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# FAMILY BACKGROUND AND SCHOOLING OUTCOMES BEFORE AND DURING THE TRANSITION: EVIDENCE FROM THE BALTIC COUNTRIES [*]


Mihails Hazans[♣]

University of Latvia and BICEPS, Riga, Latvia

Mailing address: M. Hazans, BICEPS, Alberta 13, LV 1010, Riga, LATVIA

fax +371 7039318

e-mail: mihazan@lanet.lv

Olga Rastrigina

CEU, Budapest, Hungary

Mailing address: Olga Rastrigina, CEU, Nador u. 9, 1051 Budapest, Hungary,

fax +361 327 3232

e-mail: C03RAO01@student.ceu.hu

Ija Trapeznikova

North-Western University, USA

Mailing address: Ija Trapeznikova,

Department of Economics

Northwestern University

2001 Sheridan Road

Evanston, Illinois 60208, US

Fax: +1 847 491-7001

i-trapeznikova@northwestern.edu



[*] The authors gratefully acknowledge support by a grant from the CERGE-EI Foundation under a program of the Global Development Network. NORBALT datasets were generously provided by the *Fafo* Institute for Applied Social Science in Oslo, Norway. Raul Eamets provided crucial help with Estonian LFS data. We thank Steven Rivkin, Randall Filer, Jeffrey Smith, Michael Spagat, Libor Dušek, Raul Eamets, Tiiu Paas, and Ott Toomet for very helpful comments on the previous version. Remaining mistakes are our own.



[♣] The correspondent author. I thank Michael Spagat whose keynote lectures at a conference in Riga (2001) generated my interest in the topic.

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## Abstract

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, but mother's education effect have been weakening.

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.

In Estonia and Latvia, ethnic gap in secondary enrollment reinforces inequality of human capital distribution between ethnicities. The unexplained ethnic gap in tertiary attainment has been declining in Lithuania (despite absence of Russian language higher education) but widening in Latvia.



**Key words:** Parental education; ethnic minorities**;** transition

JEL: J24, J15, P51

## 1. Introduction

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

Positive correlation between parental and children's educational attainment is an almost universal finding; see Card (1995) for a survey. It is, however, less well documented in transition context, when one can expect some adverse effects of restructuring on intergenerational correlations (see Fan et al, 1999; Spagat, 2002a, 2002b). Recent literature (see e. g. Black et al, 2003; Chevalier, 2004) has addressed the question whether the link between parental and children's education is causal, and the results so far support a positive answer, at least for natural parents. Theoretical models of education 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.

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, both explicitly and by 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).

In transition countries, one can also expect that higher parental education can help navigate through transition induced changes. This idea is consistent with the finding of Fleisher *et al* (2004) that both the speed of reforms and the degree of economic disequilibrium help to explain cross-country differences in the time paths of the returns to schooling.

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 which face credit constraints in child's adolescent years. The second argument stresses long-term effects and point out that parental income works very much like parental education as long as shaping children's cognitive ability and taste for education are concerned. Carneiro and Heckman (2002) show that after controlling for ability income effect is very weak. This provides support for the second explanation. 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.

Increasing (respectively, decreasing) 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 classes (see Appendix for a formal exposition). Understanding the nature, strength and dynamics of 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.

The transition from central planning has brought dramatic changes into the market for higher education. In Latvia, for example, number of state-financed places declined by roughly one third between 1989 and 1994 and remained stable

thereafter, while number of places financed by tuition fees increased more than 20 times between 1992 and 2002 and accounts now for 73 percent of all students (Figure 1).

[Figures1 and 2 about here]

Many programs admit virtually all applicants who are willing to pay. In this way, ability threshold has been to some extent substituted by income threshold (annual tuition fees in each of the three Baltic countries vary around 3 to 6 average net monthly wages). On average, admission/application ratio in Latvia has been above 60 percent since 1998[1]; it would be even higher if calculated with respect of number of applicants rather than applications.

In all three Baltic countries total number of students experienced a sharp increase in 1995-2003 (Figure 2)[2]. Several factors contributed to this increase. First, rising returns to education provided new strong participation incentives. Second, quantitative supply constraints were removed. Third, new fields of study emerged in the market. Fourth, the ability barrier has become lower for those willing to pay. Finally, study loans have been introduced in mid 1990s in Estonia and in late 1990s in Latvia and Lithuania.

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). 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[3]. After regaining independence, instruction in Russian has been gradually

[1] In Estonia the ratio was less than 40 percent in 1998-99, suggesting somewhat stronger competition.
[2] In the early 1990s the number of students decreased compared to late 1980s, at least in Latvia (see Figure 1).
[3] 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.

but almost completely replaced by instruction in titular languages, as long as state financed education is concerned. Phasing out state-financed higher education in Russian has begun in 1992 (students enrolled in Russian groups before could continue in Russian). By the year 2002 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 1 for details).

[Table 1 about here]

Almost all of them were paying for tuition. At the same time large numbers of minority students study in state languages (it is hard to tell how many of them are state financed, but this proportion is definitely not negligible). However, Figure 3 documents that in all three Baltic countries the ratio of gross tertiary enrollment rates between minority and majority population has dropped compared to pre-transition levels.

[Figure 3 about here]

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 have the family background effects on schooling outcomes evolved during the transition?*

The rest of the paper is organized as follows. Section 2 presents the background information on higher education in the Baltic countries in Soviet times and during the transition. Section 3 describes the data. Econometric models and estimation strategy are discussed in Section 4. Section 5 presents results related to emerging inequality between titular population and ethnic minorities in terms of tertiary attainment and enrollment. Section 6 tries to find out at which stages of the schooling ladder in each country the two language groups diverge. Section 7 looks

at the evolution of the ethnic gap in human capital. Section 8 discusses results on parental education effects in Soviet times and during the transition (in particular, the question whether there are differences between ethnicities in this respect). Section 9 presents evidence for strong income effects on participation in post-secondary education; ethnic effects, however, do not result from to the income differences between 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), Munich et al (2000), Campos and Jolliffe (2002), Fleisher et al (2004)). While higher education was free, decision to enter university still was a costly one. First, forgone earnings were substantial (only part of students received scholarships, and the typical scholarship was about 30% of young worker's salary). Second, psychic learning costs of course existed like elsewhere. Third, in many cases there were direct costs (preparation and/or bribing) associated with the entry.

How can one reconcile this with the standard human capital theory argument (go to university if present value of expected lifetime benefits exceeds costs)? One explanation comes from the theory of comparative advantage in labor market (Bjorklund and Moffitt, 1987; Carneiro and Heckman, 2002; Carneira 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 Soviet Union were more likely to encourage their children to enter university. Starting from 1970s, young males had an additional incentive to pursue full-time higher education, as many universities have established their own military departments and 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 stronger.

However, the decision to enter university did not mean one automatically gets enrolled. Number of places was fixed. Of course, degree of competition varied across fields of study.

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 (at least in theory) warranted. 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 relevant person in the university also worked; in this case ability did not matter.

Above all, some 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 required documents was an autobiography with full details on the applicant’s parents, so social background could, in principle, be used as a screening device. 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.

To sum up, there were two means of payment (direct or indirect) for a place in a university – ability (A) and money (M). Assume for a moment that all applicants have low, average or high ability (A=0; 1; 2) and likewise for willingness to pay (M=0; 1; 2). To get enrolled into a popular field of study, one had to have either A=2 (and whatever M) or A=1, M ≥ 1; limited number of places were available at a price M=2 even with A=0 if one had right connections (anecdotic evidence suggests in some of the 15 Soviet Republics it was virtually impossible to enter college without connections and/or bribe). For a less popular field (or for evening or distant studies) A=1 (or sometimes just M=1) was sufficient.

One can thus conclude that before the transition both parental education and income of a secondary school graduate were likely to be positively correlated with willingness to apply to a university and with the probability to be enrolled. But the first split of the cohort into more and less well educated happened several years earlier, after basic school.

As explained before, less educated parents were less likely to motivate their off-springs to pursue a university education; therefore completing secondary education was not necessarily a “must do” thing for children from such families, especially because they were also likely to have, on average, lower cognitive ability and taste for education. Hence they often either entered labor market immediately after basic school or chose vocational (rather than general) track of secondary education. Graduates of secondary vocational schools were much less likely to apply to universities than their counterparts with general secondary education.

Children from low-income families were, for obvious reasons, more likely to choose options associated with higher earnings in the short run. In other words, they were, other things equal, less likely to complete secondary education; when they did complete it, however, it was most likely vocational one.

After the transition, proportion of university seats available with poor or average ability and at least average willingness to pay ($A \leq 1$, $M \geq 1$) has increased (see Figure 1 and discussion in the Introduction). Hence ability (and therefore parental education) is likely to become less significant, while importance of parental income should increase. Moreover, once financial incentives for studies are in place and understood by the youth, parental encouragement could become less important, which also can weaken the impact of parental education.

Representatives of language minority were faced by another change: necessity to pass the exams and to study in a language different from their first language and from the language of instruction in the secondary school. This may have led, at least initially, to a lower tertiary enrollment, other things equal (and also to higher drop-out rate).

It is less clear how should this additional constraint affect the link with parental education. Given that higher education with Russian-language instruction has become available predominantly for fee, the outlined above mechanism of undercutting the intergenerational link was likely to affect minorities stronger than majority population in Estonia and Latvia (in Lithuania the share of students instructed in Russian is so small that both language groups are virtually in the same market). On top of this, well-educated parents were not necessarily good in state language, so their ability to help decreased. Moreover, large numbers of Russian speaking engineers working in manufacturing were hit by restructuring and could not serve as an example of success for their children. On the other hand, as noticed

before, children of well-educated parents are likely to have better cognitive ability and to study in better secondary schools, both factors enhancing their state language skills and increasing chances to be enrolled and complete tertiary education.

## 3. Data

This paper explores two (types of) data sources. The first is Living Condition 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, Living Condition surveys, and Working Condition surveys. In particular, it provides total household income, as well as subjective evaluation of household economic situation and its progress compared to 5 years ago. More than 4,000 households in Estonia, 3,000 households in Latvia and about 3,000 households in Lithuania are covered. While full information (including personal income, migration history, and education of parents who have died or live separately) is available only for one randomly selected individual (RSI) per household, the family structure is well described and allows to identify parental education for many additional respondents in two- or three-generation households. This allows analyzing schooling decisions made in the Soviet times.

The other sources are Labor Force Surveys (LFS): Estonian – 2001, Latvian – 2002, 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, total sample size in the LFS is much larger than in NORBALT surveys, so we have again sufficient number of observations for young respondents with non-missing parental education. An advantage of these datasets is that they give exact year when the respondent has completed the highest education level.

To sum up, our data are not as good as the best US and UK data used for analysis of schooling decisions, but much better than most available transition data.

## 4. Estimation strategy

The human capital accumulation process within educational system with mandatory basic education can be described by the following five-stage model (which ignores secondary school drop-outs for simplicity):

*Continue Education after Basic School (and Complete Secondary):*

$$y_0^* = \alpha' X + \varepsilon_{0i}, \quad y_0 = 1 \text{ if } y_0^* > 0, \; y_0 = 0 \text{ if } y_0^* \le 0 \qquad (1)$$

*Choose between General ($y_1$=1) and Vocational ($y_1$=0) Education:*

$$y_1^* = \beta' X + \varepsilon_1, \quad y_1 = 1 \text{ if } y_1^* > 0, \; y_1 = 0 \text{ if } y_1^* \le 0, \quad y_1 \text{ is observed if } y_0^* > 0 \qquad (2)$$

*Apply for Tertiary:*

$$y_2^* = \gamma' X + \varepsilon_2, \quad y_2 = 1 \text{ if } y_2^* > 0, \; y_2 = 0 \text{ if } y_2^* \le 0, \quad y_2 \text{ is observed if } y_0^* > 0 \qquad (3)$$

*Enroll in Tertiary:*

$$y_3^* = \phi' X + \varepsilon_3, \quad y_3 = 1 \text{ if } y_3^* > 0, \; y_3 = 0 \text{ if } y_3^* \le 0, \quad y_3 \text{ is observed if } y_2^* > 0 \qquad (4)$$

*Complete Tertiary:*

$$y_4^* = \psi' X + \varepsilon_4, \quad y_4 = 1 \text{ if } y_4^* > 0, \; y_4 = 0 \text{ if } y_4^* \le 0, \; y_4 \text{ is observed if } y_3^* > 0 \qquad (5)$$

$$\varepsilon_k \sim N(0; 1), \; \mathrm{Cov}(\varepsilon_k, \varepsilon_j) = \rho_{kj} \quad (0 \le k < j \le 4). \qquad (6)$$

Here $X$ is vector of relevant characteristics of the potential student, his family, and residential area. In this paper only normally distributed errors are considered, leading to a sequence of standard probit models with sample selection (see Greene, 2000, p. 857).

Table 2 presents expectations about signs of family background effects on schooling outcomes before and during transition, as well as directions of changes in

these effects. Expectations are based on discussion in the Introduction and refer to models without direct ability controls (our data do not include ability measures).

[Table 2 about here]

Estimates of the models for completing secondary education and for the choice between general and vocational secondary school are discussed in section 6. Our data do not allow modeling tertiary application and enrollment separately. The following models are estimated for tertiary enrollment:

(i) simple reduced form probit $y_3^* = \eta' X + \varepsilon_5$, $y_3 = 1$ if $y_3^* > 0$, $y_3 = 0$ if $y_3^* \leq 0$ on the sample of young respondents with completed basic education;

(ii) simple probit $y_3^* = \lambda' X + \varepsilon_6$, $y_3 = 1$ if $y^* > 0$, $y_3 = 0$ if $y_3^* \leq 0$ on the sample of young respondents with completed secondary education,

(iii) probit with sample selection like (4), using $y_0$ (completed secondary) as selection variable instead of $y_2$ (apply for tertiary).

Three similar (types of) models are estimated for completed tertiary education; in this case the dependent variable is $y_4$. The results with sample selection are not presented in the paper because hypothesis of independent equations was not rejected (see Appendix 2 for discussion)

Provided the expectations listed in Table 2 are correct, there is no ambiguity about the sign of parental education effect on enrollment in or completion of tertiary studies, although due to data limitations, we will not identify what part of this effect is related to schooling decision (application) and what – to enrollment conditional on application. There is also no ambiguity about expected direction of change in the parental education and income effects in the reduced form models (except the parental education effect for Russian-speakers).

Most our models will not control for income. This is because income information is only available at the time of the survey, while the relevant explanatory

variables would be parental income in child's adolescent years and immediately after secondary studies. In models without income control, estimated effects of parents' education on likelihood that children enroll in (or complete) higher education are measures of total (direct + indirect) impact.

In the Soviet Union, as argued in section 2, parental income could have a direct (not related to parents' education) effect on tertiary enrollment. This is also true at least for early transition years, when study loans did not exist and credit market in general was underdeveloped. Does it mean that our estimates of the effect of parents' education on children's educational attainment suffer from omitted variable bias? It is well know that in the Soviet Union income was almost not correlated with educational attainment, so the bias is zero if sample is restricted to those who has completed both basic and, if underwent, secondary studies in the Soviet Union. For those born after 1973, parental income at relevant time was positively correlated with parental education, so one can expect that effect of parental education is biased upward[4]. Hence, to support the hypothesis that transition has weakened the impact of parents' education on children's education it is enough to find that estimated effect is decreasing over time or even that its value during transition (in the models without income control) is not larger than it was in Soviet times.

For the baseline models (without income controls) only immigrants from abroad at age >12 are excluded. Dummy variables are created for respondents with unknown education of one of the parents (excluding these respondents would significantly reduce the sample size; see Appendix 2 for discussion of the potential sample selection bias due to exclusion or respondents with no information on parental education).

[4] 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.

Tertiary enrollment models discussed in Section 9 control also for household per capita income excluding respondent's income (if any); only respondents who are not the only or main contributors to their household income are included, so the samples become smaller.

Place of residence is of course an important determinant of both application and enrollment. 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). NORBALT data contain information on the last move between municipalities of one household member, RSI, who was randomly selected from the population register[5]. This allows constructing dummies by type of settlement (and/or region) for persons who did not move between 12 and 17, and amend them with dummies for particular types of migration (repeated moves are neglected).

In contrast with the models of completed higher education, the enrollment models use all household members aged 17-24 with secondary education rather than just RSI (otherwise the sample would be too small). When the respondent is a direct (rather than in-law) relative of RSI, we assume common migration. Remaining 15 percent of respondents (whose exact residence location at age 17 is unknown) are treated as a separate group (a dummy is included). Notice that estimates of the key parameters do not change much even when current residence is used. LFS data contain, at best, last year migration history, so in LFS based models we use current residence; of course respective coefficients are not interpretable in a standard way, but as long as the focus is on parental education and income, this is not a big problem.

[5] A substitute RSI (houselold 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.

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

Are the Baltic countries facing an emerging ethnic gap in the stock of human capital? Figure 4, using data of 2001-2003, provides a simple descriptive view by comparing 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 4 about here]

The patterns are clearly country-specific. In the older cohort, on average from 21 to 23.6 percent have tertiary education; the ethnic gap is relatively small (about 2 percentage points) in Estonia and Latvia but twice as big in Lithuania. In the younger cohort, the gap has increased dramatically in Estonia and Latvia (to 8 and 10 percentage points respectively); 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). Young ethnic Estonians have higher stock of human capital than the previous generation, while it goes the other way around for young non-Estonians; on average, the level is almost the same. In Latvia, both groups have improved compared to the previous generation, but progress was a lot stronger for ethnic Latvians. In Lithuania, both groups have made an equally impressive progress.

Tables 3 compares determinants of completed higher education across countries and ethnic groups using evidence from recent (2001-2003) Labor Force Surveys.

[Table 3 about here]

The samples consist of individuals older than 20 living together with at least one of the parents and have average age slightly above 30.[6] The descriptive statistics show that in Latvia and Lithuania members of ethnic minorities (in this age group) have only slightly less educated parents[7] than majority population, but for the current generation ethnic gap in educational attainment is much more pronounced. In Estonia minorities have more educated parents than ethnic Estonians; nevertheless, share of individuals with tertiary education is higher among Estonians.

Table 4, column (7) confirms that the ethnic gap in tertiary attainment in all three countries cannot be explained by parental education, gender, age and residence location (these results are based on models from Table 3). Here

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

where $E[\ |\ ]$ stands for conditional mean, $\Phi$ is the standard normal cumulative distribution, and $\beta$ is the vector of estimated probit coefficients, so that the first term on the right is just observed probability of completed tertiary education among titular population[8], while the second term is the expected probability of completed tertiary education among non-titular population if this probability would depend on characteristics in the same way as for titular population. In other words, explained difference is caused by different distributions of characteristics among the two groups. On the other hand,

*Unexplained difference* = *Observed difference* – *Explained difference*. (8)

Column 7 in Table 4 also reports (based on pooled sample estimates) that in Latvia and Lithuania members of ethnic minorities are significantly less likely to have higher education than their majority counterparts with similar parental education.

[Table 4 about here]

[6] Persons without tertiary education who are enrolled in tertiary studies are excluded (they are, however, accounted for in models for tertiary enrollment discussed later).
[7] We focus here on the share of parents with higher education.
[8] This would not be the case if predicted probabilities would be computed at means.

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

Table 4 summarizes ethnic and [some of] parental education effects from eight probit models intended to explain schooling decisions and outcomes at different levels, as outlined in section 4 above. Each model has been estimated three times (for titular population, minority population, and pooled sample) for each of the three countries, so there are 72 models altogether. As can be seen from age statistics reported in Table 4, results on participation in further education refer to late transition, while results on tertiary educational attainment refer predominantly 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 1990-2002.

In Estonia one finds a substantial difference between the ethnic groups in current (by 2001) propensity to enroll in secondary education (column (1)). Observed difference of more than 7 percentage points in enrollment rates among 15-18 year olds[9] is completely unexplained by parental education, place of residence, age, and gender; *ceteris paribus* difference of 12 percentage points is significant at 5% level. This gap is of recent origin, because the difference in secondary attainment among respondents aged 18+ is in favor of non-titular population, see column (2).

Among individuals who study in or have completed [upper] secondary education, conditional on parental education, gender and residence location, the difference between ethnic Estonians and non-Estonians in propensity to choose general rather than vocational track is not statistically significant; see columns (3) and (4) in Table 4. 68 percent of ethnic Estonians currently enrolled in secondary schooling and 66 percent of their non-Estonian counterparts have chosen general education. Proportion of general secondary school graduates among persons with completed secondary education is 64 and 59 percent for Estonians and non-

[9] Completed [at least] basic education and living together with at least one of the parents is assumed throughout this section.

Estonians respectively, but the difference is fully explained by observed characteristics. Thus choice between general and vocational schooling is not responsible for the existing ethnic gap in human capital, neither is it likely to contribute to expanding this gap in future.

Representatives of ethnic minorities in Estonia are significantly less likely to be enrolled in tertiary studies, compared to ethnic Estonians with similar family background and place of residence. Although currently net tertiary enrollment in age group 17-24, conditional on basic education, is the same for both ethnic groups, *ceteris paribus* enrollment gap is 8.5 percentage points (significant at 5% level), and unexplained difference is 5 percentage points; see column (5) in Table 4. More importantly, among secondary school graduates aged 17 to 24 tertiary enrollment of non-Estonians is lower by 3.3 percentage points, unexplained gap is 5.4 points, and *ceteris paribus* ethnic gap in enrollment 11.4 points, which is substantial given that overall rate is 47 percent; see column (6) in Table 4.

Finally, column (8) documents that among young secondary school graduates ethnic gap in tertiary attainment is not big (2.4 percentage points) but mostly unexplained, although *ceteris paribus* difference is not statistically significant.

The above analysis suggests that in Estonia there is no statistically significant ethnic gap neither in secondary nor in tertiary educational attainment, but both are likely to emerge, because non-Estonians (other things equal) have significantly lower propensity to continue education after basic school and to enroll in tertiary studies after secondary school.

Similar analysis (details omitted, see Table 4) suggests that in Latvia and Lithuania observed ethnic gap in tertiary *attainment* is very significant and is not explained by family background and residence location, so *ceteris paribus* gap is even larger. Observed gap in tertiary *enrollment* of secondary school graduates is

also quite big and significant in both countries, and only in Lithuania it is in part explained, so corresponding *ceteris paribus* gap here is less significant, while in Latvia it is very big and significant. As documented in the previous section, in Latvia this gap has increased during the transition.

In all three countries share of individuals with completed [at least] upper secondary education is somewhat higher among non-titular population; nonetheless, the difference is smaller than it should be according to parental education and other characteristics, so *ceteris paribus* gap ethnic gap in tertiary attainment is partly rooted in propensity to complete secondary school (see column (2) in Table 4; note that ethnicity effect in Latvia becomes larger and significant (-0.045**) when interactions of age and age squared with ethnicity are included).

## 7. Evolution of the ethnic gap

Figure 5 documents the different patterns of accumulation of the secondary education in by titular and non-titular population in Latvia and Lithuania. In both cases the propensity to complete secondary school falls significantly for the cohorts which graduated from the basic school during pre-transition or early transition (1988-1994 in Latvia, 1989-1997 in Lithuania; corresponding dummies are significant at 0.001 level). Other things equal, members of ethnic minorities in Latvia were less likely to complete secondary school than their Latvians counterparts starting from mid 1970s and at least until 1998, while in Lithuania the *ceteris paribus* gap was quite wide in mid 1960s but almost closed by late 1980s and has been eliminated during the transition (although observed gap still exists).

[Figure 5 about here]

In Latvia the ethnic gap in current (by 2002) propensity to continue education after basic school reinforces inequality in the distribution of human capital across

ethnic groups (the effect is almost significant), while in Lithuania it goes the other way around (Table 4, column (1)).

Figure 6 (based on probit models where ethnic dummy is interacted with age and, when significant, with age squared) suggests that the unexplained ethnic gap in tertiary attainment has been recently declining in Lithuania but widening in Latvia. For Estonia we have not found evidence for significant changes in *ceteris paribus* ethnic tertiary attainment gap during the transition.

[Figure 6 about here]

Another way to approach the question how the ethnic gap has evolved over time is to compare the results described so far, which are based on the samples with an average age just over 30, with estimates from a much "older" samples (mean age about 50 years) of the 1999 Living Conditions Survey. This age difference can be viewed as the one between two generations, hence, according to the Proposition (see Appendix 1), direction of the change of (the absolute value of) the estimated probit coefficients of the ethnic minority dummy indicates the direction of the evolution of the ethnic gap in human capital. Inspection of the Table 5 clearly supports the conclusion that the gap has increased in Latvia: the *minority* beta has changed from -0.120 (s.e. 0.075) to -0.363*** (s.e. 0.093). There is no evidence for increase in the unexplained human capital inequality between Estonians and non-Estonians. For Lithuania the coefficient has increased but the difference is not statistically significant. The increase might reflect weakness of the ethnic effect in Lithuania in 1960s and early 1970s and does not imply a conflict with the evidence from Figure 6, which refers to a later period.

Another observation (see Table 6) is that by 1999 stock of human capital[10] of titular and non-titular adult population in each of the three countries was similar,

[10] Measured by the proportion of population with completed tertiary education.

although minorities had more educated parents, especially in Estonia. So the ethnic gap in human capital observed in Table 3 has emerged in predominantly during the last 20-25 years.

[Tables 5, 6 about here]

To shed more light on the evolution of the ethnic effects as well as parental education effects, Table 7 presents results of estimation by cohort for the pooled three country sample based on the NORBALT survey (only main effects are included).

[Tables 7, 8 about here]

Again, consistently with Proposition in the Appendix, we to capture the evolution we focus on probit coefficients rather than marginal effects (the latter are found in Table 8 for models which include also significant interactions of the ethnic dummy with parental education). Significant negative effects of non-titular ethnicity on the probability to complete tertiary education have emerged in the 1970s and have increased dramatically in the transition period. Results reported in table 8 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 times and during the transition

Consistently with expectations outlined in Table 2, effect of parental education on 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), 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; father's higher education and mother's secondary education have smaller but substantial impact (which is somewhat less pronounced in Estonia).

Is the parental education effect equally strong for titular population and minorities? The only case, when effect of *mother's* higher education on children's educational attainment seems to be significantly weaker for minority population, refers to decisions made between 1980 and 2000 in Latvia (Table 3)[11]. However, results based on the 1999 Living Conditions Survey, NORBALT (Tables 6 and 8) suggest that in all three countries impact of father's higher education is somewhat weaker for non-titular population than for the titular ethnicity (this observation is reinforced by results on tertiary enrollment, see the next section). Perhaps this is reflection of the fact that in most cases Russian-speaking males with higher education were engineers or natural scientists, two groups which were strongly hit by the restructuring during the early transition. This effect seems to be of a transitory nature, because it is not found 3 years later in the samples dominated by young individuals (see Table 3; recall that LFS, in contrast with NORBALT, allow to find parent's education only when the respondent live together with this parent).

Moreover, the models for tertiary enrollment in 2001-2003 (Table 9) feature somewhat larger marginal effects of father's higher education for minorities in all three countries! A further research is needed to clarify this issue.

[Table 9 about here]

Table 8 suggests that impact of mother's education was very strong in Soviet times There is one notable exception: Stalin's deportations of wealthy families

[11] 85 percent of the respondents in Latvian sample used in Table 3 turned 18 in 1980 or later. When respondents who turned 18 before 1990 are excluded the contrast in marginal effects is even sharper: 0.410 for ethnic Latvians vs. 0.205 for others, but this in part is due to difference in probabilities of the positive outcome (0.241 vs. 0.154). In Lithuania the marginal effects of mother's education for minorities are also smaller but in the same proportion as is smaller probability of the positive outcome.

(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.

Tables 7 and 8 are consistent with the story outlined in section 2. First, probit coefficients in Table 7 imply that the positive effect of father's higher education, as well as the negative effect of father not living in the household, was strengthening in 1980s and 1990s[12]. Plausibly, this manifests increasing importance of family income (which became positively correlated with parental education in pre-transition and especially transition period). Second, coefficients of mother's higher education have stayed basically constant in 1970s, 1980s, and 1990s. Assuming that in the transition period these coefficients also partly capture family income effect, this is consistent with weakening of the effect of mother's higher education. Marginal effects displayed in Table 8 also support this idea, although the timing differs by ethnicity: in 1980s the estimated effect for the titular population is by 9 percentage points lower than in 1970s (despite unchanged probability of positive outcome); in 1990s, compared to 1980s, the estimated marginal effect falls from 39 to 16 percentage points for non-titular population, while observed probability only declines by 6 percentage points.

## 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 titular population?

[12] 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 50 and 30 years respectively, see Table 5.

(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 10 about here]

Table 10 presents the results based on 1999 Living Conditions Survey. The sample consists of respondents who are younger than 25 with educational attainment ISCED 3A: comprehensive secondary school, or general secondary combined with vocational education, or postsecondary vocational based on basic school. 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 have enough observations, Estonian, Latvian and Lithuanian samples are pooled together. Income is converted to euros using the nominal exchange rates in October 1999.[13] The dependent variable is 1 if the respondent „is currently studying," which may refer either to higher education or to non-tertiary postsecondary vocational studies.

First column present results without income control 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 (recall that the data contain total family income and income of one randomly selected household

[13] 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.

member). Remaining specifications include the income variable; column four includes also dummy for the households which reported substantial improvement in their economic situation compared to 5 years ago; column five presents two-stage estimates (see Maddala, 1983, sections 5.7 and 8.8) with income instrumented by number of earners in the household, log household size, education and employment status of the main earner, and his/her demographic characteristics. The last two columns show (non-instrumented) estimates separately for titular and minority population.

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 increases probability of participation in further education by 6 percentage points according to non-istrumented estimates, by 10 percentage points according to the two step estimates, and by 7 percentage points according to a two-step estimate (not shown here) with out-of-sample prediction of income (note that average enrollment in the sample is 56.6 percent).

Omitting the income variable almost does not change the estimates of the effect of mother's education but increases size and significance of the coefficient of father's higher education. According to non-instrumented estimates, the income dependence is more pronounced among non-titular population, although the difference in coefficients is not statistically significant. Remarkably, father's education effect on postsecondary enrollment disappears completely in the non-titular sub-sample once family income is controlled for (see column (7) in Table 10).

Other things (including income) equal, young people are significantly less likely to participate in postsecondary studies if economic situation of their household was substantially worse 5 years ago (see column (4) in table 10); the marginal effect is substantial: 6 percentage points. One explanation is 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 poor counterparts.

## 10. Conclusion

This paper has documented rapid changes which took place in the process of accumulation of the human capital in the three Baltic countries since the fall of communism. After 12 years of transition, propensity to continue education after basic school still has not fully recovered, although 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 preliminary evidence).

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, and for Latvia and Lithuania also the gap in propensity to complete higher education, remains significant after controlling for parental education and (as long as tertiary enrollment is concerned) parental income. Both the language issue and (especially in Estonia) lower returns to schooling might be among potential reasons.

Remarkably, however, the least troubleshooting 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, despite the fact that minorities had relatively lower stock of parental human capital.

What are the likely reasons of the Lithuanian phenomenon? One which comes into the mind first is that minorities are better integrated in Lithuania than in the other two countries (according to the Population Census 2000-2001, 99 percent of population in Lithuania held Lithuanian citizenship, while this indicator was 80 percent in Estonia and 74.4 percent in Latvia), and that young non-Lithuanians have better state language skills that their counterparts in Estonia and Latvia. This issue requires a further research. One can 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 in Soviet times, have done more "catching up" than others and is now ahead of other minorities as long as tertiary enrollment is concerned. However, there is no significant difference in terms of secondary enrollment of the 15-18 year olds, in terms of propensity to complete higher education for 21-31 year olds, and in terms of the trend of this propensity over the transition period (these results are available on request), so the Polish factor cannot be the major explanation.

The unexplained ethnic gap in human capital is most pronounced and increasing in Latvia. In Estonia and (to a lesser extent) in Latvia, ethnic gap in secondary enrollment threatens to reinforce inequality in the distribution of human capital across ethnic groups. By contrast, choice between general and vocational secondary education does not contribute to the ethnic gap.

Parental (especially mother's) 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. Some evidence is found for weakening of mother's higher education effect during the transition. 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 1980s and 1990s[14]. 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. Ethnic composition of population and language of instruction in higher education establishments. Estonia, Latvia, and Lithuiania, 1989-2002.**

| | Estonia | | | Latvia | | | Lithuiania | | |
|---|---|---|---|---|---|---|---|---|---|
| | Minority population percent of total | Percent of students instructed in Russian | Percent of students instructed in English | Minority population, percent of total | Percent of students instructed in Russian | Percent of students instructed in English | Minority population, percent of total | Percent of students instructed in Russian | Percent of students instructed in 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 | n.a. |

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

**Table 2. Hypothetical effects of family background on schooling outcomes**

| | (1) Continue after Basic (and Complete Secondary) | (2) Choose Secondary General | (3) Apply for Tertiary | (4) Enroll in Tertiary | (5) Complete Tertiary |
|---|---|---|---|---|---|
| | **Parental education effects** | | | | |
| | Socialist era | | | | |
| Language majority | + | + | + | + | + |
| Russian-speakers | + | + | + | + | + |
| | Transition (signs and change vs. socialist era) | | | | |
| Language majority | +, ↓ | +, ↓ | +, ↓ | +, ↓ | +, ↓ |
| Russian-speakers | +, ↓ | +, ↓ | +, ↓? | +, ↓? | +, ↓ |
| | **Parental income effects** | | | | |
| | Socialist era | | | | |
| Language majority | + | + | + | + | + |
| Russian-speakers | + | + | + | + | + |
| | Transition (signs and change vs. socialist era) | | | | |
| Language majority | +, ↑ | +, ↑ | +, ↑ | +, ↑ | +,↑ |
| Russian-speakers | +, ↑ | +, ↑ | +,↑[a] | +,↑[a] | +,↑ |

Notes: [a] In Estonia and Latvia we expect the increase of income effect for the Russian-speakers to be stronger than for the majority population (see Section 2 for discussion).

**Table 3. Determinants of completed higher education by country and ethnicity. The Baltic countries, 2001-2003.**

| **Country** | Estonia, 2001 | | Latvia, 2002 | | Lithuania, 2002-2003 | |
|---|---|---|---|---|---|---|
| **Ethnicity** | Titular | Other | Titular | Other | Titular | Other |
| | | | **Educational attainment (means)** | | | |
| Mother: secondary | 0.445 | 0.450 | 0.504 | 0.545 | 0.450 | 0.439 |
| Mother: higher | 0.147 | 0.180 | 0.149 | 0.135 | 0.119 | 0.101 |
| Father: secondary | 0.215 | 0.265 | 0.276 | 0.272 | 0.274 | 0.253 |
| Father: higher | 0.068 | 0.072 | 0.090 | 0.074 | 0.084 | 0.071 |
| Mother: unknown | 0.082 | 0.061 | 0.051 | 0.045 | 0.071 | 0.081 |
| Father: unknown | 0.481 | 0.511 | 0.475 | 0.504 | 0.438 | 0.468 |
| **Respondent: higher** | 0.154 | 0.145 | 0.227 | 0.170 | 0.278 | 0.209 |
| | | | **Marginal effects (probit)[a]** | | | |
| Female | 0.094*** | 0.012 | 0.193*** | 0.101*** | 0.172*** | 0.128*** |
| Age | 0.004* | 0.006* | 0.003** | 0.004** | 0.002* | 0.000 |
| **Parental education (vs. basic)** | | | | | | |
| Mother: secondary | 0.060* | 0.054 | 0.109*** | 0.074** | 0.131*** | 0.097*** |
| Mother: higher | 0.326*** | 0.352*** | 0.359** | 0.174*** | 0.350*** | 0.273*** |
| Father: secondary | -0.030 | 0.045 | 0.123** | 0.140*** | 0.087*** | 0.032 |
| Father: higher | 0.036 | 0.133 | 0.200*** | 0.227*** | 0.227*** | 0.245*** |
| **Other controls** | Dummies for missing parental education, Dummies by current residence | | | | | |
| Mean age of the sample | 30.1 | 30.2 | 30.6 | 31.3 | 32.2 | 32.8 |
| Number of observations [b] | 956 | 382 | 1463 | 954 | 5881 | 1406 |
| Pseudo R-squared | 0.192 | 0.277 | 0.178 | 0.127 | 0.173 | 0.178 |
| Log pseudo-likelihood | -332.3 | -114.1 | -643.4 | -379.0 | -2875.6 | -593.0 |

*Notes:* Population older than 20 years with completed basic education living together with at least one of the parents (students without completed higher education excluded).

[a] 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. ***, **, * indicate that underlying coefficients are significantly different from zero at 0.01, 0.05, 0.10 level respectively, based on robust standard errors adjusted on clustering within household.

[b] With few exceptions, each respondent appears in the Estonian and Latvian sample twice (in different waves of the LFS), so number of unique respondents is two times smaller than reported. For Lithuania, there are only 10 to 15 percent of repeated observations.

*Source:* Calculation based on LFS data (Estonia: Q1-Q4; Latvia: Q1-Q4; Lithuania Q2 and Q4).

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

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Dependent variable Y (dummy) | Study in secondary | Complete Secondary | Choose Secondary General | | Study in Tertiary | | Complete Tertiary | Complete Tertiary |
| Sample: education | Basic | Basic+ | Basic, study in sec. | Sec. | Basic or sec. | Sec. | Basic+ | Secon-dary+ |
| Sample: age | 15-18 | 18+ | | | 17-24 | | 21+ | 21+ |
| Sample: living | | | Together with at least one parent | | | | | |
| Mean age, EE | 16.6 | 26.0 | 16.9 | 26.2 | 19.8 | 20.4 | 30.2 | 31.0 |
| Mean age, LV | 16.8 | 27.2 | 17.1 | 28.0 | 19.9 | 20.7 | 30.9 | 31.5 |
| Mean age, LT | 17.2 | 28.4 | 17.6 | 29.1 | 19.8 | 20.8 | 32.3 | 32.6 |
| **Estonia, 2001: mean Y by ethnicity** | | | | | | | | |
| Total | 0.878 | 0.755 | 0.674 | 0.621 | 0.268 | 0.469 | 0.152 | 0.193 |
| Titular | 0.899 | 0.745 | 0.680 | 0.637 | 0.269 | 0.480 | 0.155 | 0.202 |
| Other | 0.825 | 0.777 | 0.659 | 0.591 | 0.266 | 0.447 | 0.145 | 0.178 |
| Observed diff. | 0.074** | -0.032 | 0.021 | 0.046 | 0.003 | 0.033 | 0.010 | 0.024 |
| Explained diff. | -0.028 | -0.067 | -0.157 | 0.037 | -0.050 | -0.021 | -0.002 | 0.008 |
| Unexplained diff. | 0.102 | 0.035 | 0.179 | 0.009 | 0.053 | 0.054 | 0.012 | 0.017 |
| **Estonia, 2001: Marginal effects (probit, pooled sample)** | | | | | | | | |
| Ethnic minority | -0.121** | -0.056 | -0.107 | 0.005 | -0.085** | -0.114* | -0.044 | -0.057 |
| Mother: higher ed | 0.278*** | 0.248*** | 0.151* | 0.265*** | 0.268*** | 0.347*** | 0.331*** | 0.346*** |
| Father: higher ed | 0.052 | 0.112 | 0.283*** | 0.043 | 0.200*** | 0.201* | 0.098 | 0.109 |
| **Latvia, 2002: Mean Y by ethnicity** | | | | | | | | |
| Total | 0.878 | 0.767 | 0.719 | 0.449 | 0.284 | 0.483 | 0.203 | 0.255 |
| Titular | 0.889 | 0.759 | 0.704 | 0.453 | 0.293 | 0.513 | 0.227 | 0.285 |
| Other | 0.857 | 0.778 | 0.748 | 0.444 | 0.269 | 0.437 | 0.170 | 0.213 |
| Observed diff. | 0.032 | -0.019 | -0.044 | 0.009 | 0.024 | 0.076** | 0.057** | 0.072*** |
| Explained diff. | -0.008 | -0.024 | -0.023 | -0.024 | -0.040 | -0.058 | -0.029 | 0.034 |
| Unexplained diff. | 0.039 | 0.005 | -0.022 | 0.033 | 0.064 | 0.134 | 0.086 | 0.106 |
| **Latvia, 2002: Marginal effects (probit, pooled sample)** | | | | | | | | |
| Ethnic minority | -0.041 | -0.028 | 0.014 | -0.016 | -0.056** | -0.123*** | -0.085*** | -0.099*** |
| Mother: higher ed | 0.153*** | 0.271*** | 0.088 | -0.019 | 0.298*** | 0.342*** | 0.294*** | 0.294*** |
| Father: higher ed | 0.017 | 0.108*** | 0.023 | 0.078 | 0.234*** | 0.295*** | 0.219*** | 0.248*** |
| **Lithuania, 2002-2003: mean Y by ethnicity** | | | | | | | | |
| Total | 0.832 | 0.793 | 0.833 | 0.548 | 0.281 | 0.498 | 0.265 | 0.309 |
| Titular | 0.839 | 0.789 | 0.824 | 0.555 | 0.286 | 0.514 | 0.278 | 0.324 |
| Other | 0.791 | 0.812 | 0.883 | 0.514 | 0.247 | 0.414 | 0.209 | 0.243 |
| Observed diff. | 0.048 | -0.024* | -0.059** | 0.041* | 0.039* | 0.100*** | 0.069*** | 0.081*** |
| Explained diff. | 0.110 | -0.046 | -0.050 | 0.044 | 0.003 | 0.043 | -0.060 | -0.057 |
| Unexplained diff. | -0.062 | 0.022 | -0.009 | -0.002 | 0.036 | 0.057 | 0.128 | 0.138 |
| **Lithuania, 2002-2003: Marginal effects (probit, pooled sample)** | | | | | | | | |
| Ethnic minority | 0.047* | -0.031** | 0.021 | 0.001 | -0.036* | -0.063* | -0.107*** | -0.118*** |
| Mother: higher ed | 0.061 | 0.191*** | 0.115*** | 0.160*** | 0.285*** | 0.349*** | 0.333*** | 0.326*** |
| Father: higher ed | 0.147*** | 0.100*** | 0.168*** | 0.175*** | 0.216*** | 0.302*** | 0.237*** | 0.245*** |

*Source*: calculations based on LFS data.

**Table 5. Determinants of completed higher education by country. The Baltic countries, 1999 and 2001-2003.**

| Country | Estonia | | Latvia | | Lithuania | |
|---|---|---|---|---|---|---|
| **Data** | 1999[a] | 2001[b] | 1999[a] | 2002[b] | 1999[a] | 2002-2003[b] |
| | | | **Means** | | | |
| **Age** | 47.2 | 30.2 | 47.8 | 30.9 | 47 | 32.3 |
| **Educational attainment** | | | | | | |
| Mother: secondary | 0.300 | 0.447 | 0.262 | 0.521 | 0.168 | 0.451 |
| Mother: higher | 0.068 | 0.159 | 0.057 | 0.143 | 0.058 | 0.115 |
| Father: secondary | 0.257 | 0.233 | 0.240 | 0.274 | 0.150 | 0.274 |
| Father: higher | 0.085 | 0.069 | 0.073 | 0.083 | 0.063 | 0.082 |
| Mother: unknown | 0.040 | 0.075 | 0.039 | 0.049 | 0.058 | 0.073 |
| Father: unknown | 0.091 | 0.492 | 0.098 | 0.486 | 0.093 | 0.441 |
| *Respondent:* higher | 0.171 | 0.151 | 0.156 | 0.203 | 0.155 | 0.265 |
| | | | **Probit coefficients** [c] | | | |
| Female | 0.131** | 0.333** | 0.188** | 0.623*** | 0.248*** | 0.584*** |
| | (0.056) | (0.155) | (0.074) | (0.083) | (0.073) | (0.047) |
| Minority | -0.204*** | -0.233 | -0.120 | -0.363*** | -0.330*** | -0.429*** |
| | (0.067) | (0.189) | (0.075) | (0.093) | (0.124) | (0.073) |
| **Parental education (vs. basic)** | | | | | | |
| Mother: secondary | 0.424*** | 0.395** | 0.535*** | 0.445*** | 0.399*** | 0.467*** |
| | (0.082) | (0.187) | (0.099) | (0.114) | (0.122) | (0.066) |
| Mother: higher | 0.991*** | 1.395*** | 1.034*** | 1.100*** | 0.655*** | 1.074*** |
| | (0.121) | (0.238) | (0.157) | (0.140) | (0.181) | (0.092) |
| Father: secondary | 0.373*** | 0.088 | 0.213** | 0.593*** | 0.397*** | 0.266*** |
| | (0.081) | (0.214) | (0.098) | (0.163) | (0.121) | (0.071) |
| Father: higher | 0.465*** | 0.466 | 0.598*** | 0.882** | 0.572*** | 0.765*** |
| | (0.108) | (0.359) | (0.141) | (0.192) | (0.168) | (0.107) |
| **Other controls** | Age, Age-squared [d], Residence[e], Dummies for missing parental education | | | | | |
| Number of observations | 3775 | 1338 | 2468 | 2417 | 2394 | 7287 |
| Pseudo R-squared | 0.129 | 0.200 | 0.144 | 0.152 | 0.152 | 0.172 |
| Log pseudo-likelihood | -1506.4 | -453.9 | -913.1 | -1035.1 | -875.5 | -3487.6 |

*Notes:* Population older than 20 years (students without higher education excluded). [a] NORBALT Living Conditions Survey. [b] LFS. [c] ***, **, * indicate that coefficients are significantly different from zero at 0.01, 0.05, 0.10 level respectively, based on robust standard errors adjusted on clustering within household. [d] Included only when significant (eventually, in 1999 samples). [e] See Tables 3, 6 for details.

**Table 6. Determinants of completed higher education by country and ethnicity. The Baltic countries, 1999.**

| **Country** | Estonia | | Latvia | | Lithuania | |
|---|---|---|---|---|---|---|
| **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 | 0.031** | 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** |
| **Residence at age of 17[b] (vs. small towns)** | | | | | | |
| Capital city | 0.060** | 0.015 | 0.067** | 0.045 | 0.192*** | 0.123*** |
| City (50,000+) | 0.078*** | -0.032 | 0.052* | -0.022 | 0.048** | 0.054** |
| Rural | -0.031** | -0.079* | 0.016 | -0.062** | -0.054*** | -0.057*** |
| **Migration at age 12 to 17 [c]** | | | | | | |
| To capital city or other city with population > 50,000 | -0.061* | 0.069* | | | 0.147*** | 0.151*** |
| **Other controls** | | | Age***, Age-squared*** | | | |
| 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 |

*Notes:* Population older than 20 years (students without higher education excluded).

[a] See Notes for Table 3.

[b] Dummies indicate that respondent either continuously lives in respective type of settlement at least since the age of 12, or has moved *from* this location at age above 17.

[c] Only significant effects are shown.

[d] The Lithuanian sub-sample does not have enough respondents of non-titular ethnicity.

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

*Source:* Calculation based on NORBALT survey data.

**Table 7. Determinants of completed higher 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 |
| Observed Probability | 0.149 | 0.196 | 0.209 | 0.159 | 0.113 | 0.075 |
| | | | **Probit coefficients** | | | |
| Female | 0.360** | 0.403*** | 0.107 | 0.241* | 0.196* | 0.006 |
| (robust s.e.) | (0.179) | (0.093) | (0.104) | (0.125) | (0.112) | (0.200) |
| Non-titular ethnicity | -0.660*** | -0.299*** | -0.246*** | -0.079 | -0.282 | 0.009 |
| (robust s.e.) | (0.126) | (0.101) | (0.087) | (0.102) | (0.215) | (0.323) |
| **Parental education (vs. basic or less)** | | | | | | |
| Mother: secondary | 0.513** | 0.379*** | 0.518*** | 0.579*** | 0.568** | 0.515 |
| Mother: higher | 0.878*** | 0.908*** | 0.815*** | 0.534** | 0.961* | 1.210* |
| Father: secondary | 0.423* | 0.240** | 0.191 | 0.419*** | 0.364 | 0.425 |
| Father: higher | 0.827*** | 0.537*** | 0.295 | 0.381 | 0.438 | 0.552 |
| Mother: unknown | -0.084 | -0.316 | -0.084 | -0.364* | 0.635* | n.a. |
| Father: unknown | -0.873** | -0.698*** | -0.210* | -0.037 | -0.717** | -0.534 |
| **Country (vs. Estonia)** | | | | | | |
| Latvia | 0.096 | 0.054 | -0.092 | -0.138 | -0.203* | 0.065 |
| Lithuania | 0.063 | 0.107 | 0.020 | 0.037 | -0.156 | -0.050 |
| **Residence at age of 17 (vs. small towns)[b]** | | | | | | |
| Capital city | 0.860*** | 0.198 | 0.294* | 0.383*** | 0.288 | -0.211 |
| City (50,000+) | 0.255 | 0.183 | 0.287* | 0.198 | 0.131 | 0.333 |
| Rural | 0.150 | -0.292** | -0.137 | -0.077 | -0.316** | -0.339 |
| **Other controls** | Age; Dummies for types of migration between 12 and 17 | | | | | |
| Number of observations | 996 | 1863 | 1864 | 1431 | 1136 | 756 |
| Pseudo R-squared | 0.246 | 0.162 | 0.097 | 0.114 | 0.119 | 0.130 |
| Log pseudo-likelihood | -315.6 | -773.8 | -862.6 | -555.4 | -353.5 | -175.3 |

*Notes:* Population older than 20 years (students without higher education excluded).
[a] Only persons born in the country of residence included.
[b] Dummies indicate that respondent either continously lives in respective type of settlement at least since the age of 12, or has moved *from* this location at age above 17.
***, **, * indicate estimates significantly different from zero at 0.01, 0.05, 0.10 level respectively.
*Source:* Calculation based on NORBALT II survey data.

**Table 8. Determinants of completed higher 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 |
| Observed Probability | 0.149 | 0.196 | 0.209 | 0.159 | 0.113 | 0.075 |
| | | | **Marginal effects** | | | |
| Female | 0.063** | 0.093*** | 0.028 | 0.051* | 0.032* | 0.001 |
| Non-titular ethnicity | -0.083*** | -0.063*** | -0.055*** | -0.033* | -0.042 | 0.001 |
| **Parental education (vs. basic or less)** | | | | | | |
| Mother: secondary | 0.082** | 0.091*** | 0.152*** | 0.155*** | 0.122** | 0.089 |
| Mother: higher | 0.161*** | 0.201*** | 0.293*** | 0.004 | 0.244* | 0.287* |
| (Mother: higher)×Non-titular[b] | | 0.193** | | 0.364** | | |
| Father: secondary | 0.071* | 0.058** | 0.050 | 0.111*** | 0.077 | 0.066 |
| Father: higher | 0.220*** | 0.209*** | 0.088 | 0.079 | 0.097 | 0.094 |
| (Father: higher)×Non-titular[b] | -0.111* | -0.146* | | | | |
| Mother: unknown | 0.000 | -0.054 | -0.019 | -0.059* | 0.141* | n.a. |
| Father: unknown | -0.074** | -0.112*** | -0.050* | -0.009 | -0.082** | -0.045 |
| **Country (vs. Estonia)** | | | | | | |
| Latvia | 0.016 | 0.012 | -0.026 | -0.026 | -0.045* | 0.008 |
| Lithuania | 0.01 | 0.026 | 0.005 | 0.009 | -0.035 | -0.006 |
| **Residence at age of 17 (vs. small towns)[c]** | | | | | | |
| Capital city | 0.173*** | 0.056 | 0.081* | 0.102*** | 0.066 | -0.027 |
| City (50,000+) | 0.040 | 0.050 | 0.078* | 0.051 | 0.028 | 0.059 |
| Rural | 0.023 | -0.065** | -0.032 | -0.014 | -0.053** | -0.039 |
| **Other controls** | Age; Dummies for types of migration between 12 and 17 | | | | | |
| Number of observations | 996 | 1863 | 1864 | 1431 | 1135 | 756 |
| Pseudo R-squared | 0.250 | 0.165 | 0.105 | 0.120 | 0.119 | 0.146 |
| Log pseudo-likelihood | -313.9 | -770.3 | -862.6 | -551.7 | -353.5 | -175.3 |

*Notes:* Population older than 20 years (students without higher education excluded).
[a] Only persons born in the country of residence included. [b] Interactions included only when significant.
[c] Dummies indicate that respondent either continously lives in respective type of settlement at least since the age of 12, or has moved *from* this location at age above 17.
***, **, * indicate estimates significantly different from zero at 0.01, 0.05, 0.10 level respectively.
*Source:* Calculation based on NORBALT II survey data.

**Table 9. Determinants of participation in tertiary education by ethnicity[a]. The Baltic countries, 2001-2003.**

| **Country** | Estonia, 2001 | | Latvia, 2002 | | Lithuania, 2002-2003 | |
|---|---|---|---|---|---|---|
| **Ethnicity** | Titular | Other | Titular | Other | Titular | Other |
| | | | **Means** | | | |
| **Parental education** | | | | | | |
| Mother: secondary | 0.611 | 0.678 | 0.644 | 0.678 | 0.678 | 0.717 |
| Mother: higher | 0.206 | 0.209 | 0.217 | 0.194 | 0.214 | 0.146 |
| Father: secondary | 0.352 | 0.402 | 0.410 | 0.486 | 0.510 | 0.517 |
| Father: higher | 0.123 | 0.068 | 0.141 | 0.134 | 0.144 | 0.134 |
| Mother: unknown | 0.044 | 0.032 | 0.026 | 0.034 | 0.028 | 0.035 |
| Father: unknown | 0.350 | 0.439 | 0.326 | 0.292 | 0.274 | 0.269 |
| | **Average probability to participate in further education** | | | | | |
| Observed | 0.269 | 0.266 | 0.293 | 0.269 | 0.286 | 0.247 |
| Observed difference (Titular – Other) | 0.003 | | 0.024 | | 0.039 | |
| Explained difference (Titular – Other) | -0.050 | | -0.040 | | 0.003 | |
| Unexplained difference (Titular – Other) | 0.053 | | 0.064 | | 0.036 | |
| | | | **Marginal effects** | | | |
| Female | 0.104*** | 0.159*** | 0.153*** | 0.194*** | 0.116*** | 0.080** |
| **Parental education (vs. basic)** | | | | | | |
| Mother: secondary | 0.158*** | 0.165* | 0.146*** | 0.110** | 0.120*** | 0.187*** |
| Mother: higher[a] | 0.270*** | 0.250** | 0.313*** | 0.276*** | 0.279*** | 0.251*** |
| Father: secondary | -0.026 | 0.226** | 0.093* | 0.132** | 0.058* | 0.019 |
| Father: higher | 0.153** | 0.354*** | 0.209*** | 0.267*** | 0.207*** | 0.282*** |
| **Year 2003 (vs. 2002)** | | | | | 0.034*** | -0.022 |
| **Other controls** | Age and age squared; Dummies for missing parental education; Region fixed effects by current residence | | | | | |
| Age of max predicted probability | 20.8 | 20.6 | 21.2 | 20.4 | 21.0 | 21.0 |
| Number of observations | 1260 | 399 | 1385 | 808 | 4494 | 817 |
| Pseudo R-squared | 0.260 | 0.220 | 0.242 | 0.224 | 0.274 | 0.229 |
| Log likelihood | -514.2 | -174.4 | -634.5 | -364.8 | -1953.4 | -352.0 |

*Notes:* [a] Population aged 17-24 without tertiary education**.** Only respondents with completed basic (ISCED 2) or upper secondary education (ISCED 3A-3C, 4A, 4B) are included. Reported results refer to the case when the sample is restricted to those living together with at least one parent. With few exceptions, each respondent appears in the Estonian and Latvian sample twice (in different waves of the LFS), so number of unique respondents is two times smaller than reported. For Lithuania there are relatively few repeated observations.

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

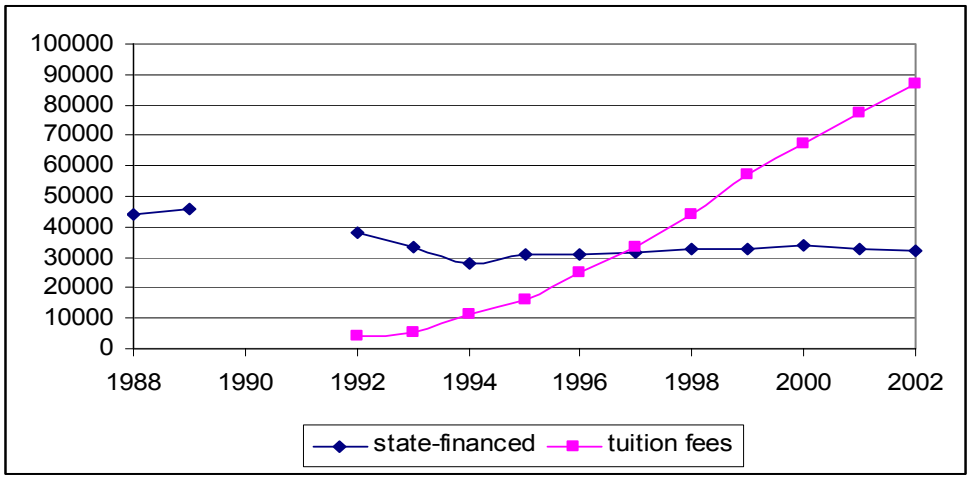
*Source:* Calculation based on LFS data.

**Table 10. Determinants of participation in post-secondary education. The Baltic countries, 1999.**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| **Ethnicity** | | | **All** | | | **Titular** | **Other** |
| | | | | **Educational attainment (means)** | | | |
| Mother: secondary | 0.533 | 0.554 | 0.554 | 0.554 | 0.554 | 0.548 | 0.568 |
| Mother: higher | 0.198 | 0.194 | 0.194 | 0.194 | 0.194 | 0.195 | 0.192 |
| Father: secondary | 0.429 | 0.425 | 0.425 | 0.425 | 0.425 | 0.400 | 0.489 |
| Father: higher | 0.138 | 0.122 | 0.122 | 0.122 | 0.122 | 0.130 | 0.102 |
| Mother: unknown | 0.158 | 0.142 | 0.142 | 0.142 | 0.142 | 0.147 | 0.130 |
| Father: unknown | 0.279 | 0.296 | 0.296 | 0.296 | 0.296 | 0.300 | 0.287 |
| | | | | **Average probability to participate in further education** | | | |
| Observed | 0.524 | 0.566 | 0.566 | 0.566 | 0.566 | 0.595 | 0.498 |
| | | | | **Marginal effects** | | | |
| Female | 0.079*** | 0.080** | 0.076** | 0.078** | 0.064* | 0.050 | 0.136*** |
| Minority | -0.128*** | -0.123*** | -0.111** | -0.116** | -0.119*** | | |
| Age | -0.093*** | -0.084*** | -0.084*** | -0.084*** | -0.084*** | -0.080*** | -0.089*** |
| **Parental education (vs. basic)** | | | | | | | |
| Mother: secondary | 0.102** | 0.117** | 0.116** | 0.114** | 0.109** | 0.054 | 0.206*** |
| Mother: higher | 0.262*** | 0.289*** | 0.259*** | 0.258*** | 0.261*** | 0.247*** | 0.276*** |
| Father: secondary | 0.088** | 0.076* | 0.065 | 0.067 | 0.056 | 0.110** | -0.054 |
| Father: higher | 0.109* | 0.135** | 0.094 | 0.102 | 0.094 | 0.135 | -0.055 |
| **Log household *per capita* income**[a] | | | 0.083*** | 0.090*** | | 0.071* | 0.091*** |
| **Log household *per capita* income**[a] *(instrumented)*[b] | | | | | 0.143*** | | |
| **Household economic situation better than 5 years ago** | | | | -0.062* | | | |
| **Country (vs. Estonia)** | | | | | | | |
| Latvia | 0.026 | 0.021 | 0.031 | 0.029 | 0.029 | 0.133*** | -0.128*** |
| Lithuania | -0.069** | -0.056* | -0.023 | -0.037 | -0.041 | -0.030 | 0.016 |
| **Residence at age of 17 (vs. small cities)** | | | | | | | |
| Capital city | 0.114*** | 0.068* | 0.036 | 0.038 | 0.003 | 0.079 | -0.113 |
| City (50,000+) | 0.087** | 0.052 | 0.036 | 0.035 | 0.034 | 0.114** | -0.157 |
| Rural | 0.016 | 0.021 | -0.005 | -0.007 | -0.010 | 0.023 | -0.139 |
| **Other controls** | Dummies for missing parental education; Migration history after age of 17 | | | | | | |
| Number of observations | 1735 | 1226 | 1226 | 1226 | 1226 | 848 | 378 |
| Pseudo R-squared | 0.231 | 0.229 | 0.243 | 0.245 | 0.241 | 0.278 | 0.267 |
| Log pseudo-likelihood | -467.8 | -646.5 | -635.2 | -633.1 | -636.8 | -413.3 | -192.0 |

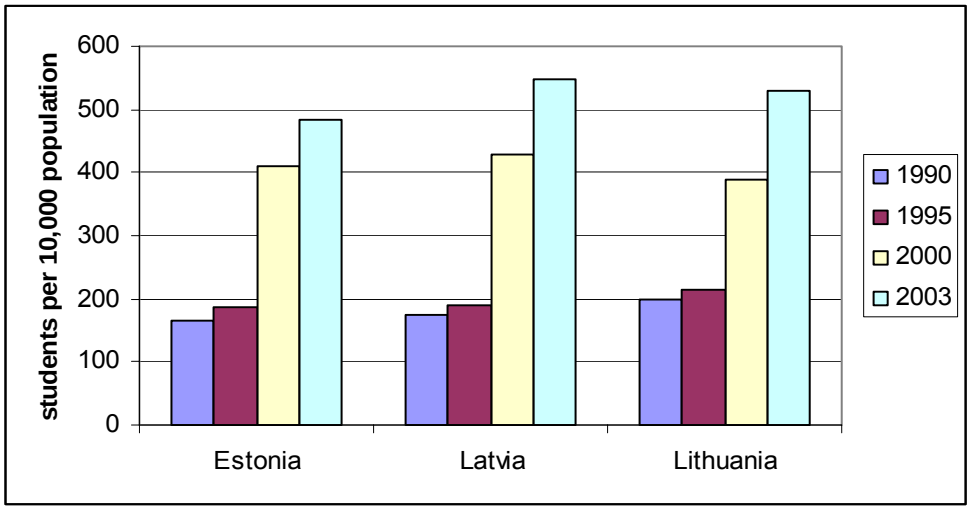
*Notes:* Population aged 17-24 with secondary education. [a] Excluding respondent's earnings.
[b] Instruments used: number of earners in the household; education, employment status and demographic characteristics of the main earner; log household size; type of settlement.
*Source:* Calculation based 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 on clustering within primary sampling unit.

**Figure 1 Tertiary students by source of financing. Latvia, 1988-2002**



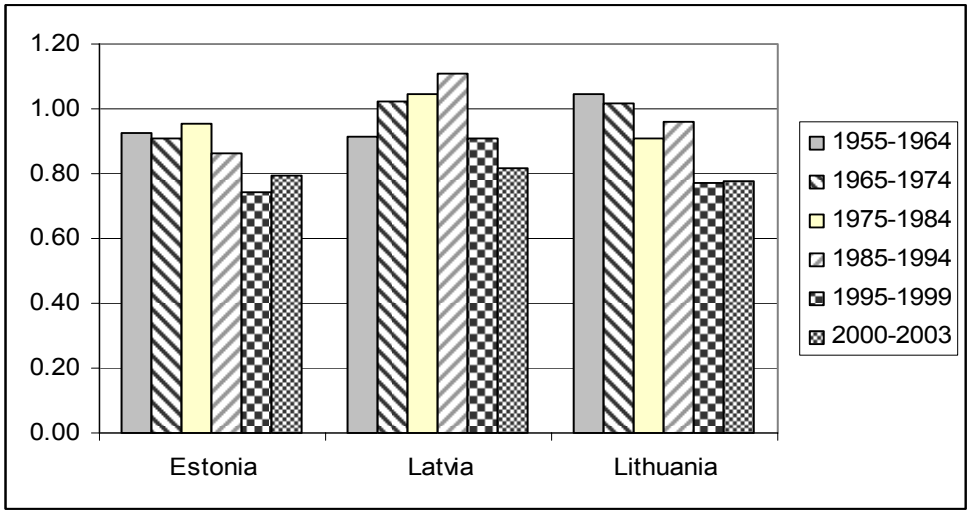

*Source*: Statistical Yearbook 2003.

**Figure 2. Tertiary students per 10,000 population. The Baltic countries, 1990-2003**




*Source*: National Statistical Offices and own calculation

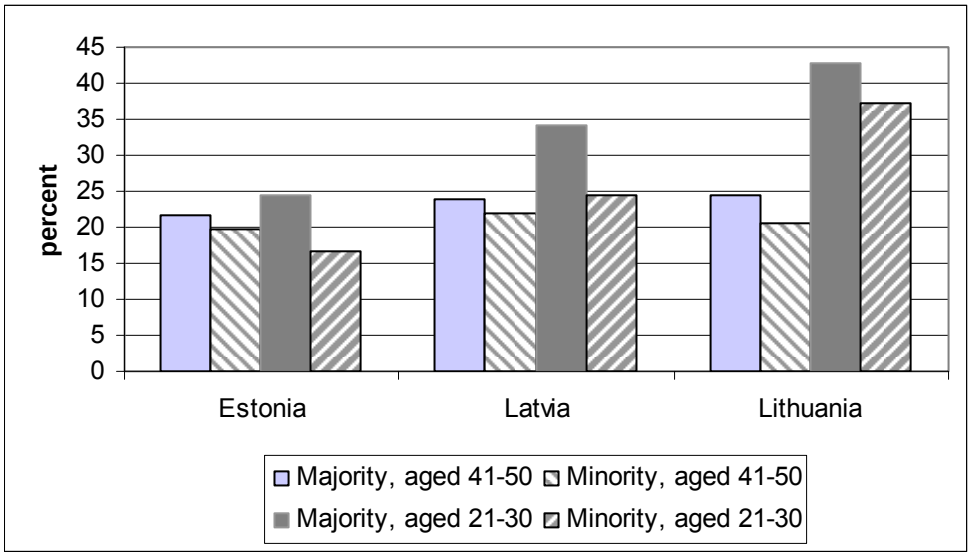
**Figure 3. Ratio of gross tertiary enrollment rates between minority and titular population. The Baltic countries, 1955-2003**




*Notes:* For 1955-1999 the ratio of enrollment rates is proxied by the ratio of graduates per 10,000 population.

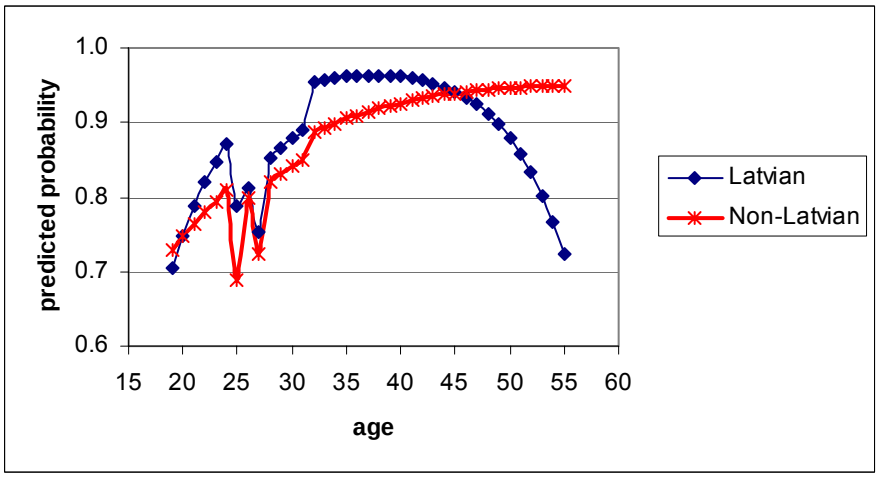
*Source*: Calculation based on Estonian LFS 1998-2001, Latvian LFS 2002, Lithuanian LFS 2002-2003.

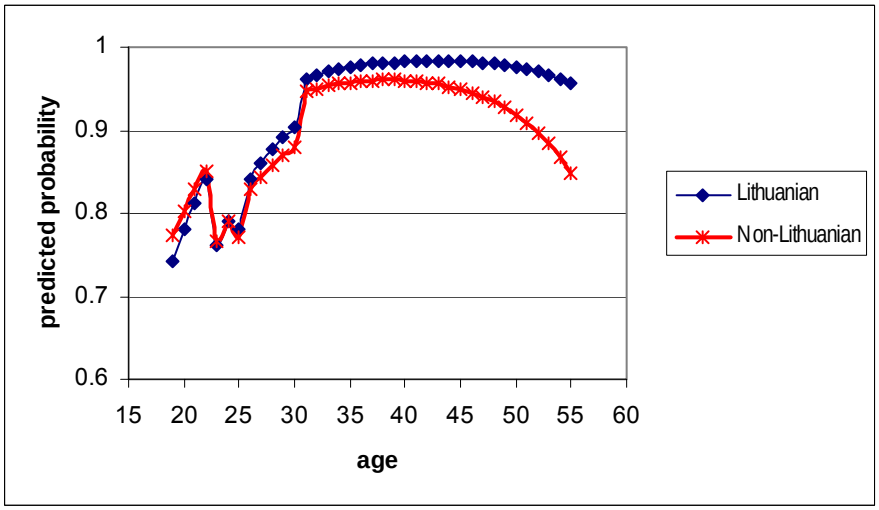
**Figure 4. Share of persons who have completed (or are enrolled in) tertiary education, by ethnicity and age group. The Baltic countries, 2001-2003**




*Source: Calculations based on LFS data*

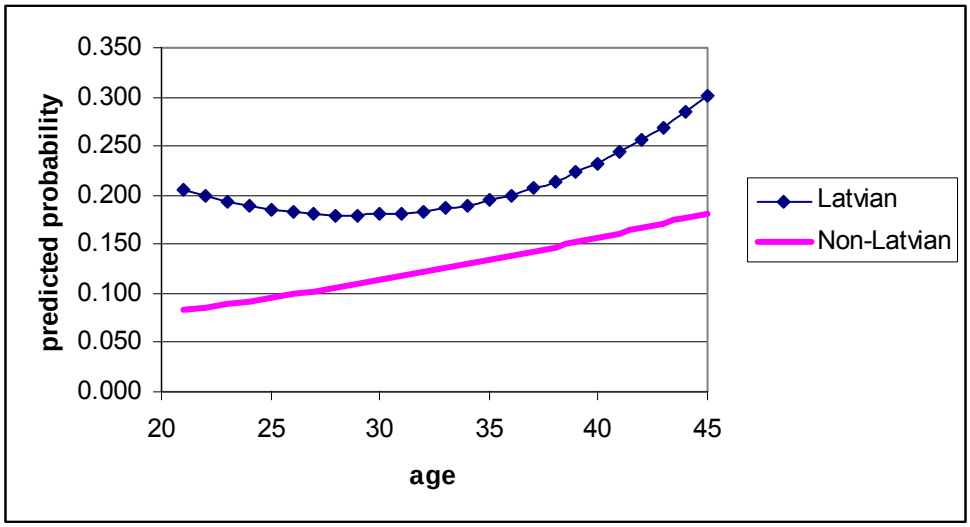
**Figure 5. Predicted probability of having completed secondary education by age and ethnicity. [a] Latvia (2002) and Lithuania (2002-2003)**

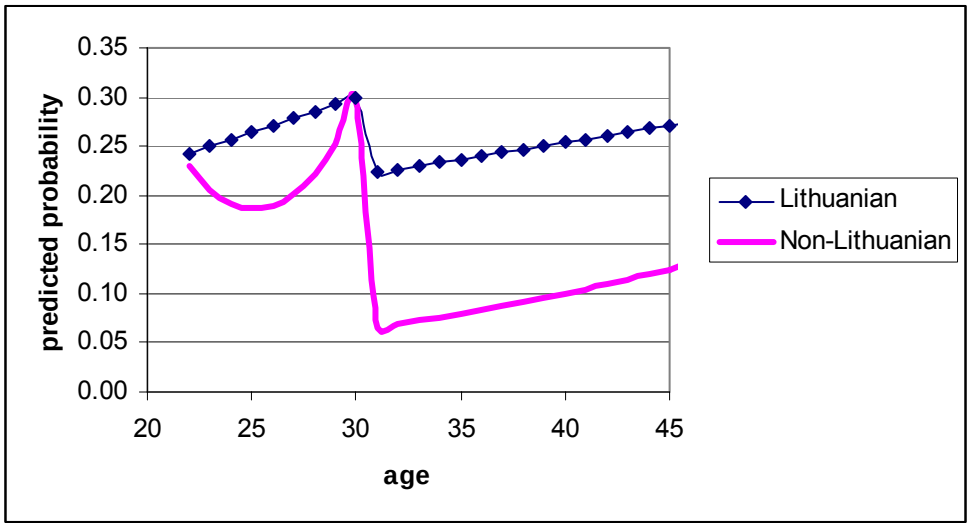



*Notes:* [a] Other characteristics are fixed at mean values.
*Source: Calculations based on LFS data*

**Figure 6. Predicted probability of having completed higher education by age and ethnicity**
**Latvia (2002) and Lithuania (2002-2003)**




*Notes:* [a] Other characteristics are fixed at mean values.
*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:

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

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 $\beta_{t+1} > \beta_t$ (respectively, $\beta_{t+1} < \beta_t$), human capital gap between classes, conditional on demographics, is larger (respectively, smaller) in generation t+1 than in generation t.[15]

**(ii)** Assume that impact of parental education and demographics other than $z$ does not change over time: $\beta_{t+1} = \beta_t = \beta$, $\gamma_{t+1} = \gamma_t = \gamma$. 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:

[15] 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.

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

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

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

increases (respectively, decreases) with *t,* if $\mu_{t+1} > \mu_t$ (respectively, $\mu_{t+1} < \mu_t$).

## Appendix 2. Sample selection issues

Presence of siblings and presence of grandparents in the household likely affect propensity to continue education after basic school (siblings – negatively, grannies- positively); however, these variables, conditional on completed secondary education and given parents' educational attainment, should not affect propensity to enroll in tertiary schooling. These variables have been used as instruments in selection equation (completed secondary education) of the following model estimated for each country:

*Continue Education after Basic School (and Complete Secondary):*

$$y_0^* = \alpha'X + \varepsilon_0, \quad y_0 = 1 \text{ if } y_0^* > 0, \; y_0 = 0 \text{ if } y_0^* \le 0$$

*Complete Tertiary:*

$$y_4^* = \psi'X + \varepsilon_4, \qquad y_4 = 1 \text{ if } y_4^* > 0, \; y_4 = 0 \text{ if } y_4^* \le 0, \; y_4 \text{ is observed if } y_0^* > 0$$

$$\varepsilon_0, \varepsilon_4 \sim N(0; 1), \; Cov(\varepsilon_0, \varepsilon_4) = \rho.$$

On the sample of individuals aged 21+ with completed basic education typically just one of these instruments was significant (with expected sign). The hypothesis $\rho = 0$ was not rejected, so we do not present these results.

Another selection issue is related to the fact that in the LFS based probit models samples were restricted to individuals living with at least one of the parents;

about 90 percent of respondents were no older than 45. To check for the selectivity bias probit models with sample selection (both for secondary and tertiary completed education) have been estimated on the samples of individuals aged 18 to 45 (respectively, 21 to 45). Dummy for being single (in some cases also dummy for being born in the country of residence) appears to be a valid instrument having a positive and significant impact on propensity to live with parents. Again, the hypothesis of independent equations was never rejected (results are available on request).

We have also experimented with using unrestricted samples and assigning a particular educational attainment when parent's education is missing. The results did not change qualitatively.