Ethnic and parental effects on schooling outcomes before and during the transition: evidence from the Baltic countries[*]

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Abstract This paper examines human capital gap between titular ethnicities and Russian-speaking minorities, which has emerged in Estonia, Latvia, and Lithuania during the transition and remains significant after controlling for parental education. For recent cohorts, unexplained gap is declining in Lithuania (despite absence of Russian language tertiary education) and in Estonia. Furthermore, we investigate intergenerational mobility in the Baltic countries. Parental education has a strong positive effect on propensity to obtain tertiary education, both in Soviet era and in post-Soviet period. Transition to the market has weakened mother's education effect for titular ethnicities, while the opposite is true for minorities.

Keywords: Parental education; ethnic minorities**;** transition

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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. There is a large body of theoretical and empirical research on relation between parental background and children's educational attainment in market economies. However, very little is known about intergenerational transmission of human capital under communism and in the transition context.

Increasing (respectively, decreasing) the impact of parental education or some specific demographic characteristic on children's education contributes to widening (respectively, narrowing) inequality of distribution of the human capital across social groups. Understanding the nature, strength and dynamics of the correlation between parental background and children's schooling choice, as well as between demographic characteristics and educational attainment is therefore important for policy purposes. This paper uses empirical evidence from the three Baltic countries to analyze family background effects on schooling outcomes under communism and their evolution during the transition.

The second question, which this study addresses, is whether schooling decisions and outcomes of ethnic minorities differ substantially from that of majority population, conditional on family background. 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 significant proportions of minority population are not citizens of respective countries and lack state language skills[1].

The results suggest that by 1999, a human capital gap between titular ethnicities and minorities has emerged in all three countries and remains significant after controlling for

[1] On ethnic effects in the Baltic labor markets see Kroncke and Smith (1999), Hazans (2003, 2004, 2005).

parental education and residence location. In the next five years, the [absolute] ethnic gap in tertiary attainment of population aged 21-45 has not become smaller in any of the three countries; in Lithuania it declined in relative terms though. However, the ethnic gap in tertiary enrollment (as well as cohort-specific gap in tertiary attainment) was declining in Estonia and Lithuania.

Parental education is found to have a strong positive effect on propensity to enroll in and 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 off-springs of working class parents. The results also provide some evidence in favor of the hypothesis that transition to the market has weakened mother's education for the titular ethnicities, while the opposite is true for the minorities.

The rest of the paper is organized as follows. Section 2 presents the review of the relevant literature. The background information on higher education[2] in the Baltic countries in Soviet era and during the transition is given in Section 3. Section 4 describes the data used for the analysis. Econometric models and estimation strategy are discussed in Section 5. Section 6 presents the results. Section 7 concludes.

2 Relevant literature

Substantial number of previous research work was devoted to intergenerational transmission of human capital. Theoretical models of educational choice in a family framework have been suggested by Chiswick (1988), Altonji and Dunn (1996), Ermisch and Francesconi (1999, 2001), Gang and Zimmerman (2000), Rey and Racionero (2002). A positive correlation between family background and children's educational attainment is an almost universal finding. Dustmann et al (2002; UK), Chevalier (2004; UK), Corak et al (2004; Canada), Bjorklund et al (2004; Sweden), Bauer and Riphahn (2006, 2007;

[2] 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.

Switzerland) are examples of recent empirical studies which confirm that schooling decisions and outcomes in developed market economies are strongly affected by parental education and family income.

There are several channels of intergenerational link. 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 schools, and to encourage post-secondary schooling. Recent literature (see for instance Black et al, 2005; Chevalier et al, 2005) has addressed the question whether the link between parental and children's education is causal, and the results so far are inconclusive[3].

The association between parental and child's education attainment, however, is less well documented in transition context. Fan et al (1999) and Spagat (2002) develop theoretical models where one can expect some adverse effects of restructuring on intergenerational correlations. Despite it, Beblo and Lauer (2004) for Poland, Gang (1996) and Varga (2006) for Hungary find strong positive effects of parental education on children's educational attainment and/or schooling decisions. Mateju et al (2003) find that in Czech Republic parental effects on the odds of transition between secondary and higher education were significant and stable in 1948-1989, and increasing during the post-communism transformation in 1990s.

The second relevant stream of the literature concerns ethnic skill differentials and their transmission across generations. Predominant finding in US and UK literature is that, although average tertiary enrollment rates for minority youth are lower than among their white counterparts, *ceteris paribus* non-white young people are more likely to go to college after secondary school than whites (see Bradley and Nguyen (2004) for a survey). On the other hand, a number of papers find that in continental Europe, second generation immigrants

[3] For instance, Chevalier et al. (2005) use instrumental variable methods to simultaneously account for the endogeneity of parental education and paternal income, and find that the strong effects of parental education become insignificant. On the other hand, Bjorklund *et al.* (2004) find that after accounting for genetics the causal effects of parental education remains highly significant.

of various ethnic origins have significantly worse schooling outcomes than otherwise similar natives; see e.g. Gang and Zimmerman (2000) and Riphahn (2003) for Germany, Colding (2006) for Denmark. The evolution of the ethnic gap is of a special policy concern.

Furthermore, recent literature provides evidence that the intergenerational transmission of human capital varies by ethnicity (Gang 1996) or race (Cameron and Heckman 2001). Gang and Zimmerman (2000; Germany), Card *et al* (2000; US), Bauer and Riphahn (2006; Switzerland), and Colding (2006; Denmark) show that for second generation immigrants parental schooling effect is absent or significantly weaker than for natives.

Our paper adds to the existing literature by analyzing ethnic and parental effects on child's schooling outcomes in the Baltic countries in Soviet era and their evolution during the transition. Along the lines of the previous research, we also explore ethnic heterogeneity in the intergenerational transmission of educational attainment.

3 The market for higher education before and during the transition

Why did people in the Soviet Union enroll in universities? The fact that returns to education in centrally planned economies were low, is well established (see Svejnar (1999), Filer et al (1999), Campos and Jolliffe (2002), Munich et al (2005)). While higher education was free, the decision to enter university was still costly due to psychic learning costs, direct costs (as preparation and/or bribing) and forgone earnings[4]. One explanation comes from the theory of comparative advantage in the labor market (Bjorklund and Moffitt, 1987; Carneiro and Heckman, 2002; Heckman and Li, 2003): education might pay off for those individuals who have chosen it, even if observed returns to schooling are low. Higher education might

[4] Only some students received scholarships; moreover, the typical scholarship was about 30% of a young worker's salary.

also provide significant non-monetary benefits[5] (e.g. in terms of working conditions and job satisfaction).

Looking at the supply side, the number of places in the universities under communism was fixed and applicants-admissions ratio was considerably high[6]. The admission system in the Soviet Union was complicated and gave enough room for manipulation[7]. Good abilities combined with studies in a "good" school (or short-term preparation courses) gave a high chance to pass the entry exams. Individuals with somewhat lower abilities were able to enter university if they enrolled in long-term preparation courses at the university, had intensive private tutoring, have chosen a less popular field, or simply bribed a relevant person in the examination committee or university administration[8].

Due to the reasons mentioned above, we expect both parental education and family income of a secondary school graduate to be positively correlated with university enrollment. The transition from central planning has brought dramatic changes into the market for higher education. Rising returns to education (see Hazans, 2003; 2005 for details), removal of quantitative supply constraints, emergence of new fields of study, and introduction of study loans in mid (Estonia) or late (Latvia and Lithuania) 1990s resulted in the increase in the total number of students between 1995 and 2003 (see Figure 1).

[Figure1 about here]

[5] Starting in the 1970s, for instance, 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.

[6] Degree of competition varied across fields of study. For instance, 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.

[7] A university could turn down the applicant's documents based on the grades in secondary school certificate or based on "personal characteristic" signed by school administration and the *komsomol* secretary. Some top higher education institutes in Moscow and Leningrad were famous by not accepting documents from Jewish applicants. Above all, formal and informal quotas (conditional on not failing in the entry exams) existed for some special categories (males after military service; orphans; applicants from the countryside, etc.) One of the documents required from 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.

[8] The composition of the pool of admitted students according to the way of getting in 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.

Finally, this historic change of environment has had another important 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). A large part of minority population includes those who moved in from other parts of the former Soviet Union in 1944-1990 and their descendants. By 2000, 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 consistent with population proportions[9]. 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; moreover, almost all students instructed in Russian were paying tuition (see Table 2 for details).

[Table 2 about here]

Therefore, the representatives of language minority were in general required to pay for higher education if studied in Russian or to study in a language different from their first language and from the language of instruction in their secondary school. This may have led, at least initially, to lower tertiary enrollment, other things equal (and also to a higher drop-out rate).

[9] 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.

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 pre-transition levels. The focus of this paper is to analyze whether this gap is still in place conditional on family background and place of residence, and to trace its evolution over time.

[Figure 2 about here]

4 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. More than 4,000 households in Estonia, 3,000 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.

5 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.

The above decisions are interconnected; moreover, some of them are observed only conditional on a positive outcome in one of the previous stages (we refer to Cameron and Heckman (2001) and Colding (2006) for particular importance of accounting for progression selectivity when studying schooling outcomes of minority groups). Estimating full structural model is not attempted here due to data limitations. Instead, we estimate a sequence of simple reduced form probit models; to avoid progression selectivity bias, tertiary enrollment and completion models are conditioned on basic (rather than secondary) education.

The baseline model of completed tertiary education can be written as follows:

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

Here $y_i = 1$ if the individual has completed tertiary education and $y_i = 0$ otherwise. Vector X_i includes demographic characteristics of the individual, as well as dummy variables describing the relevant residential area, S_i is a vector describing parental education, and ε_i is normally distributed zero-mean error. We specify S as follows:

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

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 with completed basic education.

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))[10].

In the NORBALT data parental schooling is observed for a representative sample of the whole population; missing values 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 no older 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:

$$y_i^* = \beta' X_i + \gamma' S_i^* + \varepsilon_i,\ y_i = 1 \text{ if } y_i^* > 0,\ y_i = 0 \text{ if } y_i^* \le 0, \qquad (2)$$

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

[10] 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.

mother (respectively, father) does not live in the same household[11]. In the models of secondary and tertiary enrollment most respondents have non-missing parental education, so that measurement error is modest. When modeling educational attainment, we rely on NORBALT data for analyzing parental effects. We use both data sources, however, when studying the ethnic effects, especially the dynamics of ethnic gap during the transition; this is because LFS data are more recent and have a lot more observations (the latter point is particularly relevant with respect to minority respondents in Lithuania)[12].

Controlling for place of residence is important for evaluating the ethnic effects, given that in the Baltic countries minorities are concentrated predominantly in big cities (especially in the capitals) and in few regions. 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 age interval 12 to 17 as a benchmark). NORBALT data such provide necessary information for most respondents, but in LFS-based models we have no choice but to use current residence. In any case, level of urbanization might be endogenous to schooling decisions, so we do not interpret (and report) the effects.

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[13]. 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 due to attrition; they can be taken at face value only for current population. We provide some evidence, however, which suggests that selection bias, if

[11] Colding (2006) is an example of a recent study where missing mother's (respectively, father's) education is replaced by a special dummy for 65% (respectively, 58%) of immigrants' children.
[12] The attainment models have been estimated also with sample selection into living with at least one parent (see section 6 for details).
[13] 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 or 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, the proportion of such respondents is negligible in the pooled samples and is below 10 percent in the minority sub-samples.

any, does not change our conclusions qualitatively. The attrition effect is mitigated by the fact that some emigrants were in fact return migrants, who were educated outside the Baltic countries and should have been excluded from the analysis in any case.

Most our models will not control for income. This 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. Model of tertiary enrollment 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.

6 Results

6.1 Emerging inequality in the distribution of human capital across ethnicities

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. Since graduation year rather than age in used in Figure 2, it features a time period effect rather than pure cohort effect (note that among persons who received higher education in 1990-2004, 17 percent in Estonia, 21 percent in Latvia, and 7 percent in Lithuania have graduated at age 30 or older). This transition effect may have two dimensions: first, titular population was attaining tertiary education at a higher rate than minorities; second, among those with higher education, natives were more actively pursuing Masters' degrees than their minority counterparts. For the latter effect, only the Estonian LFS data provide direct evidence: among ethnic Estonians with higher education, who have graduated in 1995-99 (respectively, 2000-2004) 14 (respectively, 10) percent have attained Master's degree, while for minorities these proportions are 2 (respectively, 0) percent.

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]

In all three countries, educational attainment of the younger cohort is higher than that of the older cohort for all ethnic groups (with the exception of minorities in Estonia in 2001, but this was compensated by enrollment boom in 2001-2004); nevertheless, in Estonia and Latvia progress was a lot stronger for titular population than for minorities. The ethnic gap in the younger cohort as compared to the older one increased dramatically from 2 to 9 percentage points in Estonia, and from 4 to 10 percentage points in Latvia. In Lithuania, the gap has increased only slightly, and it has even become smaller in relative terms. Note also that only in Lithuania relative position of minorities in terms of [gross] tertiary graduation rates have recovered in 2000-2004 compared to 1995-1999 (Figure 2). These findings are especially interesting given that Lithuania is the only Baltic country where higher education in Russian is virtually absent (Table 1).

In order to assess to what extent emigration of minorities in 1990s might have affected the comparison of ethnic gap between cohorts in Figure 3, we use earlier data sources. According to Estonian Population Census data in 1989, the ethnic gap in the "older" cohorts (i.e. aged 41-50 in 2001 or in 2004) was close to zero; according to the first round of NORBALT survey in 1994, the same was true for Latvia and Estonia, while in Lithuania the gap was substantial: 7 percentage points (even larger for locally born population). This suggests that after accounting for emigration, Estonia and Latvia still feature emergence of the ethnic gap in the younger cohort, while in Lithuania the gap have been partly inherited from Soviet times.

Given that the number of ethnically-mixed marriages is significant in the Baltic countries, we use the latest Population Census data for Estonia (March 2000) and Lithuania

(March 2001) to look at a long-term picture based on mother tongue rather than ethnicity. Figure 4 confirms a declining trend of the relative position of the Russo-phone minorities starting already in late 1960s. In Estonia, a recovery is observed for the cohort with the likely period of tertiary schooling in late 1990s. 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 graduated from secondary school in the 1990s. By contrast, tertiary attainment of the Polish-speaking minority in 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 in tertiary attainment ratio for cohorts graduated from secondary school between 1980 and 1999, however.

[Figure 4 about here]

For Estonia, results based of the 1989 Population Census are presented in the same Figure[14]. On average, relative position of Russian-speakers with likely period of tertiary studies in 1950-1989 was somewhat better according to the 1989 data than according to the 2000 Census results; for local-born Russian-speakers the picture is reversed. Given that our target population includes both groups: local born persons and those who immigrated before the age of 18, the attrition effect in the year 2000 data seems to be small.

Table 3 presents the ethnic effects from reduced form probit models of completed tertiary and secondary education (conditional on completed primary education) estimated for each of the three countries, with age, gender, parental education, and residence controls. Columns [1] and [2] are based on NORBALT data and refer, respectively, to population aged 21+ (average age about 47) and population aged 21 to 45 (average age about 34) in 1999. Column [3] is similar to column [2], but uses only current residence indicators, to allow comparison with LFS-based models. Columns [4] to [6] also refer to population aged 21 to 45 but are based on LFS data collected three to five years later (hence, when one moves from

[14] Latvian and Lithuanian statistical offices do not possess data of the 1989 Census.

column [1] to columns [2-3] to columns [4-6], the proportion of respondents, whose schooling outcomes were determined during the transition, increases). Column [4] provides the baseline specification; to address the problem of missing parental education, results in columns [5] and [6] are based on probit models with sample selection (Van de Ven and Van Pragg (1981)) into living with at least one parent[15]. As instruments, we use dummy for being "single" (as opposed to married, cohabiting, divorced or widowed) in column [5], and dummy for participating in the survey through another household member (rather than giving the interview directly) in column [6]; the latter refers only to tertiary attainment models. Both instruments have a positive and very significant impact on propensity to live with parents; for Latvia and Lithuania, both lead to virtually identical estimates of the ethnic effect on tertiary attainment (similar to those from simple probit on unrestricted samples), while for Estonia both do not reject the hypothesis of independent equations[16].

We first discuss the ethnic effects on tertiary attainment. Coefficient on the ethnic minority dummy is negative and highly significant in all tertiary attainment models. In 1999, probability to have completed tertiary education among minority population aged 21-45 was 7 to 8 percentage points lower than for their otherwise similar majority counterparts; in 2002-2004, the difference was 8 percentage points in Estonia, 9 to 10 points in Latvia and Lithuania. For all three countries, the coefficient in column [2] is larger in size than that in column [1] (significantly so for Latvia); the same is true for the marginal effects and for their ratios to tertiary attainment rates. This suggests that in 1999, the *ceteris paribus* ethnic gap in human capital among 21 to 45 year olds was wider than among those older than 45 (note that

[15] Note also that the ethnic effects in columns [1]-[4] are virtually unchanged if parental controls are omitted.

[16] Regarding the validity of the instruments, it seems reasonable to believe that the method of participating in the survey is uncorrelated with errors in the tertiary attainment equation. Regarding the other instrument, early marriage can, in theory, affect consequent schooling outcomes; however, two critical schooling decisions are made at the age of 15 and 17-18, while mean year of the first marriage in the Baltic countries is about 25/23 for males/females. More than 85% of population aged 18 to 24 have never been married. The instrument seems beyond suspicion as long as secondary attainment is concerned. Furthermore, our definition of "single" excludes cohabiting, which makes association between "single" status and marriage weaker. So it is plausible that being "single" should not have a direct effect on tertiary attainment. Correlation between "single" and error term in linear probability model is close to zero. We thus consider this as a valid instrument as well. Given that that the two instruments are virtually uncorrelated (the correlation is -0.05 in Estonia, 0.13 in Latvia, and -0.16 in Lithuania), and nevertheless they give very similar results, we believe the results are credible.

for the latter group the likely period of tertiary schooling falls within the Soviet era)[17]. The raw ethnic gap in tertiary attainment among 21 to 45 year olds ranged from two (Estonia) to four (Latvia) percentage points in 1999, from four (Estonia) to five (Latvia and Lithuania) percentage points in 2002-2004.

Comparing the ethnic effects reported in columns [4-6] with the ones in column [3] (note that the control variables are identical) suggests that the ethnic gap in human capital for the age group 21-45 has increased somewhat in 2002-2004 compared to 1999 in Estonia; in Lithuania, the gap has become smaller in relative terms (despite absolute increase in the raw gap), while in Latvia the change is negligible. These changes (if any) may include time effect (between 1999 and 2002-2004, human capital accumulation could be slower or faster among minorities than among titular population), as well as cohort effect (the gap is larger or smaller among the youth than among 46-50 year olds which were removed from the sample).

[Table 3 about here]

To what extent do differences in secondary attainment of the 21-45 year olds between the ethnicities contribute to the unexplained tertiary gap in the same age group? In 1999, raw gap in secondary attainment in each country was three to four percentage points in favor of minorities, while the *ceteris paribus* gap was absent. By 2002-2004, the raw gap has narrowed down in Estonia and disappeared in Latvia and Lithuania; moreover, a five percentage points *ceteris paribus* gap in favor of titular population has emerged in Estonia and Latvia[18]. This gap, however, is modest compared to attainment rates which range between

[17] Formally, suppose that every (adult) member of current generation *(t)* can have either high (y_t=1) or low (y_t=0) education level, which is determined by the following probit model: $y_t^* = \beta_t y_{t-1} + \mu_t z + \gamma_t' X_t + \varepsilon$, $y_t = 1$ if $y_t^* > 0$, $y_t = 0$ if $y_t^* \leq 0$, $\varepsilon \sim N(0; 1)$, where y_{t-1} is parents' education level; z is a binary variable defining two demographic groups, and X is a vector of other relevant demographic characteristics. Assume that impact of parental education, demographics other than z, and unobservables does not change over time: $\beta_{t+1} = \beta_t = \beta$, $\gamma_{t+1} = \gamma_t = \gamma$. Assume also that $\mu_t > 0$ without loss of generality. Then human capital gap between demographic groups, conditional on parental education and other demographic characteristics, $\delta_{t+1}(y, X) = E(y_{t+1}|y_t=y, z=1, X) - E(y_{t+1}|y_t=y, z=0, X) = \Phi(\beta y + \mu_{t+1} + \gamma' X) - \Phi(\beta y + \gamma' X)$ is larger (respectively, smaller) in generation t+1 than in generation t if $\mu_{t+1} > \mu_t$ (respectively, $\mu_{t+1} < \mu_t$).

[18] In Latvia, the reason was a sharp drop in secondary completion rate of minorities (from 80.4 percent for those born in 1972-78 to 74.4 for those born in 1979-83). In Estonia, a similar cohort effect was accompanied by intensive completion of secondary education by individuals of titular ethnicity aged 25 and older between 1999 and 2004

80 and 90 percent. Overall conclusion is that ethnic differences in secondary attainment of the 21-45 year olds do not seem to contribute substantially to unexplained gap in tertiary attainment.

To focus on the evolution of the ethnic gap in completed higher education *during the transition*, we look at the educational attainment of the recent cohorts (born in 1972 or later and being 21 or older in the year of observation). Figure 5 presents, for each of the three countries, cohort-specific rates of completed tertiary education by ethnicity in 2001-2004 (i. e. several years later than Figure 4). The difference between these rates for titular and non-titular population (the *cohort-specific raw ethnic gap*) is also shown, along with the *cohort-specific unexplained ethnic gap*. The latter is the difference between [averaged over each cohort] predicted and observed rates for minorities, where predictions are based on probit models estimated on the titular sample in each country[19]. For Lithuania, we present separately the gaps between titular population and each of the two minorities (Polish and Russian-speaking).

[Figure 5 about here]

There is a clear evidence of increasing of the unexplained ethnic gap for the first few cohorts, whose likely period of tertiary studies falls within early transition. The peak level of the unexplained ethnic gap was about 15 percentage points in each of the three countries (although it was much higher for the Polish population in Lithuania). Note that the raw gap is always smaller than the unexplained gap; this is because minority population is concentrated predominantly in the capitals and in (relatively) big cities where access to tertiary studies is easier.

In Lithuania, more recent cohorts feature declining trend in the unexplained gap between titular and Polish population, while the gap between titular and Russian-speaking population does not exceed 5 percentage points for the last seven cohorts. Despite starting at

[19] Controls include: gender, region, and rural dummies, birth year dummies, as well as observation year dummies. See next subsection for a formal definition of explained and unexplained gap. Note that cohort and age effects cannot be estimated separately. However assuming that age effects on propensity to obtain higher education are independent of ethnicity, the trend in the unexplained ethnic gap should be attributed to the cohort effects.

very different positions in early 1990s, both ethnic gaps are nearly equal (about 5 percentage points each) by the end of the transition. In Estonia and Latvia, the unexplained gap was fluctuating around high levels, but became significantly smaller for the last four cohorts in Estonia (about three percentage points) and for the last two cohorts in Latvia (three and seven points). To sum up, there is sufficient evidence that recent cohorts of minorities in Lithuania and Estonia have been successful in catching up with the titular population in terms of tertiary attainment; in Latvia, the evidence is less conclusive.

To shed more light on the evolution of the ethnic effects, as well as parental education effects, Table 4 presents results by cohort for the models of completed tertiary education based on the pooled three-country sample of the 1999 NORBALT survey. 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[20].

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

Table 5 summarizes the ethnic effects from probit models intended to explain schooling decisions and outcomes at different levels, as outlined in Section 5 above. We have also modeled the choice between academic and vocational secondary school, which appeared to be virtually unrelated to the ethnic gap (to save space, the results are not presented here). In order to have enough observations to analyze enrollment in each country, we use LFS data. For each model, the table provides decomposition of the observed gap in enrollment or attainment between titular and non-titular population into explained and unexplained components. Here

$$Explained\ gap = E[\Phi(\beta'_{\text{titular}} X) \mid titular] - E[\Phi(\beta'_{\text{titular}} X) \mid nontitular], \qquad (3)$$

[20] We have made similar comparison also for LFS-based models estimated (by country) separately for population born in 1957-1971 and in 1972-1983 (results are available on the request). The minority coefficients are larger in size for the latest cohort (which could receive tertiary education only in the post-transition period) for Latvia and Estonia: -0.443 (0.067) vs. -0.320 (0.046) and -0.398 (0.117) vs. -0.335 (0.090), respectively; while it goes the other way in Lithuania: -0.360 (0.088) vs. -0.441 (0.070).

where $E[\ |\ .]$ stands for conditional sample mean, $\Phi.$ is the standard normal cumulative distribution, and β is the vector of estimated probit coefficients. The first term on the right is the 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 population[21]. In other words, the explained gap is caused by different distributions of characteristics among the two groups. On the other hand[22],

$$\textit{Unexplained gap} = \textit{Observed gap} - \textit{Explained gap}. \qquad (4)$$

Tests of significance of the unexplained gap use the methodology of Yun (2005a, 2005b).

[Table 5 about here]

Results on tertiary attainment (columns [4, 5]) are presented for completeness; they are of course similar in spirit to those from Table 3 (columns [4, 5]); note, however, that this time we use a different measure of the ethnic gap; also, Table 5 applies similar residence controls for all three countries, while in Table 3 they are less detailed in Lithuania to ensure perfect comparison with NORBALT-based results. Results on participation in further education refer to late transition, while results on tertiary attainment refer to population aged 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.

In Estonia, one finds a substantial difference between the ethnic groups in propensity to enroll in secondary education (column [1]) in 2001. 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. This gap appears to be of post-Soviet origin, because the difference in secondary attainment of the 21-45 year olds is in favor of non-titular population (see Table 3).

[21] This decomposition has been used e.g. by Gang *et al* (2002); see also Yun (2005a, 2005b).
[22] The definition of unexplained difference given in (3), (4) is equivalent to the one applied in Figure 5 (see discussion above), except for the fact that here, means are taken over the whole sample rather than by cohort.

Remarkably, just three years later, both observed and unexplained gap in secondary enrollment shrinks by three percentage points each. Similar pattern is found in tertiary enrollment of 17-24 year old secondary school graduates (see column [3] in Table 5): the observed ethnic gap decreases 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, higher enrollment of minorities at secondary, as well as at tertiary levels, 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 gap is 8 percentage points (see column [2] in Table 5). This suggests that the gap in tertiary enrollment is partly due to lower secondary enrollment of minorities in 1995-2001.

To sum up the above discussion and the results on tertiary attainment (columns [4] and [5] in Table 5), 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 unexplained ethnic gap in tertiary attainment of population aged 21-45.

Similar analysis for Latvia (2002-2004) and Lithuania (2002-2003)[23] 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 in propensity to enroll in tertiary studies is about 10 percentage points in Lithuania and 10 to 15 percentage points in Latvia. This clearly suggests that the unexplained ethnic gap in tertiary attainment (currently 9

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

percentage points in Latvia, 12 points in Lithuania) is likely to remain significant in the near future.

6.3 Parental education effects in Soviet era and during the transition

Consistent with our expectations, the effect of parental education on the likelihood that children have completed tertiary studies or continue education after secondary is positive and significant in all three countries, both for the titular population and for minorities. For titular population aged 21+ in 1999, the marginal effects of mother's and father's higher (vs. basic) education on probability of tertiary attainment are 0.27 and 0.14 in Estonia, 0.22 and 0.18 in Latvia, 0.12 and 0.18 in Lithuania (see Table 6)[24]. The marginal effects of parents' higher education on postsecondary enrollment of the 17-24 year olds in the pooled Baltic sample are 0.26 for mother and 0.11 for father (Table 7, column [1]).[25] It appears that maternal effects (at least in Estonia and Latvia) are close to the upper end of their range in developed countries, while paternal effects are somewhat weaker. Parent's secondary education has smaller but substantial impact.

Table 4 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

[24] For comparison, similar estimates [for own birth children] are 0.20 and 0.29 in US (Plug 2004), 0.15 and 0.21 in Sweden (Bjorklund et al 2004).

[25] LFS-based country-specific estimates for tertiary enrollment in 2001-2004 not conditional on completion of secondary school give very similar (0.27 to 0.30) maternal effects; paternal effects range from 0.16 to 0.24. Similar effects for 17 years olds in Switzerland (Bauer and Riphahn 2006) are 0.28 (mother) and 0.32 (father). Note that parental education effects in Switzerland are stronger than elsewhere in Western Europe (Woessman 2004).

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 willing to pay has increased[26]; 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 4 (panel C) supports this hypothesis for titular population. First, probit coefficients show that positive effect of father's higher education, as well as negative effect of the father not living in the household, became stronger during the 1980s and 1990s. 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; the ratio of corresponding marginal effect to the observed tertiary attainment rate falls from 1.35 in 1970s to 1.02 in 1980s to 0.78 in 1990s (by the most likely period of tertiary schooling).

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, despite omission of the income variable. For those born after 1973, parental income at the relevant time was positively correlated with parental education[27], so one can expect the effect of parental education to be biased upward[28]. Hence the fact that in the titular sub-population our estimates of the effect of mother's education are lower for the transition period than for the previous one, support the

[26] 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 2002.
[27] See estimated earnings functions in Kroncke and Smith (1999), Hazans (2003, 2005).
[28] 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 he relevant NORBALT samples, while the LFS-based samples do not include such respondents at all.

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 0.281 *(0.186)* to 1.022 *(0.353)*, while that on mother with tertiary education – from 1.208 *(0.309)* to 1.753 *(0.440)*. 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. One can suggest that the increase of the strength of maternal effects within minority population is likely to be a temporarily phenomenon[29].

In the same time, father's education effects for the minorities have lost any significance (Table 4, 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]

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 professionals[30], 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 then other fathers with higher education.

[29] Available evidence from the LFS-based models is consistent with these effects being smaller in the 2000s compared to the previous five yeas in Latvia and Lithuania; these results are not reported.
[30] 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.

Nevertheless, this effect might be of a transitory nature, as 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 than for titular population in all three countries.

6.4 Income effects on post-secondary enrollment

The effect of parental income on children schooling outcomes 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.

Living Conditions Survey 1999 includes the data on current family income, which allows distinguishing direct parental education effect from income effect. We use this information to analyze whether current family income is a significant determinant of the decision to continue education after secondary school and whether income effect is of long-term nature. Moreover, given that Russian-language tertiary instruction is only available for a fee (alternatively, language-caused difficulties may be less of a problem for those paying tuition, as rules are less stringent for tuition-based than for budget-funded students), we want to look at the differences between ethnic groups to test whether the liquidity constraint is more important for ethnic minorities than for titular population.

The sample consists of respondents who are younger than 25 and have completed upper secondary education (ISCED 3A). 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 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 types of families as instruments) were estimated as well; the hypothesis of independent equations was not rejected for the pooled sample (Prob > chi2 = 0.294) and for the titular population (Prob > chi2 = 0.634), but rejected for the non-titular population (rho = -0.753 ; Prob > chi2 = 0.060). Only the latter estimates are reported (column [7] in Table 7), and they are almost identical to simple probit estimates.

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.[31] The dependent variable is 1 if the respondent „is currently studying," which may refer either to tertiary education or to non-tertiary postsecondary vocational studies.

[Table 7 about here]

Table 7 presents results based on the 1999 Living Conditions Survey. 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 [4] 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.

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

The results indicate that in the late 1990s income had a significant role in schooling decisions. The size of the income effect seems modest, however: Doubling family income results in about 6 percentage points increase in probability of participation in further education (note that average enrollment in the sample is 56.6 percent).

Inclusion of the income variable does not change estimates of the effect of mother's education but decreases 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 sub-sample once family income is controlled for (see columns [6], [7] in Table 7).

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 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.

7 Conclusion

This paper documents rapid changes which took place in the process of accumulation of human capital in the three Baltic countries since the fall of communism. After eliminating Russian-language instruction from state-financed higher education, a wide gap in tertiary enrollment and graduation rates has emerged between the titular ethnicity in each country and

the sizable (predominantly Russian speaking, but also Polish in Lithuania) ethnic minorities. By 1999, after controlling for residence location, age, gender, and parental education, probability to have completed tertiary education among minorities aged 21-45 was 7 to 8 percentage points lower than for titular population, while the *ceteris paribus* (this time also with parental income control) ethnic gap in postsecondary enrollment of population aged 17-24 was 12 percentage points. In contrast with situation for Black and Hispanic minorities in US and UK, the observed gaps are smaller than the unexplained ones.

Comparing the outcomes across Baltic countries, each of them stands out in some respects. We provide evidence that several recent cohorts of minorities in Lithuania and Estonia have been successful in catching up with the titular population in terms of tertiary attainment; in Latvia, the evidence is less conclusive. In Estonia, the ethnic gap in tertiary attainment of population aged 21-45 is smaller than in the other two countries, but it tends to increase, partly due to a gap in secondary enrollment; the latter is of recent origin and declining (as does the gap in tertiary enrollment).

Latvia features the largest ethnic gap in tertiary enrollment of secondary graduates. Lithuania is the only one of the three countries without a substantial provision of higher education in non-titular language even by the private sector. Nevertheless, in Lithuania the ethnic gap in tertiary attainment of population aged 21-45 has declined in relative terms since 1999, while it was persistent in Latvia and increased somewhat in Estonia. Only in Lithuania tertiary graduation rates of minorities in 2000-2004 were growing faster than that of titular population. Plausibly, one of the reasons is the fact that minorities are better integrated in Lithuania than in the other two countries, and that young non-Lithuanians have better state language skills that their counterparts in Estonia and Latvia (Table 1).

Two minority groups in Lithuania have entered the transition from very different positions: the human capital stock was very low in the Polish minority, while the Russian-speakers were better educated than ethnic Lithuanians. However, for the two most recent

observed cohorts, tertiary attainment rates are the same in all three ethnic groups, and unexplained gap between titular population and each of the two minorities is about five percentage points.

Regarding the intergenerational transmission of educational attainment, we find that parental (especially mother's) education has a strong positive effect on the propensity to enroll in, and complete, secondary and tertiary education, both in Soviet era and during the transition. Maternal effects (at least in Estonia and Latvia) are close to the upper end of their range in developed countries, while paternal effects are somewhat weaker. 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, were 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, although 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. Sources of data on instruction by language in 1996 and 2002 are official publications of national ministries of education or national statistical offices.
*****Estimate by Stanislav Buka, deputy head of Department of Higher Education at the Latvian Minstry of Education and Science in late 1980s (personal communication, 2004).

Table 3 Ethnicity effects on educational attainment.
The Baltic countries, 1999; 2001-2004.

		[1]	[2]	[3]	[4]	[5]	[6]
Data		**NORBALT 1999**			**Labour Force Surveys, 2001-2004**		
Model		Probit	Probit		Probit	Probit with sample selection: living with at least one parent [f, i]	[h, i]
Sample [a]: Age		**21+**	**21-45**		**21-45**	**21-45**	
Urbanization		By residence at age of 17	By current residence		By current residence	By current residence	
Other controls		Parents' education [b], age, age squared, gender, region; observation year (in LFS models)					
		ESTONIA			**ESTONIA, LFS 2001&2004**		
Tertiary	Coefficient [c]	-0.234***	-0.292***	-0.281***	-0.363***	*p*-value for H_0: ρ =0	
	Std. Error	*(0.090)*	*(0.063)*	*(0.092)*	*(0.072)*	0.5495	0.4755
	Marg. effect [d]	-0.048***	-0.065***	-0.062***	-0.082***	Results are not presented	
	(Marg. eff.)/ $\overline{Y}$	-0.281	-0.343	-0.328	-0.451	(independence of equations is not rejected)	
	Raw gap in $\overline{Y}$ [e]	-0.013	0.022		0.037***		
	N	3780	2021		11420	11420 (selected 2374)	
Secondary	Marg. effect	-0.037**	-0.010	-0.005	-0.049***	*p*-value for	Instrument
	(Marg. eff.)/ $\overline{Y}$	-0.051	-0.011	-0.006	-0.058	H_0: ρ =0	is not valid
	Raw gap in $\overline{Y}$	-0.108***	-0.039*		-0.025**	0.9822	
	N	3879	2117		12081	Results are not presented	
						12081 (selected 2714)	
		LATVIA			**LATVIA, LFS 2002-2004**		
Tertiary	Coefficient	-0.175**	-0.344***	-0.378***	-0.372***	-0.313***	-0.306***
	Std. Error	*(0.069)*	*(0.095)*	*(0.102)*	*(0.039)*	*(0.065)*	*(0.066)*
	Marg. effect	-0.034**	-0.072***	-0.079***	-0.091***	-0.093***	-0.085***
	(Marg. eff.)/ $\overline{Y}$	-0.219	-0.389	-0.426	-0.465	-0.473	-0.436
	Raw gap in $\overline{Y}$ [e]	0.004	0.042		0.048***	0.048***	
	N	2471	1067		22248	22248 (selected 6992)	
Secondary	Marg. effect	-0.053***	-0.002	-0.004	-0.051***	-0.050***	
	(Marg. eff.)/ $\overline{Y}$	-0.077	-0.002	-0.005	-0.059	-0.057	Instrument is not valid
	Raw gap in $\overline{Y}$	-0.033*	-0.034		0.004	0.004	
	N	2527	1122				
		LITHUANIA			**LITHUANIA, LFS 2002-2003**		
Tertiary	Coefficient	-0.331***	-0.377**	-0.532***	-0.338***	-0.400***	-0.393***
	Std. Error	*(0.070)*	*(0.081)*	*(0.121)*	*(0.055)*	*(0.071)*	*(0.072)*
	Marg. effect	-0.060***	-0.079**	-0.105***	-0.092***	-0.102***	-0.095***
	(Marg. eff.)/ $\overline{Y}$	-0.379	-0.402	-0.535	-0.356	-0.396	-0.371
	Raw gap in Y	0.012	0.027		0.051***	0.051***	
	N	2409	1155		16754	16754 (selected 6503)	
Secondary	Marg. effect [d]	-0.024	-0.001	-0.006	-0.012	-0.008	
	(Marg. eff.)/ $\overline{Y}$	-0.028	-0.001	-0.007	-0.013	-0.009	Instrument is not valid
	Raw gap in $\overline{Y}$	-0.053*	-0.033		-0.005	-0.005	
	N	2438	1184		17713	17713 (selected 7239)	

Notes: [a] Population with completed primary education, excluding immigrants from abroad at age 18 or older; in tertiary attainment models, also tertiary students without completed tertiary education excluded.
[b] Four categories (higher, secondary, less than secondary, and missing) are distinguished for each parent. 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. In all models the ethnic effects are almost unchanged if parental controls are omitted.
[c] ***, **, * 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. [d] Hereafter, *marginal effect* of a dummy variable is change in predicted probability, *P*, when the variable changes its value from 0 to 1. All effects are evaluated at each observation and averaged across the sample. [e] Difference in mean Y between titular and minority population. [f] Instrument: Single (as opposed to married, cohabiting, divorced, or widow). [g] Instrument: Direct interview (as opposed to information provided by another household member). [i] Instrument is significant at 0.001 level in selection equation in all cases. *Source:* NORBALT and LFS data and calculation.

Table 4 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	0.124***	0.099***	0.076***	0.006	0.043	0.003
Probit coefficients [b] and marginal effects [c]						
B. Ethnic effects: Whole population						
Non-titular ethnicity	-0.680***	-0.312***	-0.249***	-0.083	-0.282	-0.019
	(0.129)	(0.101)	(0.088)	(0.101)	(0.221)	(0.315)
Marginal effects	-0.104***	-0.068***	-0.061***	-0.017	-0.041	-0.002
Number obs.	996	1863	1864	1431	1136	756
Pseudo R-sq.	0.253	0.161	0.098	0.114	0.132	0.154
C. Effects of parental education (vs. basic or less): Titular population						
Mother: secondary	0.389	0.384***	0.568***	0.616***	0.594***	0.426
	(0.262)	*(0.125)*	*(0.140)*	*(0.222)*	*(0.226)*	*(0.338)*
Marginal effects	*0.065*	*0.092****	*0.170****	*0.164****	*0.134****	*0.066*
Mother: higher	0.673**	0.756***	0.904***	-0.100	0.801 [d]	0.999 [d]
	(0.299)	*(0.190)*	*(0.228)*	*(0.312)*	*(0.565)*	*(0.730)*
Marginal effects	*0.127***	*0.207****	*0.294****	*-0.019*	*0.198*	*0.209*
Father: secondary	0.559**	0.164	0.157	0.445**	0.355	0.339
	(0.243)	*(0.114)*	*(0.177)*	*(0.175)*	*(0.236)*	*(0.283)*
Marginal effects	*0.100***	*0.040*	*0.043*	*0.110***	*0.077*	*0.047*
Father: higher	1.203***	0.648***	0.290	0.444	0.483	0.545 [d]
	(0.281)	*(0.174)*	*(0.225)*	*(0.334)*	*(0.324)*	*(0.507)*
Marginal effects	*0.283****	*0.186****	*0.084*	*0.110*	*0.111*	*0.086*
Father: unknown	-0.767*	-0.629***	-0.185	-0.266**	-0.659*	0.037
	(0.409)	*(0.232)*	*(0.142)*	*(0.263)*	*(0.369)*	*(0.465)*
Marginal effects	*-0.061**	*-0.108****	*-0.045*	*-0.046***	*-0.080**	*0.004*
D. Effects of parental education (vs. basic or less): Non-titular population						
Mother: secondary	1.022***	0.281	0.218	0.536**		
	(0.353)	*(0.186)*	*(0.238)*	*(0.268)*		
Marginal effects	*0.093****	*0.056*	*0.054*	*0.131***		
Mother: higher	1.753***	1.208***	0.364	1.147***		
	(0.440)	*(0.309)*	*(0.462)*	*(0.432)*		
Marginal effects	*0.239****	*0.327****	*0.096*	*0.334****		
Father: secondary	-0.065	0.604**	0.333	0.519**		
	(0.418)	*(0.262)*	*(0.224)*	*(0.256)*		
Marginal effects	*-0.009*	*0.132***	*0.088*	*0.124***		
Father: higher	-0.170	0.498	0.506*	0.330		
	(0.399)	*(0.359)*	*(0.281)*	*(0.410)*		
Marginal effects	*-0.024*	*0.104*	*0.142**	*0.074*		
Father: unknown	-5.369	-5.554	-0.578**	0.354		
	NA	*NA*	*(0.265)*	*(0.295)*		
Marginal effects	*-0.127****	*-0.108****	*-0.098***	*0.080*		
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	712/284	1373/489	1323/541	1120/311	1037/99	686/70
Pseudo R-sq.: Tit/Non-	0.268/0.303	0.171/0.197	0.108/0.099	0.102/0.183	0.120/NA	0.159/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 adjusted for clustering on primary sampling units 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. 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 5 Ethnicity effects on schooling outcomes. The Baltic countries, 2001-2004

	[1][d]	[2][d]	[3][d]	[4][d]	[5] [e]
Dependent variable Y (dummy)	Study in secondary	Study in Tertiary		Complete Tertiary	
Sample: education	Basic	Basic or sec.	Sec.	Basic+	
Sample [a]: age	15-18	17-24	17-24	21-45 [b]	21-45 [b]
Sample % living with a parent[c]	92-96	70-89	61-87	20-35	100
	Estonia 2001 & 2004: mean Y by ethnicity				
Titular, 2001	0.883	0.259	0.440	0.177	
Minority, 2001	0.816	0.209	0.312	0.144	
Observed gap, 2001	0.066	0.049*	0.129***	0.033*	
Explained gap, 2001	-0.025	-0.029	0.033	-0.038	
Unexplained gap, 2001	0.092***	0.078**	0.096***	0.071***	
Titular, 2004	0.877	0.300	0.471	0.214	
Other, 2004	0.847	0.255	0.418	0.171	
Observed gap, 2004	0.030	0.045*	0.053	0.043*	
Explained gap, 2004	-0.035	-0.039	0.004	-0.026	
Unexplained gap, 2004	0.065**	0.084**	0.048	0.069***	
	Latvia, 2002-2004: Mean Y by ethnicity				
Titular	0.903	0.299	0.514	0.216	0.216
Minority	0.884	0.242	0.415	0.168	0.168
Observed gap	0.019	0.058***	0.099***	0.048***	0.048***
Explained gap	-0.003	-0.039	-0.056	-0.050	-0.038
Unexplained gap	0.022	0.096***	0.155***	0.098***	0.086***
	Lithuania, 2002-2003: mean Y by ethnicity				
Titular	0.831	0.294	0.502	0.268	0.268
Minority	0.792	0.242	0.398	0.216	0.216
Observed gap	0.039	0.052**	0.103***	0.052***	0.052***
Explained gap	0.102	-0.046	0.002	-0.088	-0.069
Unexplained gap	-0.063***	0.098***	0.100***	0.140***	0.121***

Notes:[a] Immigrants from abroad at age 18 or older are excluded.
[b] Tertiary students without completed tertiary education are excluded in [4], [5].
[c] By country and ethnicity (lower bounds refer to Estonia).
[d] Simple probit models in columns [1]-[4]. All models control also for age, gender, region, level of urbanization, parental education (for each parent, we distinguish four categories: higher, secondary, less than secondary, and missing), and observation year.
[e] Alternative estimates of model [4] using probit with sample selection into living with at least one parent. The instrument (dummy *Single*) is significant in selection equation at 0.001 level in all cases. The Estonian results omitted as H_0: $\rho = 0$ is not rejected ($p = 0.58$).
***, **, * indicate estimates 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.
Source: calculations based on LFS.

Table 6 Determinants of completed tertiary education by country and ethnicity.
Panel A: The Baltic countries, 1999.

Country	Estonia, 1999		Latvia, 1999		Lithuania, 1999	
Ethnicity	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	0.027**	0.030**	0.036**	0.043*	0.049***	0.050***
Parental education (vs. basic)						
Mother: secondary	0.088***	0.097***	0.125***	0.102***	0.093***	0.084***
Mother: higher	0.268***	0.264***	0.217***	0.393***	0.122***	0.159***
Father: secondary	0.079***	0.093**	0.028	0.068*	0.082**	0.089***
Father: higher	0.139***	0.072*	0.182***	0.102**	0.182***	0.136***
Mother: unknown	0.028	0.083	-0.061	-0.017	-0.027	-0.015
Father: unknown	-0.031	-0.106***	-0.096***	-0.011	-0.058*	-0.059**
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	53.2	53.5	48.5	55.4	49.1	49.5
# observations	2819	956	1615	853	2114	2394
Pseudo R-squared	0.140	0.127	0.155	0.158	0.168	0.152
Log pseudo-likelihood	-1097.0	-395.0	-593.4	-307.5	-765.0	-875.6

Notes: Population older than 21, 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 primary sampling units.

Source: Calculation based on NORBALT data

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***	0.081**	0.077**	0.079**	0.050	0.145***	0.110**
Minority	-0.128***	-0.128***	-0.115***	-0.120***			
Age	-0.093***	-0.084***	-0.085***	-0.084***	-0.080***	-0.091***	-0.084***
Parental education (vs. basic)							
Mother: secondary	0.103**	0.118**	0.115**	0.113**	0.054	0.190**	0.182**
Mother: higher	0.262***	0.289***	0.258***	0.258***	0.247***	0.275***	0.269***
Father: secondary	0.088**	0.075	0.064	0.065	0.109**	-0.046	-0.069
Father: higher	0.109*	0.133**	0.091	0.099	0.134*	-0.055	-0.084
Log household *per capita* income[b]			0.081***	0.088***	0.071*	0.090***	0.091***
Household economic situation better than 5 years ago				-0.062*			
Country (vs. Estonia)							
Latvia	0.027	0.021	0.030	0.028	0.133***	-0.136***	-0.155***
Lithuania	-0.069**	-0.059*	-0.026	-0.040	-0.032	0.019	0.045
Other controls	Dummies for missing parental education; Dummies for residence (by type of settlement) at age of 17						
Number of observations	1735	1226	1226	1226	848	378	434
Pseudo R-squared	0.230	0.229	0.243	0.245	0.279	0.264	NA
Log pseudo-likelihood	-924.0	-645.9	-634.9	-632.9	-413.1	-192.1	-189.0

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 types of families) 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 = 0.294) and for the titular population (Prob > chi2 = 0.634), but rejected for the non-titular population (rho = -0.783 ; Prob > chi2 = 0.060). Only the latter estimates are reported (column [7]).

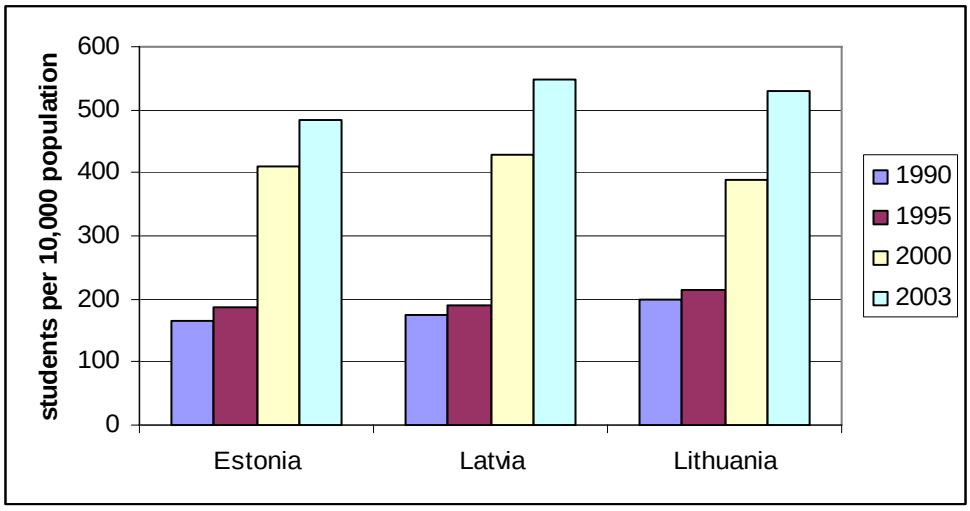
[a] As a robustness check, specification [1] is estimated on the sample which includes also respondents for whom it was not possible to construct the income variable.

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

***, **, * 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.

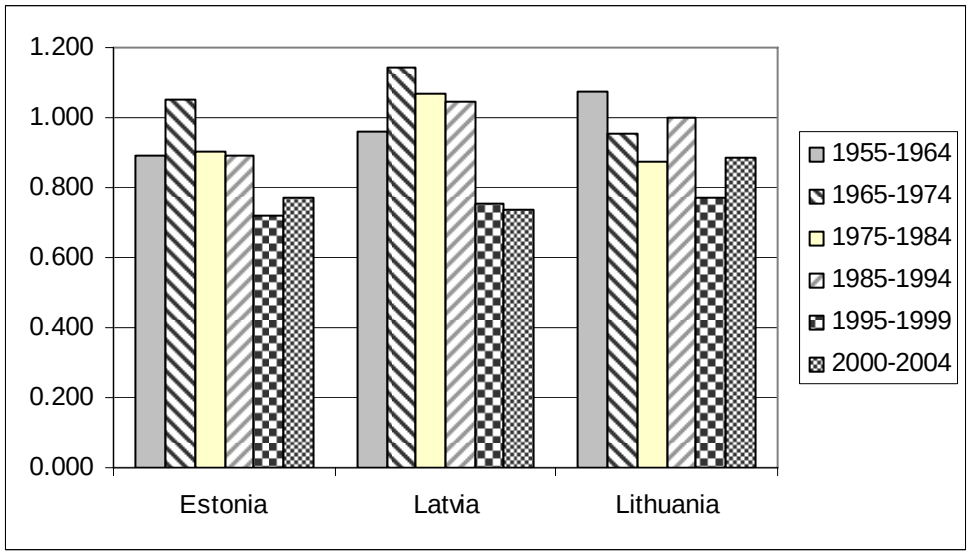
Source: Calculation based on NORBALT II survey data.

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



Source: National Statistical Offices and own calculation

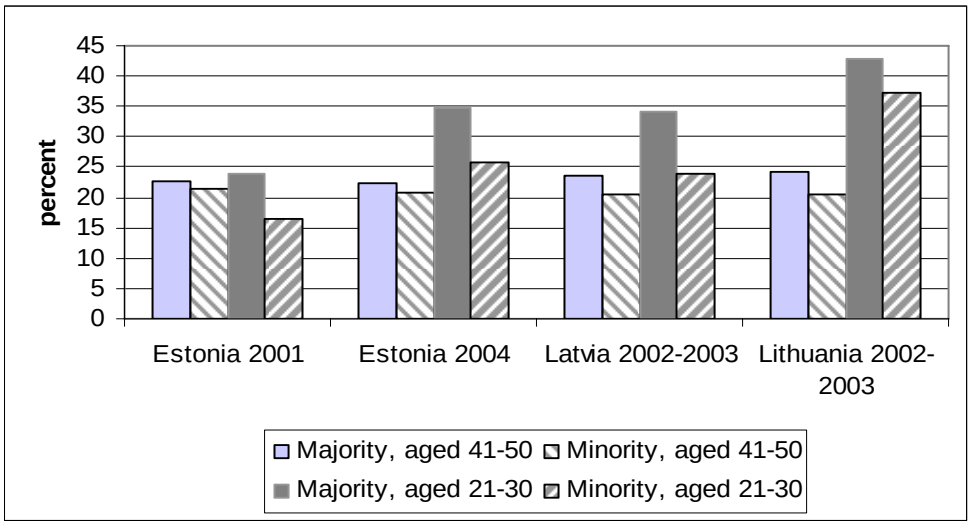
Figure 2 Ratio of tertiary graduation rates between minority and titular population. The Baltic countries, 1955-2004



Notes: 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.

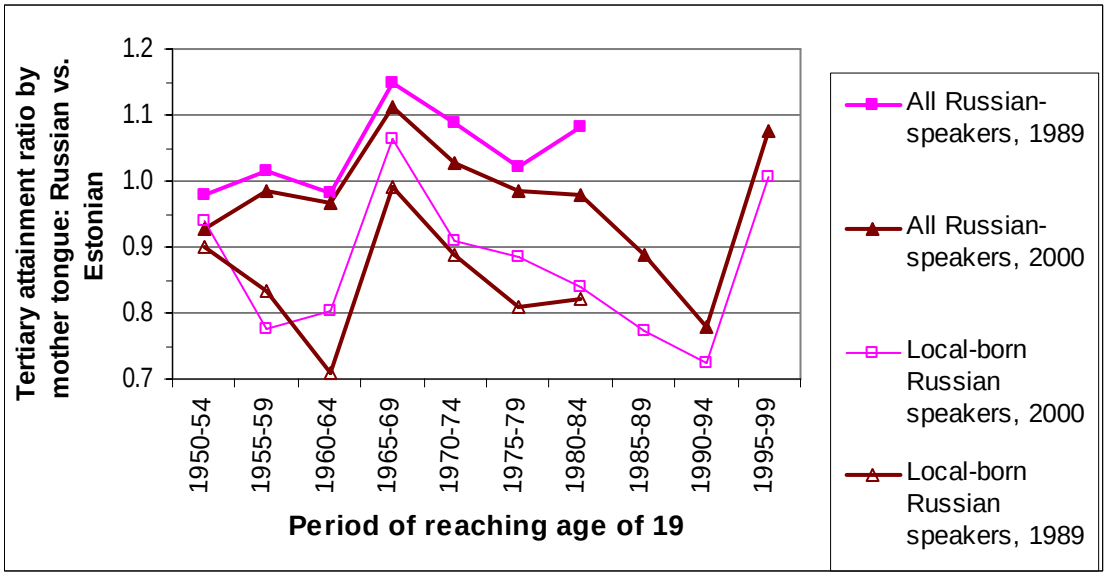
Source: Calculation based on Estonian LFS 1998-2001 and 2004, Latvian LFS 2002-2004, Lithuanian LFS 2002-2003.

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

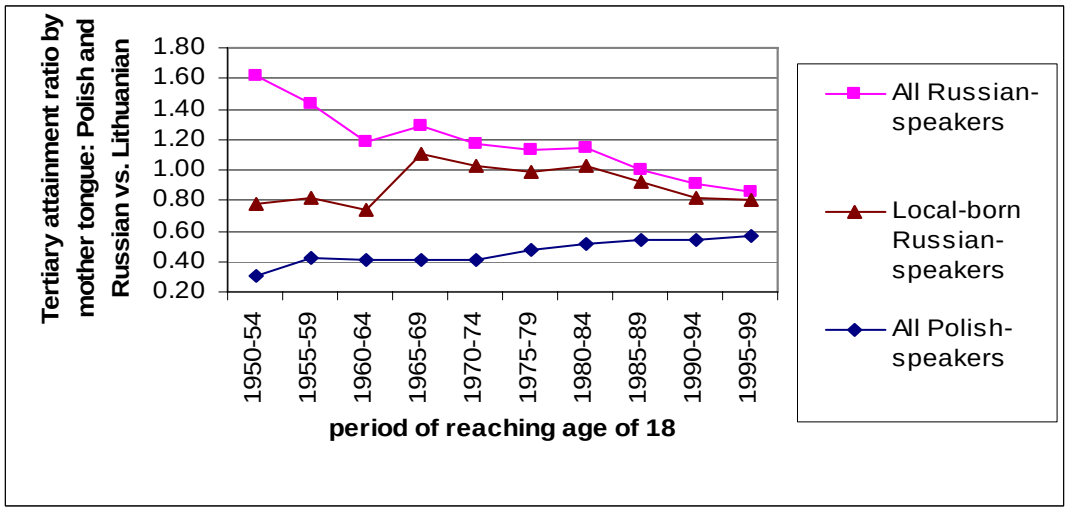


Source: Calculations based on LFS data

Figure 4 Tertiary attainment ratio: Language Minorities vs. Native Speakers.
a) Estonia, March 1989 and March 2000

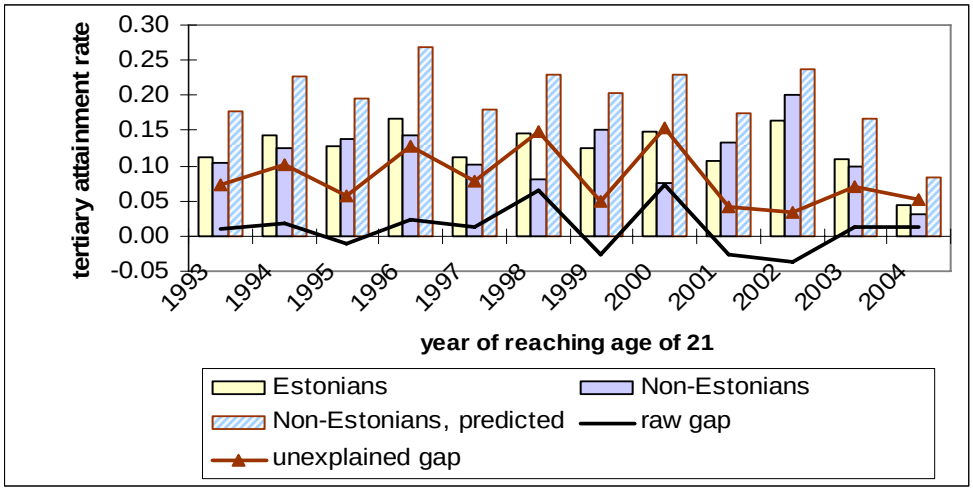


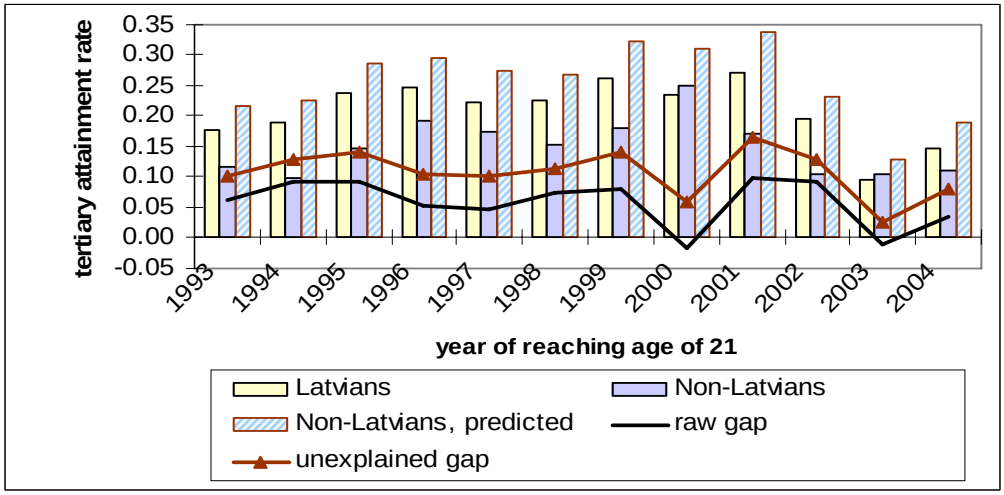
b) Lithuania, March 2001

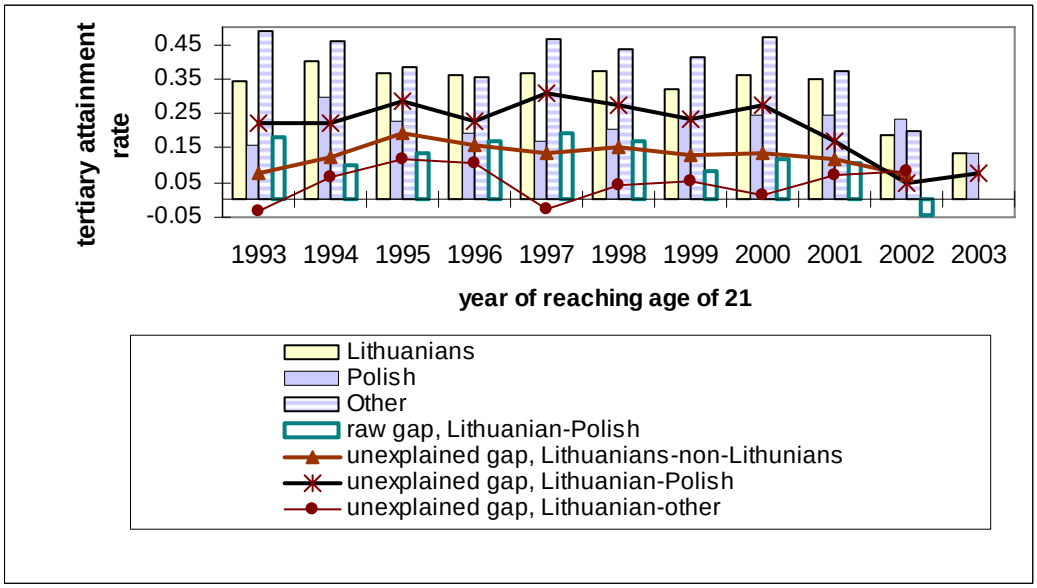


Notes: For Lithuania, the curve for local-born Polish-speakers is not shown, as it virtually coincides with the one for all Polish-speakers (vast majority of them are local-born). *Source*: Calculation with Census data.

Figure 5 Tertiary attainment rate during the transition, by ethnicity and cohort. Estonia (2001-2004), Latvia (2002-2004), Lithuania (2002-2003)







Notes: 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. In each country, *raw gap* is the difference between the observed rates for titular ethnicity and minorities. *Unexplained gap* is the difference between [averaged over each cohort] predicted and observed rates for minorities, where predictions are based on probit models estimated on the titular sample in each country. Controls include: gender, region, and rural dummies, observation year dummies, as well as birth year dummies. Predicted rates are shown only for Estonia and Latvia; for Lithuania, observed rates and gaps are shown separately for each of the two minorities (Polish and Russian-speaking). *Source*: Calculation based on LFS data.