** (0.086)	0.399*** (0.122)	0.366*** (0.067)
Mother: higher	0.991*** (0.121)	1.384*** (0.163)	1.034*** (0.157)	1.063*** (0.102)	0.655*** (0.181)	0.946*** (0.093)
Father: secondary	0.373*** (0.081)	0.294* (0.168)	0.213** (0.098)	0.440*** (0.115)	0.397*** (0.121)	0.236*** (0.073)
Father: higher	0.465*** (0.108)	0.646*** (0.238)	0.598*** (0.141)	0.763*** (0.140)	0.572*** (0.168)	0.735*** (0.109)
Other controls: Age, Age-squared ^e , Residence, Dummies for missing parental education, year dummies						
Number of observations	3775	11331	2468	22104	2394	16630
Pseudo R-squared	0.129	0.095	0.144	0.088	0.152	0.094
Log pseudo-likelihood	-1506.4	-4880.7	-913.1	-9998.4	-875.5	-8622.1

Notes: ^a Living conditions survey. ^b Population with completed basic education, excluding tertiary students without completed tertiary education and immigrants from abroad at age 18 or older.

^c In NORBALT-based models, unknown parent's education indicates that the respective parent was indeed "missing" from the family (or, in rare cases, inability of respondents to recall this information). In LFS-based models this means that respective parent does not *currently* live in the same household.

^d Robust standard errors in parentheses. Hereafter, ***, **, * indicate that coefficients are significantly different from zero at 0.01, 0.05, 0.10 level respectively, based on robust standard errors adjusted for clustering on primary sampling units.

^e Hereafter, *marginal effect* of a dummy variable is change in predicted probability, P, when the variable changes its value from 0 to 1. For a continuous variable, e. g. x = age, marginal effect is dP/dx. All effects are evaluated at each observation and averaged across the sample.

^f Included only when significant (eventually, in 1999 samples).

Table 4. Effects of ethnicity and family background on schooling outcomes

	[1]	[2]	[3]	[4]	[5]	[6] ^e
Dependent variable Y (dummy)	Study in secondary Basic	Complete Secondary Basic+	Study in Tertiary Basic or sec.	Sec.	Complete Tertiary Basic+	
Sample: education						
Sample ^a : age	15-18	18-45	17-24	17-24	21-45 ^b	21-45 ^b
Sample % living with a parent ^c	92-96	30-43	70-89	61-87	20-35	100
Estonia 2001 & 2004: mean Y by ethnicity						
Titular, 2001	0.883	0.821	0.259	0.440	0.177	
Minority, 2001	0.816	0.862	0.209	0.312	0.144	
Observed gap, 2001	0.066	-0.041***	0.049*	0.129***	0.033*	
Explained gap, 2001	-0.025	-0.058	-0.029	0.033	-0.038	
Unexplained gap, 2001	0.092***	0.017	0.078**	0.096***	0.071***	
Titular, 2004	0.877	0.830	0.300	0.471	0.214	
Other, 2004	0.847	0.831	0.255	0.418	0.171	
Observed gap, 2004	0.030	-0.002	0.045*	0.053	0.043*	
Explained gap, 2004	-0.035	-0.064	-0.039	0.004	-0.026	
Unexplained gap, 2004	0.065***	0.062***	0.084**	0.048	0.069***	
Marginal effects^d (probit, pooled sample)						
Minority, 2001	-0.115**	-0.028	-0.091**	-0.133***	-0.081***	
Minority, 2004	-0.104**	-0.079***	-0.088**	-0.074	-0.085***	
Mother: higher ed, 2001	0.241***	0.170***	0.290***	0.345***	0.309***	
Mother: higher ed, 2004	0.075*	0.282***	0.312***	0.244**	0.437***	
Father: higher ed, 2001	0.067*	0.085*	0.160**	0.192*	0.073	
Father: higher ed, 2004	0.114*	0.124***	0.211***	0.268***	0.311***	
Latvia, 2002-2004: Mean Y by ethnicity						
Titular	0.903	0.831	0.299	0.514	0.216	0.216
Minority	0.884	0.837	0.242	0.415	0.168	0.168
Observed gap	0.019	-0.006	0.058***	0.099***	0.048***	0.048***
Explained gap	-0.003	-0.040	-0.039	-0.056	-0.050	-0.041
Unexplained gap	0.022	0.034***	0.096***	0.155***	0.098***	0.089***
Marginal effects^d (probit, pooled sample)						
Minority	-0.028*	-0.042***	-0.088***	-0.147***	-0.091***	-0.098***
Mother: higher ed	0.128***	0.226***	0.305***	0.376***	0.282***	0.362***
Father: higher ed	0.013	0.082***	0.180***	0.190***	0.206***	0.273***
Lithuania, 2002-2003: mean Y by ethnicity						
Titular	0.831	0.870	0.294	0.502	0.268	0.268
Minority	0.792	0.885	0.242	0.398	0.216	0.216
Observed gap	0.039	-0.014*	0.052**	0.103***	0.052***	0.052***
Explained gap	0.102	-0.034	-0.046	0.002	-0.088	-0.069
Unexplained gap	-0.063***	0.020***	0.098***	0.100***	0.140***	0.121***
Marginal effects^d (probit, pooled sample)						
Minority	0.051*	-0.023**	-0.088***	-0.110***	-0.107***	-0.113***
Mother: higher ed	0.080	0.120***	0.276***	0.329***	0.291***	0.351***
Father: higher ed	0.150***	0.069**	0.236***	0.287***	0.239***	0.250***

Notes:^a Immigrants from abroad at age 18 or older are excluded. ^b Tertiary students without completed tertiary education are excluded in [5], [6]. ^c By country and ethnicity (lower bounds refer to Estonia). ^d Simple probit models in columns [1]-[5]. All models control also for age, gender, region, level of urbanization, secondary or missing parental education, and year. ^e Alternative estimates of model [5] using probit with sample selection into living with at least one parent. The instrument (dummy *Single*) is significant at 0.001 level in all cases. The Estonian results omitted as $H_0: \rho=0$ is not rejected ($p = 0.58$). For Latvia, $\rho = -0.47$; for Lithuania, $\rho = -0.19$. Source: calculations based on LFS.

**Table 5. Determinants of completed tertiary education by cohort.
The Baltic countries, 1999.**

Birth year	1971-77	1961-70	1951-60	1941-50	1931-40 ^a	1921-30 ^a
Most likely period of tertiary schooling	1990s	1980s	1970s	1960s	1950s	1940-1955
A. Mean tertiary attainment by sub-population						
Total	0.149	0.196	0.209	0.159	0.113	0.075
Titular	0.162	0.203	0.218	0.149	0.119	0.073
Non-titular	0.112	0.175	0.183	0.193	0.071	0.094
Observed gap	0.050	0.028	0.036	-0.043	0.048	-0.021
Unexplained gap	0.121***	0.095***	0.074***	0.006	0.044	0.000
Probit coefficients^b and marginal effects^c						
B. Ethnic effects: Whole population						
Non-titular ethnicity	-0.660*** (0.126)	-0.299*** (0.101)	-0.246*** (0.087)	-0.079 (0.102)	-0.282 (0.215)	0.009 (0.323)
<i>Marginal effects</i>	-0.083***	-0.063***	-0.055***	-0.033*	-0.042	0.001
Number obs.	996	1863	1864	1431	1136	756
Pseudo R-sq.	0.246	0.162	0.097	0.114	0.119	0.130
C. Effects of parental education (vs. basic or less): Titular population						
Mother: secondary	0.425* (0.260)	0.419*** (0.123)	0.581*** (0.136)	0.608*** (0.218)	0.549** (0.226)	0.523 (0.359)
<i>Marginal effects</i>	0.073*	0.103***	0.175***	0.164***	0.124**	0.088
Mother: higher	0.701** (0.299)	0.763*** (0.192)	0.929*** (0.225)	-0.104 (0.310)	0.810 ^d (0.566)	1.197* ^d (0.687)
<i>Marginal effects</i>	0.136**	0.210***	0.304***	-0.020	0.204	0.280
Father: secondary	0.575** (0.239)	0.159 (0.111)	0.172 (0.176)	0.442** (0.175)	0.419* (0.234)	0.366 (0.287)
<i>Marginal effects</i>	0.106**	0.040	0.048	0.111**	0.095*	0.054
Father: higher	1.166*** (0.268)	0.670*** (0.178)	0.293 (0.225)	0.447 (0.332)	0.537* (0.322)	0.486 ^d (0.491)
<i>Marginal effects</i>	0.278***	0.197***	0.085	0.113**	0.128*	0.076
Father: unknown	-0.739* (0.398)	-0.638*** (0.236)	-0.169 (0.143)	-0.265 (0.262)	-0.671* (0.360)	-0.108 (0.464)
<i>Marginal effects</i>	-0.061*	-0.111***	-0.041	-0.047	-0.081*	-0.012
D. Effects of parental education (vs. basic or less): Non-titular population						
Mother: secondary	0.997*** (0.376)	0.228 (0.185)	0.219 (0.236)	0.643** (0.287)		
<i>Marginal effects</i>	0.091***	0.046	0.056	0.173**		
Mother: higher	1.711*** (0.442)	1.130*** (0.312)	0.374 (0.458)	1.180*** (0.419)		
<i>Marginal effects</i>	0.237***	0.307***	0.101	0.368***		
Father: secondary	-0.067 (0.423)	0.575** (0.258)	0.331 (0.224)	0.465* (0.274)		
<i>Marginal effects</i>	-0.010	0.126**	0.090	0.120*		
Father: higher	-0.109 (0.371)	0.494 (0.359)	0.493* (0.278)	0.166 (0.460)		
<i>Marginal effects</i>	-0.016	0.104	0.141*	0.038		
Father: unknown	-2.402*** (0.529)	-2.460*** (0.273)	-0.575** (0.261)	0.180 (0.296)		
<i>Marginal effects</i>	-0.124***	-0.109***	-0.101**	0.042		
Other controls	Gender; Age; Dummies for residence (by type of settlement) at age of 17; Dummies for types of migration between 12 and 17; country dummies					
N obs.: Titular/Non-titular	712/285	1373/490	1323/541	1120/311	1037/99	686/70
Pseudo R-sq.: Tit/Non-tit.	0.246/0.279	0.162/0.193	0.097/0.093	0.114/0.143	0.119/NA	0.130/NA

Notes: Population older than 21 years (tertiary students without higher education and immigrants from abroad at age 18 or older are excluded). ^a Only persons born in the country of residence included.

^b Robust standard errors in parentheses. ^c *Marginal effect* of a dummy variable is change in predicted probability, P, when the variable changes its value from 0 to 1. For a continuous variable, e. g. x = age, marginal effect is dP/dx. All effects are evaluated at each observation and averaged across the sample. ^d Estimates based on small number of observations.

***, **, * indicate estimates significantly different from zero at 0.01, 0.05, 0.10 level respectively.

Source: Calculation based on the NORBALT II survey (1999) data.

Table 6. Determinants of completed higher education by country and ethnicity.
Panel A: The Baltic countries, 1999. Population aged 21+.

Country Ethnicity	Estonia, 1999		Latvia, 1999		Lithuania, 1999	
	Titular	Other	Titular	Other	Titular	All ^d
Educational attainment (means)						
Mother: secondary	0.276	0.368	0.248	0.287	0.158	0.168
Mother: higher	0.061	0.088	0.058	0.054	0.057	0.058
Father: secondary	0.223	0.352	0.228	0.260	0.142	0.150
Father: higher	0.069	0.130	0.066	0.084	0.057	0.063
Mother: unknown	0.043	0.031	0.043	0.032	0.052	0.058
Father: unknown	0.100	0.067	0.095	0.103	0.086	0.093
Respondent: higher	0.168	0.181	0.157	0.153	0.157	0.155
Marginal effects (probit)^a						
Female	0.031**	0.029	0.036**	0.043*	0.051***	0.050***
Parental education (vs. basic)						
Mother: secondary	0.096***	0.106**	0.129***	0.104***	0.099***	0.089***
Mother: higher	0.283***	0.281***	0.223***	0.393***	0.127***	0.162***
Father: secondary	0.084***	0.106**	0.030	0.066*	0.085***	0.092***
Father: higher	0.141***	0.083	0.182***	0.105**	0.187***	0.142***
Mother: unknown	0.027	0.092	-0.057	-0.016	-0.032	-0.016
Father: unknown	-0.027	-0.101**	-0.096***	-0.014	-0.059*	-0.061**
Other controls						
Age, Age-squared, Dummies by type of settlement at age of 17, Dummies for particular types of migration between age 12 and 17.						
Mean age of the sample	48.7	43.3	49.1	45.6	47.3	47.0
Age of max propensity to have completed higher education	52.9	53.2	48.1	54.8	48.8	49.2
# observations	2819	956	1615	853	2114	2394
Pseudo R-squared	0.136	0.131	0.152	0.158	0.165	0.152
Log pseudo-likelihood	-1102.7	-393.0	-595.1	-307.6	-767.4	-875.5

Panel B: The Baltic countries, 2001-2004. Population aged 21-45

Country Ethnicity	Estonia, 2001 & 2004		Latvia, 2002-2004		Lithuania, 2002-2003	
	Titular	Other	Titular	Other	Titular	Other
Educational attainment (means)						
Mother: secondary	0.092	0.122	0.172	0.173	0.147	0.174
Mother: higher	0.028	0.044	0.045	0.044	0.038	0.038
Father: secondary	0.045	0.075	0.095	0.088	0.091	0.106
Father: higher	0.015	0.020	0.026	0.025	0.027	0.029
Mother: unknown	0.820	0.762	0.699	0.709	0.723	0.674
Father: unknown	0.898	0.873	0.829	0.849	0.820	0.792
Respondent: higher	0.195	0.157	0.216	0.168	0.268	0.216
Marginal effects (probit)^a						
Female	0.065***	0.035*	0.124***	0.068***	0.107***	0.079***
Age (effects × 10)	0.049***	0.037**	0.017**	0.020**	-0.030*	-0.060***
Parental education (vs. basic)						
Mother: secondary	0.049*	0.051*	0.093***	0.054**	0.096***	0.066**
Mother: higher	0.380***	0.330***	0.336***	0.197***	0.291***	0.221***
Father: secondary	0.036	0.112	0.104***	0.106**	0.077***	0.045
Father: higher	0.136*	0.220*	0.179***	0.239***	0.222***	0.286***
Other controls						
Dummies for missing parental education, Region and type of settlement dummies by current residence						
Mean age of the sample	33.5	32.7	33.6	34.4	33.9	34.1
Number of observations	8690	2641	13433	8671	13760	2870
Pseudo R-squared	0.104	0.080	0.097	0.075	0.102	0.090
Log pseudo-likelihood	-3841.0	-1057.6	-6332.1	-3633.9	-7178.2	-1362.7

Notes: Population with completed basic education, excluding tertiary students without completed tertiary education and immigrants from abroad at age 18 or older.

^a ***, **, * indicate that underlying coefficients are significantly different from zero at 0.01, 0.05, 0.10 level respectively, based on robust standard errors adjusted for clustering on households.

Source: Calculation based on NORBALT data for panel A and on LFS data (Estonia: Q1-Q4; Latvia: Q1-Q4; Lithuania: Q2, Q4) for panel B.

**Table 7. Determinants of participation in post-secondary education.
The Baltic countries, 1999.**

	[1] ^a	[2]	[3]	[4]	[5]	[6]	[7] ^c
Ethnicity							
			All		Titular		Other
			Educational attainment (means)				
Mother: secondary	0.533	0.554	0.554	0.554	0.548	0.568	0.566
Mother: higher	0.198	0.194	0.194	0.194	0.195	0.192	0.196
Father: secondary	0.429	0.425	0.425	0.425	0.400	0.489	0.497
Father: higher	0.138	0.122	0.122	0.122	0.130	0.102	0.109
Mother: unknown	0.158	0.142	0.142	0.142	0.147	0.130	0.126
Father: unknown	0.279	0.296	0.296	0.296	0.300	0.287	0.267
			Average probability to participate in further education				
Observed	0.524	0.566	0.566	0.566	0.595	0.498	0.485
			Marginal effects				
Female	0.079***	0.080**	0.076**	0.078**	0.050	0.136***	0.101**
Minority	-0.128***	-0.123***	-0.111**	-0.116**			
Age	-0.093***	-0.084***	-0.084***	-0.084***	-0.080***	-0.089***	-0.084***
Parental education (vs. basic)							
Mother: secondary	0.102**	0.117**	0.116**	0.114**	0.054	0.206***	0.190**
Mother: higher	0.262***	0.289***	0.259***	0.258***	0.247***	0.276***	0.268***
Father: secondary	0.088**	0.076*	0.065	0.067	0.110**	-0.054	-0.081
Father: higher	0.109*	0.135**	0.094	0.102	0.135	-0.055	-0.088
Log household per capita income^b			0.083***	0.090***	0.071*	0.091***	0.091***
Household economic situation better than 5 years ago				-0.062*			
Country (vs. Estonia)							
Latvia	0.026	0.021	0.031	0.029	0.133***	-0.128***	-0.150***
Lithuania	-0.069**	-0.056*	-0.023	-0.037	-0.030	0.016	0.045
Residence at age of 17 (vs. small cities)							
Capital city	0.114***	0.068*	0.036	0.038	0.079	-0.113	-0.095
City (50,000+)	0.087**	0.052	0.036	0.035	0.114**	-0.157	-0.164**
Rural	0.016	0.021	-0.005	-0.007	0.023	-0.139	-0.132
Other controls	Dummies for missing parental education; Migration history after age of 17						
Number of observations	1735	1226	1226	1226	848	378	434
Pseudo R-squared	0.231	0.229	0.243	0.245	0.278	0.267	NA
Log pseudo-likelihood	-467.8	-646.5	-635.2	-633.1	-413.3	-192.0	-186.5

Notes: Population aged 17-24 with completed secondary education but without higher education. Immigrants from abroad at age 18 or older are excluded. Individuals [aged 17-24] who are the main contributors to family income are excluded. To test whether the latter restriction does not cause bias, probit models with sample selection (using as instruments dummies for 6 household types) were estimated as well (at least two of the instruments were significant at 0.001 level); the hypothesis of independent equations was not rejected for the pooled sample (Prob > chi2 = 0.273) and for the titular population (Prob > chi2 = 0.582), but rejected for the non-titular population (rho = -0.783 ; Prob > chi2 = 0.027). Only the latter estimates are reported (column [7]).

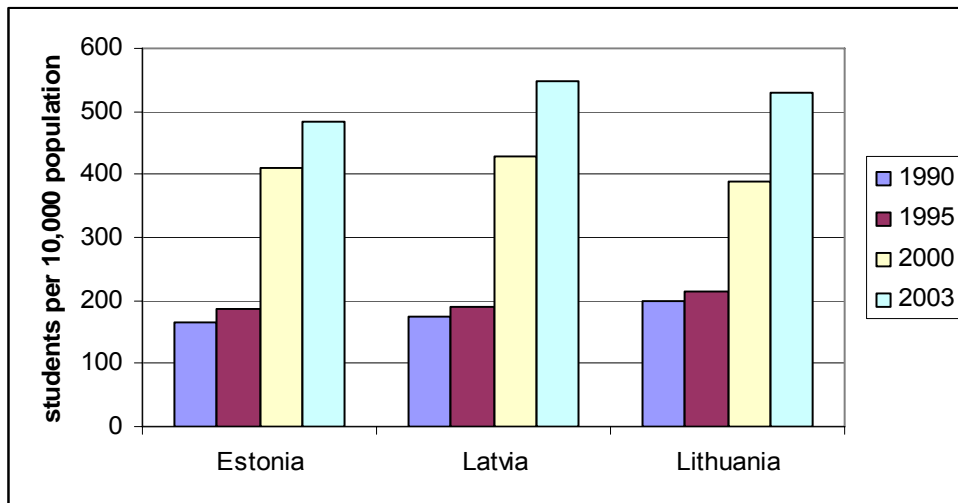
^a As a robustness check, specification [1] is estimated on the sample which includes also respondents for whom it was not possible to construct the income variable.

^b Excluding respondent's earnings (if any). ^c Probit with sample selection.

Source: Calculation based on NORBALT II survey data.

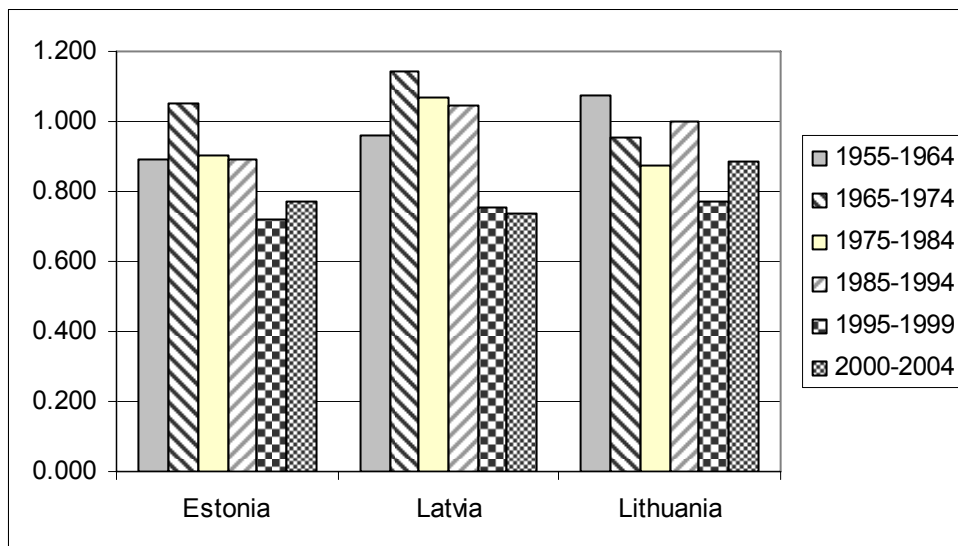
***, **, * indicate that underlying coefficients are significantly different from zero at 0.01, 0.05, 0.10 level respectively, based on robust standard errors adjusted for clustering on primary sampling units.

Figure 1. Tertiary students per 10,000 population. The Baltic countries, 1990-2003



Source: National Statistical Offices and own calculation

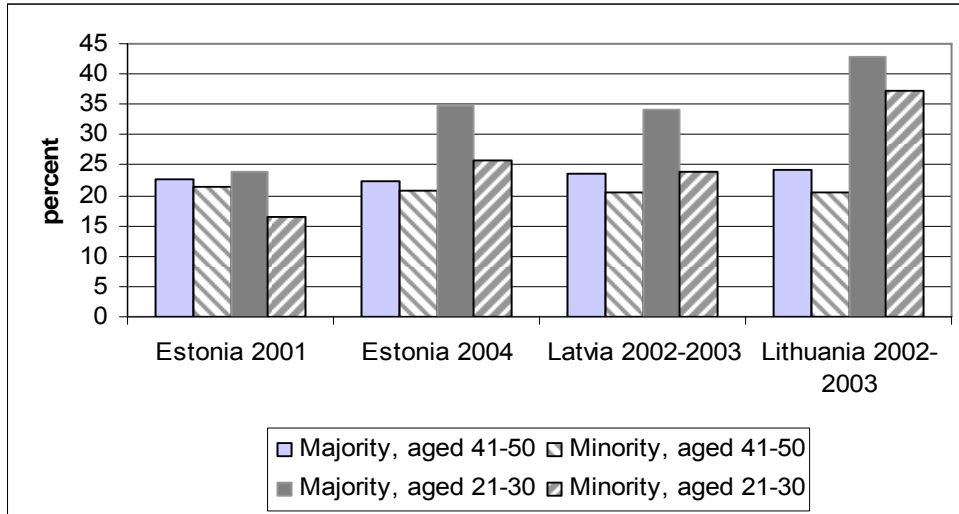
Figure 2. Ratio of tertiary graduation rates between minority and titular population. The Baltic countries, 1955-2003



Notes: Age groups for calculation of the graduation rates are chosen to include at least 70% of all graduates in respective periods. For Estonia, all immigrants from abroad at age 18 or older are excluded. For Latvia and Lithuania, only those immigrants from abroad at age 18 or older who live in the country for no more than 10 years at the time of observation (2002-2004) are excluded. However, starting from 1975-1984, both levels and dynamics of the ratios shown in the chart are similar to those based on local-born respondents only, hence the results would be almost identical if all post-18 immigrants would be excluded. For the 1955-1964 and 1965-1974 periods ratios for local-born population are substantially lower.

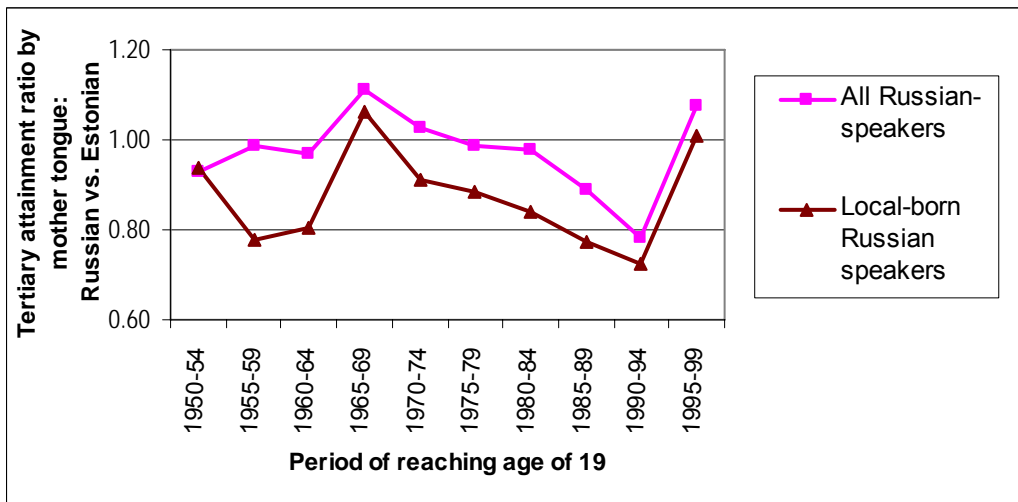
Source: Calculation based on Estonian LFS 1998-2001 and 2004, Latvian LFS 2002-2004, Lithuanian LFS 2002-2003.

Figure 3. Share of persons who have completed (or are enrolled in) tertiary education, by ethnicity and age group.

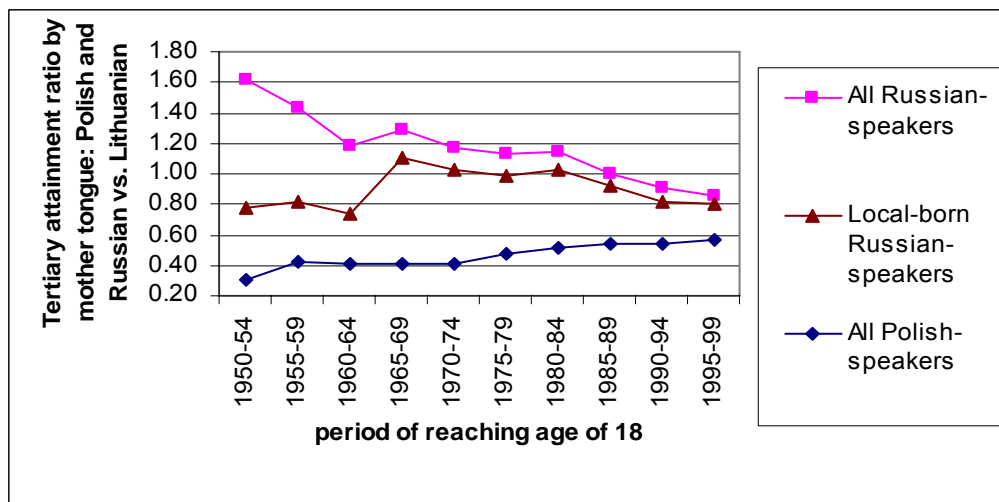


Source: Calculations based on LFS data

Figure 4. Tertiary attainment ratio: Language Minorities vs. Native Speakers. a) Estonia, 2000



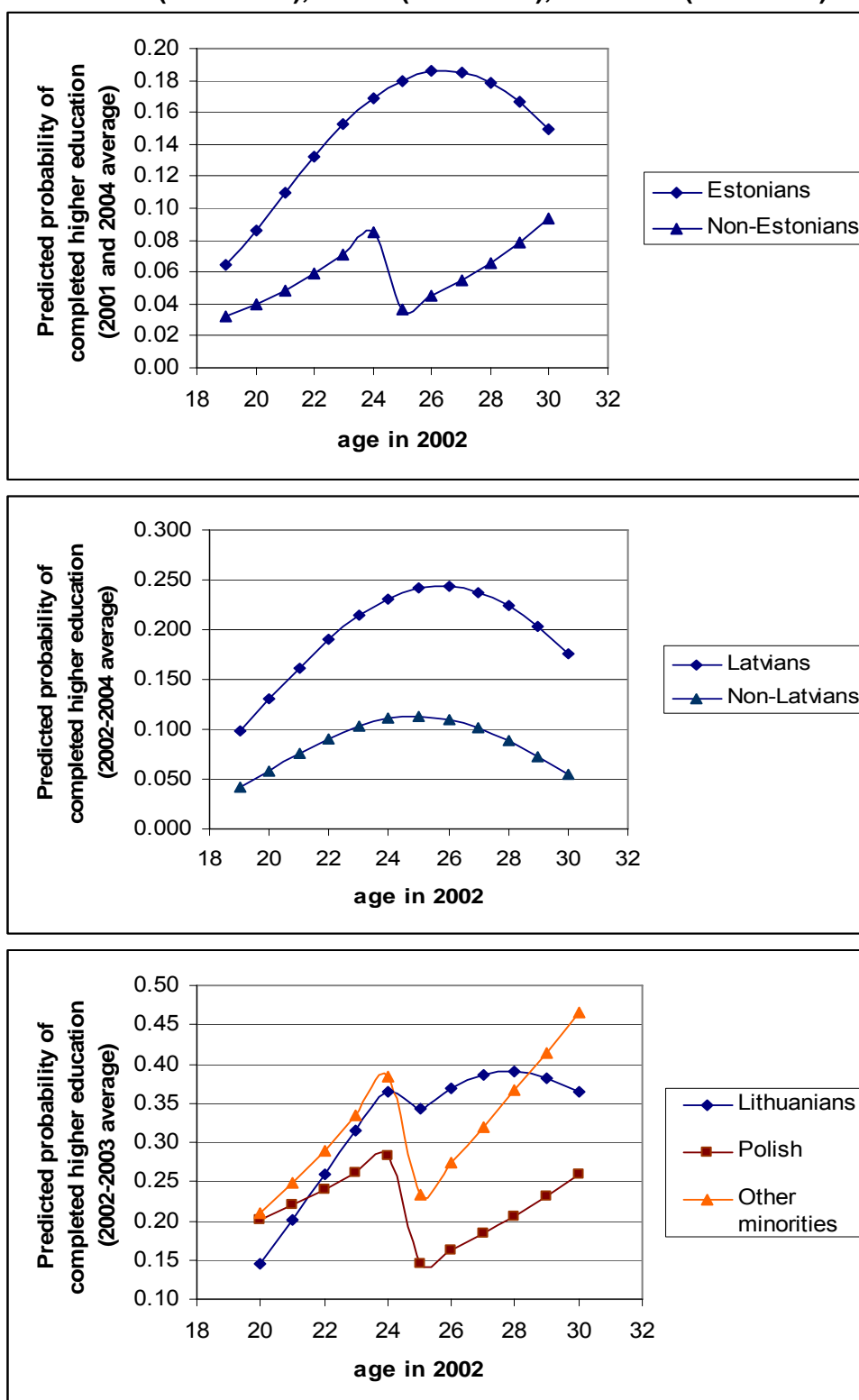
b) Lithuania, 2001



Notes: For Lithuania, the curve for local-born Polish-speakers is not shown, as it virtually coincides with the one for all Polish-speakers (vast majority of them are local-born).

Source: Calculation based on Population and Housing Census data.

**Figure 5. Predicted probability of having completed higher education by age and ethnicity ^a.
Estonia (2001-2004), Latvia (2002-2004), Lithuania (2002-2003)**



Notes: ^a Predictions are based on probit models estimated by country and ethnicity. The samples consist of respondents aged 21 or older in respective year and born in 1972 or later, excluding immigrants from abroad at age 18 or older. Other characteristics (gender, parental education, time, region, and rural dummies) are fixed at mean values for the pooled sample in respective country. Parental education is missing for significant proportions of respondents, but results are similar when parental education is not controlled for.

Source: Calculation based on LFS data.

Appendix 1.

Proposition. Assume that every (adult) member of current generation (indexed t) can have either high ($y_t=1$) or low ($y_t=0$) education level, which is determined by the following probit model:

$$y_t^* = \beta_t y_{t-1} + \mu_t z + \gamma_t' X_t + \varepsilon, \quad y_t = 1 \text{ if } y_t^* > 0, \quad y_t = 0 \text{ if } y_t^* \leq 0, \quad \varepsilon \sim N(0; 1),$$

where y_{t-1} is parents' education level (for clarity of exposition we assume both parents to have the same education level); z is a binary variable defining two demographic groups: $D_1 = (z = 1)$, $D_0 = (z = 0)$; and X is a vector of other relevant demographic characteristics. Define the upper class, C_{1t} , as children of educated parents ($y_{t-1} = 1$), while the lower class $C_{0t} = (y_{t-1} = 0)$.

(i) Assume that impact of demographic characteristics does not change over time: $\mu_{t+1} = \mu_t = \mu$, $\gamma_{t+1} = \gamma_t = \gamma$. Then, if $\beta_{t+1} > \beta_t > 0$ (respectively, $0 < \beta_{t+1} < \beta_t$), human capital gap between classes, conditional on demographics, is larger (respectively, smaller) in generation $t+1$ than in generation t .²³

(ii) Assume that impact of parental education and demographics other than z does not change over time: $\beta_{t+1} = \beta_t = \beta$, $\gamma_{t+1} = \gamma_t = \gamma$. Assume also that μ_t does not change sign. Then, if $|\mu_{t+1}| > |\mu_t|$ (respectively, $|\mu_{t+1}| < |\mu_t|$), human capital gap between demographic groups, conditional on parental education and other demographic characteristics, is larger (respectively, smaller) in generation $t+1$ than in generation t .

Proof. The conditional human capital gap is just the difference between shares of educated individuals among members of upper and lower class with given demographic characteristics:

$$\Delta_{t+1}(z, X) = E(y_{t+1}|y_t=1, z, X) - E(y_{t+1}|y_t=0, z, X) = \Phi(\beta_{t+1} + \mu z + \gamma'X) - \Phi(\mu z + \gamma'X).$$

If $\beta_{t+1} > \beta_t$, the latter expression exceeds $\Delta_t(z, X)$, because Φ , the cumulative normal probability function, is increasing. Likewise, the conditional gap between groups

$$\delta_{t+1}(y, X) = E(y_{t+1}|y_t=y, z=1, X) - E(y_{t+1}|y_t=y, z=0, X) = \Phi(\beta y + \mu_{t+1} + \gamma'X) - \Phi(\beta y + \gamma'X)$$

²³ Consequently, if the distribution of demographic characteristics is the same for both generations, the absolute human capital gap between classes is larger (respectively, smaller) in generation $t+1$ than in generation t .

(where we assume $\mu_{t+1} > 0$ without loss of generality) increases (respectively, decreases) with t , if $\mu_{t+1} > \mu_t$ (respectively, $\mu_{t+1} < \mu_t$).

Appendix 2. Admission to universities in the Soviet Union

The decision to apply to university did not necessarily lead to enrollment. The number of students admitted was fixed in advance. Of course, degree of competition varied across fields of study²⁴.

There were three basic ways to enter. First, good abilities combined with studies in a “good” school (or short-term preparation courses) gave a high chance to pass the entry exams. If one’s grades in the secondary school certificate were also high enough, enrollment was warranted²⁵. Second, average abilities combined with intensive (and costly) private tutoring (or long-term preparation courses at the university) could lead to the same result. Finally, having a (very expensive) tutor who was at the same time related to the examination committee, or simply bribing a relevant person in the university also worked. In this case the role of ability was reduced to determining the size of the bribe (it was more expensive to push through somebody who objectively should be failed in the first exam than just to “correct” the grade upwards a little bit).

The composition of the pool of admitted students according to the way of getting through differed across regions of the Soviet Union, across universities in the same city, and even across departments of the same university. In the Baltic countries the third channel (bribing) did exist but was, on average, of relatively small importance.

A university (or another higher education institution) could turn down the applicant’s documents based on the grades in secondary school certificate or on “personal characteristic” signed by school administration and the *komsomol* secretary (if the applicant has worked or served in the army after school, the characteristic was provided by the workplace or military unit).

Most universities required 4 or 5 entry examinations in subjects of their choice, two or three of which were written. A written exam in Mathematics or Physics, for example, consisted of 4 to 6 problems (rather than multiple-choice tests) to which the applicant had to provide detailed solutions. Another written exam was an essay

²⁴ In the University of Latvia, applicants-admission ratio for full-time studies in 1980s ranged from 1-1.5 in mathematics and physics to 3-4 in economics to 7-8 in foreign languages.

²⁵ if one’s documents were not turned down by the university. Some top higher education institutes in Moscow and Leningrad, for instance, were famous by not accepting document from Jewish applicants.

which was judged by contents, style, grammar, and spelling. Each university had a (rotating) examination commission in every subject. Exam problems and essay themes were prepared each year by heads and deputy heads of these commissions; they also compiled theoretical questions (from more or less standard secondary school level program) with practical tasks into sets (“tickets”) for the oral exams. Each exam paper (or oral answer) had to be evaluated by two commission members. In practice (especially for written exams), this rule was frequently abused: the second referee just signed the grade suggested by the first. Top grades and failures were signed by the head or deputy head of the commission. When number of applicants was big, commissions included selected secondary school teachers in addition to university staff. The admission decision was based on the sum of grades in all exams (sometimes some school grades were also included), but one or two of them (chosen by the respective faculty) had a priority in case of ties. At each faculty, decisions on the margin were made by the admission committee, which could take into account many factors, some clearly measurable (like success in national or regional subject competitions) but others loosely defined (like activity in social life).

Above all, formal and informal quotas (conditional on not failing in the exams) existed for some special categories (males after military service; orphans; applicants from the countryside, etc.). One of the documents required of applicant was an autobiography with full details on the applicant’s parents. Thus, social background could, in principle, be used as a screening device; according to the prevailing ideology, one would suppose that policy would favor applicants from working class backgrounds.

To sum up, the admission system was complicated and gave enough room for manipulation.

Appendix 3. Measurement errors and sample selection issues

A measurement error issue is related to the fact that for a large proportion of respondents in some of the LFS-based probit models both mother’s and father’s education is missing (see Table 4 for details). We have included these respondents (dummies for missing parental education were used in the estimates). To check that this measurement error does not cause bias in the coefficients of interest (ethnicity; in some cases parental education or age) we have re-estimated models without parental education controls; results do not change substantially (these alternative estimates are presented only in Table 3).

As another sensitivity check, we have estimated probit models of completed tertiary education with sample selection into living with at least one parent. Dummy for being single appears to be a valid instrument having a positive and very significant impact on propensity to live with parents. Given that two critical schooling decisions are made at the age of 15 and 17-18, while mean year of first marriage in Baltic countries is about 25/23 for males/females, while marriage rates of those younger than 25 are low and falling, there is no reason why marital status should have a direct effect on schooling outcomes. For Estonia, the hypothesis of independent equations was not rejected. For Latvia and Lithuania, error correlation was significant, but coefficients of interest are similar to those obtained using simple probit (with dummies for missing parental education) on unrestricted samples. These results are found in Table 4, column [6].

Place of residence is an important determinant of both application and enrollment: there is a direct effect of distance to universities, as well as indirect effect through quality of schools. The relevant place for tertiary enrollment or completion models would be the one where respondent lived up to graduating from secondary school (we use the interval 12 to 17 as a benchmark). Although we do not discuss residence-related effects in this paper, it is preferable to include the controls in the most appropriate way. NORBALT data contain information on the last move between municipalities of the household member (RSI) who was randomly selected from the population register²⁶. This allows constructing dummies by type of settlement for persons who did not move between 12 and 17, and amending them with dummies for particular types of migration (repeated moves are neglected).

By contrast with the models of completed higher education, the enrollment models discussed in section 9 use all household members aged 17-24 with secondary education rather than just the representative sample of randomly selected individuals (otherwise the sample would be too small). When the respondent is a direct (rather than in-law) relative of the RSI, we assume common migration. The remaining 15 percent of respondents (whose exact residence location at age 17 is unknown) are treated as a separate group (a dummy is included). However, estimates of the key parameters do not change much even when current residence is used.

²⁶ A substitute RSI (household member aged 18 or older having his/her birthday next) was selected when original RSI was younger than 18 or not available for the interview.

In LFS-based models we have no choice but to use current residence; of course the respective coefficients are not interpretable in a standard way (and not reported).

Emigration of minority population between 1991 and 2002, when 17%, 30%, and 33% of initial non-titular population of Latvia, Lithuania, and Estonia respectively left these countries, might affect some comparisons between periods. Hence our results, especially for the older cohorts, could be affected by sample selection; they can be taken at face value only for current population. The selection effect is mitigated by the fact that some emigrants were in fact return migrants, who were educated outside the Baltic countries and should be excluded from the sample anyway.

Finally, to focus on educational choices and outcomes in the Baltic countries, one has to exclude immigrants from abroad at age 18 or older. This has been done perfectly for the NORBALT data, as well as for Estonian LFS data. For Latvian and Lithuanian LFS data it was possible to exclude only those who have immigrated during the ten years prior to observation. This is enough for the models of secondary and tertiary enrollment. For the models of secondary and tertiary attainment of the 18/21-45 year olds, Latvian and Lithuanian samples include some respondents who have immigrated at age 18 or older. However, using estimates based on the NORBALT survey, one can show that the proportion of such respondents is negligible in the pooled samples and is below 10 percent in the minority sub-samples.